Sustainable Energy Finance Market Study for Financial Sector in Nepal

SouthAsia Enterprise Development Facility

Managed by IFC, in partnership with DFID and Norad

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UKaid from the Department for International Development

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IFC International Finance Corporation World Bank Group

IFC Advisory Services in South Asia

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International Finance Corporation
World Bank Group

Hotel Yak & Yeti Complex
Durbar Marg, Kathmandu, Nepal

Phone: (977-1) 4226792
Fax: (977-1) 4225112
www.ifc.org/southasia

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Towards Nepal's Sustainable Future

The reality and severity of climate change impact have resulted in new thinking around how business should be conducted. Private sector has emerged as an important ally in combating climate change impacts. Private sector has taken the lead in introducing initiatives to evolve and adapt, and in offered innovative solutions.

Forward-looking companies recognize that renewable energy and energy efficiency are increasingly becoming central to any country's energy security agenda. This backdrop offers many business opportunities for private sector and shapes the nature of new projects. Not to be left behind, financial institutions are adapting themselves to meet financing needs of these new projects.

Leading financial institutions are equipping themselves to take advantage of this market trend – a clear direction towards supporting new projects that are climate-friendly or 'green'. Another term for this is Sustainable Energy Finance.

Global investments in renewable energy jumped 32% in 2010 to a record 211 billion dollars[i]. To remain competitive, financial institutions have complemented this transition by offering cutting-edge Sustainable Energy Finance products to energy intensive industries. The move has resulted in responsible and profitable business opportunities related to sustainability and inclusiveness.

In Nepal too, given the country's energy needs, many 'green energy' projects need to be commissioned. Financial institutions in Nepal can take advantage of the drive for renewable energy and energy efficiency.

Our interactions with stakeholders indicate that financial institutions in Nepal would benefit from a market study on the energy efficiency and renewable energy potential of key industries and their corresponding financing needs. In response to this, SouthAsia Enterprise Development Facility, managed by IFC, in partnership with UK Department for International Development and the Norwegian Agency for Development Cooperation, commissioned this study.

This study, focused on ten key industrial sectors of Nepal, will help financial institutions make strategic decisions on product development, market approaches to be adopted and resource allocation to be made. It also aims to raise awareness amongst industries covered and key stakeholders.

We trust this contribution will add value to the efforts in creating an environment conducive to promoting sustainable energy in Nepal and help the private sector make a significant contribution towards clean and sustainable economic development.

Anil Sinha
Regional Head of Advisory Services, South Asia
International Finance Corporation

[i] United Nations Environment Programme (UNEP): Global Trends in Renewable Energy Investment 2011

Sustainable Energy Finance Market Study
for Financial Sector in Nepal

Content

1. Introduction **2**
1.1 Executive Summary 4

2 Policy and Regulatory Environment **8**
2.1 Overview of Industrial Policy, EE and RE Policies 8
2.2 Overview of Government Programs and Plans 10

3 Overview of Selected Industry Sectors **12**
3.1 Industry Sectors in Nepal 12
3.2 Introduction to Selected Industry Sectors 15
3.3 Energy Demand and Consumption in Industries 28
3.4 Important Stakeholders in the Industry Sector 34

4 EE/ RE Potential in Selected Industry Sectors **43**
4.1 Energy Consumption Pattern in Selected Industry Sectors 43
4.2 Specific Energy Consumption Pattern in Selected Industry Sectors 44
4.3 Local and Regional (Indian) Norms and International Benchmarks/Best Practices of Selected Sectors 46
4.4 Estimation of Energy Saving Potential with EE Improvement and use of RE in Selected Industry Sectors 50
4.5 Possible EE and RE Options in Selected Industry Sectors 56
4.5.1 RE Intervention Potential in Selected Sector 56
4.5.2 EE Intervention Potential in Selected Sector 58

5 Mapping of Financial Industry **62**
5.1 Overview of Financing Sector in Nepal 62
5.2 Overview of Present Policies for Industrial Finance 65
5.3 Sampling of the Financial Institutions for the Study 68

6 Investment Potential And Barriers **78**
6.1 Investment Potential And Financing Needs 78
6.2 Barriers To Ee And Re Promotion 80

7 Proposed Financing Mechanisms and Approaches **83**
7.1 Existing Financing Products and Mechanisms 83
7.2 Proposed Financing Mechanism 85
7.3 Technical Assistance Needs and Advisory Services 88

8 Conclusion and Recommendations **91**

9 Study Limitations **94**

Annexes

Annex 1 Approach and Methodology 99

Annex 2 Questionnaires 102
Annex 2.1 Instrument for the Plant Manager / Technical Director: 103
Annex 2.2 Instrument for Finance Manager/Director of the Industry 106
Annex 2.3 Instrument for Owner/CEO/MD of the Industry 107
Annex 2.4 Instrument for the Consultant / Consulting Companies: 108
Annex 2.5 Instrument for EE/RE Equipment Vendors 110
Annex 2.6 Instrument for Banks and Financial Institutions 111

Annex 3 List of Meetings Conducted During Study 113
Annex 3.1 Industrial Units 114
Annex 3.2 Banks and Financial Institutions 117
Annex 3.3 Donors' Programs 118
Annex 3.4 Business Leaders/Representatives of Chambers and Industry 118
Annex 3.5 Research Institutions/Universities, Consulting Companies 118
Annex 3.6 Government Institutions 119
Annex 3.7 Engineering Firms/Turn-key Contractors/Experts 119

Annex 4 Relevant Laws and Regulations: Industrial Policy, EE and RE Policies 120
Industries Requiring IEE and EIA 124
Industries Requiring Certificate of Pollution Control 125

Annex 5 Government Programs and Plans 127

Annex 6 Possible EE and RE Options in Selected Industrial Sectors 132

Annex 7 Relevant Laws and Regulations: Present Policies for Industrial Finance 140

Annex 8 Brief Summary of Sampled Bank and Financial Institutions 143

Annex 9 Lists of Tables 149
Annex 9.1 Sector Wise Loan and Advances of Sampled Banks and Financial Institutions 150
Annex 9.2 Product Wise Loan and Advances of Sampled Banks and Financial Institutions 151

List of Tables

Table 1	Policy and Regulatory Environment in Nepal	8
Table 2	Government Programs and Plans	10
Table 3	Classification of Industries by the Industrial Enterprises Act 1992	13
Table 4	Industries Based Upon Fixed Assets	13
Table 5	Number of Industries Registered in Dol and Dcsi up to Fy 2009/10	14
Table 6	Total Project Cost and Total Fixed Cost of the Industries Registered in Doi Up To Fy 2009/10	15
Table 7	Assumption of Scale of Industries Based Upon Fixed Assets of CBS 2006/07	16
Table 8	Total Number of Establishments in Ten Industrial Sectors	16
Table 9	Total Energy Consumption by Sectors 2008/09	29
Table 10	Historical Trend of Industrial Energy Consumption in Nepal	29
Table 11	Industrial Sector Energy Consumption by Fuel Types	30
Table 12	Tariff Rates of Different Voltage	32
Table 13	Time of Day Tariff Rates	33
Table 14	Fuel Tariff Structure	34
Table 15	Energy/Fuel use in Selected Industrial Sectors	43
Table 16	Specific Energy Consumption in the Selected Industrial Sectors	45
Table 17	Number of Industry with EE/RE Intervention Potential	50
Table 18	Sector-wise Energy Consumption and Saving Pattern	53
Table 19	Energy Consumption and Saving Pattern of Selected Sector	54
Table 20	Co2 Emission Factor	54
Table 21	Total CO_2 Emission and Reduction	55
Table 22	Re Intervention Options in the Selected Sectors	57
Table 23	Most Common EE Options	58
Table 24	Growth of Financial Institutions in Nepal Licensed by NRB	63
Table 25	Present Policies for Industrial Finance	66
Table 26	Brief Financial Status of the Sampled Banks	69
Table 27	Banks Involved in EE/RE Financing	71
Table 28	Sectoral Lending Portfolio of the Selected Banks	73
Table 29	Credit Assessment Criteria of Banks	74
Table 30	Risk Mitigation Measures Adopted by Banks	75
Table 31	Banks' Participation in Donor Assisted Programs	76
Table 32	Sector-wise Total Investment Potential	79
Table 33	Barriers to EE and RE Promotion	81
Table 34	Proposed Financing Mechanisms for EE/RE Intervention Options	86

Sustainable Energy Finance Market Study
for Financial Sector in Nepal

List of Figures

Figure 1	Number of Industries Registered in Doi by Scale in Nepal (up to Fy 2009/10)	14
Figure 2	Electricity Consumption by Sectors 2008/09	31
Figure 3	Number of Commercial Bank Branches in Different Development Regions of Nepal	64
Figure 4	Sectoral Loans And Advances of Commercial And Development Banks	83
Figure 5	Product-wise Loans And Advances of Sampled Banks	84
Figure 6	Loan Products of Selected Banks	85

Abbreviations

AEPC	Alternative Energy Promotion Centre
BAFIA	Banking and Financial Institution Act
BoK	Bank of Kathmandu
BSP	Biogas Support Programme
BTK	Bull's Trench Kiln
CDM	Clean Development Mechanism
CEDBL	Clean Energy Development Bank Limited
CES	Centre for Energy Studies
CNI	Confederation of Nepalese Industry
CO2	Carbon dioxide
CP	Cleaner Production
CTC	Cut, Turn, Curl
DANIDA	Danish International Development Agency
DCSI	Department of Cottage and Small Industry
DDCs	District Development Committees
DoI	Department of Industry
EBL	Everest Bank Limited
EE	Energy Efficiency
EIA	Environmental Impact Assessment
EMS	Environmental Management System
EPA	Environmental Protection Act
EPR	Environmental Protection Rules
ESAP	Energy Sector Assistance Programme
ESPS	Environment Sector Programme Support
FCBTK	Fixed Chimney Bull's Trench Kiln
FINNIDA	Finnish International Development Agency
FIs	Financial Institutions
FNCCI	Federation of Nepalese Chambers of Commerce and Industry
FNCSI	Federation of Nepal Cottage and Small Industries
FY	Fiscal Year
GDP	Gross Domestic Product
GHG	Green House Gas
GJ	Giga Joule
GoN	Government of Nepal
GIZ	Deutsche Gesellschaft Fur Internationale Zusammenarbeit
GTZ	Deutsche Gesellschaft Fur Technische Zusammenarbeit
GWh	Gigawatt Hour
HBL	Himalayan Bank Limited
I/NGOs	International Non-governmental Organizations
ICS	Improved Cooking Stoves
IEE	Initial Environmental Examination
IEM	Institute of Environment and Management
IEMP	Industrial Energy Management Project
IFC	International Finance Corporation
IPPs	Independent Power Projects
ISO	International Organization for Standardization

Sustainable Energy Finance Market Study
for Financial Sector in Nepal

JICA	Japan International Cooperation Agency
kCal	Kilo Calorie
KfW	Development Bank of Germany
kVA	Kilo Volt Ampere
kWh	Kilowatt Hour
MCBTK	Movable Chimney Bull's Trench Kiln
MoE	Ministry of Energy
MoEnv	Ministry of Environment
MoI	Ministry of Industry
MT	Metric Tons
MVA	Megavolt Ampere
MW	Mega Watt
MWh	Megawatt Hour
NBSM	Nepal Bureau of Standards and Metrology
NEA	Nepal Electricity Authority
NEEP	Nepal-GIZ Energy Efficiency Programme
NGOs	Non-Governmental Organizations
NIBL	Nepal Investment Bank Limited
NIC	Nepal Industrial and Commercial Bank
NPC	National Planning Commission
NRB	Nepal Rastra Bank
NRs	Nepalese Rupees
OHS	Occupational Health and Safety
PEP	Perspective Energy Plan
PEs	Public Enterprises
RE	Renewable Energy
REDP	Rural Energy Development Programme
REPPON	Renewable Energy Perspective Plan of Nepal
RETs	Renewable Energy Technologies
SDC	Swiss Agency for Development and Cooperation
SEAM-N	Strengthening of Environmental Administration and Management at the Local Level in Nepal
SEED-Nepal	Society for Environmental and Economic Development Nepal
SHS	Solar Home System
SMEs	Small and Medium Enterprises
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organization
USAID	United States Agency for International Development
VDCs	Village Development Committees
VSBK	Vertical Shaft Brick Kiln
WECS	Water and Energy Commission Secretariat

Exchange Rate

1 USD = NRs. 71.80 as on March 16, 2011
Source: http://www.oanda.com/currency/converter/

Introduction

1

Introduction

The industrial sector in Nepal is one of the major sources of pollution and inefficient energy use. Nepal also suffers from inadequate investment in energy efficiency and renewable energy in the industrial sector. Therefore, the South Asia Enterprise Development Facility took the initiative to conduct a market study to understand the current energy efficiency and renewable energy potential of Nepal, and identify areas where financial institutions can invest for maximum impact. Frankfurt School of Finance and Management, Germany, as the lead agency, partnered with Winrock International, Nepal, which provided local expertise and market analysis, to estimate the investment potential for energy efficiency and renewable energy projects.

The objectives of this study were to:

1) Estimate the energy savings and renewable energy potential, and
2) Estimate the investment required to achieve this potential.

The details of the approach and methodology adopted for this study are presented in Annex 1; and the structured questionnaires designed for stakeholder interviews are presented in Annex 2.

The following report is structured into nine sections. The first is the introductory section which provides an overall synopsis of the report. The second section provides an overview of the industrial policy and policies related to energy efficiency/renewable energy technology. It also gives an overview of the government and donor-assisted programs and plans, mainly focusing on energy efficiency for sustainable industrial development.

Section three of the report begins with a brief overview of industrial development in Nepal, including classification of industries (as per Industrial Enterprises Act 1992) based on fixed assets, energy demand, energy consumption by fuel type, and historical trend of energy consumption in the industrial sector of Nepal. It also contains a brief introduction of the role of government, non-government organizations, donors, and private sector in Nepal's industrial and energy efficiency sector. Finally, the section provides an introduction of the ten industrial sectors specifically identified for this study.

Section four of the report provides information on the types of energy used in each of the ten industrial sectors along with their energy consumption patterns, local and regional norms of selected sectors, and the international best practices. This section, based on industry visits and interviews, covers the energy efficiency/renewable energy options for each industrial sector, estimation of energy saving potential for energy efficiency improvement, and the use of renewable energy in select industries.

Section five presents a mapping of the financial industry, giving an overview of the financial sector in Nepal along with brief financial status of the sampled banks and financial institutions. It provides an overview of present policies relevant to industrial finance.

1

Section six calculates the investment potential and financing needs and lists the key barriers to sustainable energy finance based on the options identified and the cost estimation made in section four.

Section seven proposes various types of financing mechanisms on the basis of industry-specific situation present in the country. The study proposes favorable financing options like debt and equity financing, project finance, consortium financing, among others, along with viable recommendations on technical assistance and advisory services in the area.

Section eight presents the recommendations and conclusions of the study and section nine covers the limitations of the study.

The ten industrial sectors selected for the Industry Specific Market Study were identified as most energy intensive and having highest energy efficiency/renewable energy potential based on the literature review and discussion with local experts working in the area of renewable energy and energy efficiency. These industrial sectors differed from the types / classification of industries presented by Industrial Enterprises Act 1992, Department of Industry (DoI) and Department of Cottage and Small Industries (DCSI) (Please Refer Table 3 and Table 5 in the report). Hence it was difficult for the study team to find the sector specific data as most of the published data would present it as per Industrial Enterprises Act 1992 classification. Likewise, most recent information on GDP contribution for ten selected sectors were unavailable. Hence the study team had to refer to the information on GDP that was available though it was dated (of year 2000/01) from different literature.

Sustainable Energy Finance Market Study
for Financial Sector in Nepal

1

1.1 Executive Summary

The industrial sector in Nepal is facing an acute energy crisis and prolonged periods of load shedding as a result. Despite the large hydropower potential, Nepal is a net importer of electricity. In 2010 the electricity demand was 915 MW but the supply was only 390 MW, resulting in up to 14 hours of power cuts daily. Due to this massive shortfall in the supply of electricity, the productivity of the industrial and service sectors is adversely affected. Many industries are unable to operate full hours, leading to shutdown in cases due to an inability to meet demand and delivery schedule.

Additionally, labor problems, security issues and political instability have had an adverse effect on the industries of Nepal. Therefore, Nepal's industrial sector has been preoccupied mostly with meeting production deadline schedules, leaving it with little resources to invest in energy efficiency measures.

As a result, Nepal has failed to make sufficient investment in improving energy efficiency and renewable energy in the industrial sector. Hence, the main objective of this study was to estimate the energy savings as well as the investment potential for sustainable energy projects in the industrial sector.

For the purpose of this study, 10 industrial sectors -- cement, rolling mills, poultry/agribusiness, plastic, cold storage, food and beverage (breweries/distilleries), steel structures, paper and pulp, brick industry and tourism (hotels) -- were identified, based on their size/production capacity, consumption of energy, potential for energy efficiency/renewable energy intervention, and investment potential. The research team visited up to 7 sites from each of the industries, and interviewed a total of 51 industrial units (Refer Annex 3.1).

Similarly, the team interviewed 11 financial institutions out of which 8 were Class 'A' commercial banks and 3 Class 'B' development banks (Refer Annex 3.2). In addition, consultations were held with various stakeholders including representatives of chambers and industries, business leaders, research institutions/universities, consulting companies, vendors, government institutions, and experts for a better overview of the industrial sector's
sustainable energy potential, intervention options, and the investment required. This study covers an analysis of the government policies related to industries, energy, and finance collected through secondary sources of information.

Even though the Nepal Government does not have any energy policy or strategy regarding energy consumption by the industrial sector, it has a supportive policy framework for overall industrial development. Industrial Policy 2010 highlights the extension of state support for the development of infrastructure to industries on a priority basis and special tax holidays for industries in rural and unindustrialized parts of the country. The Policy has listed information technology, cement, hydropower, vehicle and motor parts, chemical fertilizers, bio- technology, and adventure tourism as high priority industries.

Further, the Industrial Enterprises Act, 1992 also provides fiscal incentives to industries established in remote or undeveloped areas and those least adversely impacting the environment. Realizing the great potential of renewable energy sources such as biogas, micro hydro power, solar energy, improved water mills, improved cooking stoves, wind energy, among others, the Government of

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Nepal and Alternative Energy Promotion Center's Rural Energy Fund have mobilized efforts to provide subsidies to establish, maintain, and deliver rural energy services.

The study assessed the energy-saving potential of each industrial sector by identifying the types of energy/fuel used. The major energy sources used in the selected industrial sectors were electricity, fossil fuels (like coal, furnace oil, diesel, liquefied petroleum gas, and kerosene) and biomass fuels (like rice husk and fuel wood). All the industrial sectors use electricity and high speed diesel. However, high speed diesel is mainly used in the captive plants for power back-up. Pulverized coal was another source of energy used in energy-intensive industrial sectors, for example, cement plants for clinker production, rolling mills for billet heating and steel structures for galvanizing. Total carbon dioxide emission was also calculated based on the total fuel consumed (coal, furnace oil and diesel). It included fossil fuel used in captive plants for electricity generation.

The study revealed that all the selected industrial sectors consumed a significant amount of electricity, with the exception of the brick industry which uses coal for firing bricks. Specifically, electricity consumption in the plastic industry was the highest (3,600 kWh/Ton), followed by pulp and paper (1,612 kWh/Ton). Seven out of ten sectors consumed thermal energy with tea, paper, and pulp as the highest consumers of followed by cement, rolling mills, steel structure, dairy, food and beverage (breweries/distilleries), and brick.

The research team identified energy efficiency and renewable energy options for ten industrial sectors under three categories: a) No cost/low cost options, b) Medium cost options and c) High cost options. These potential options were identified through interviews of production professionals from the corresponding industries, walk-through visits of industrial units and previous audit reports. Most of the options thus identified involve retrofitting rather than a new technology installment for new industrial establishments.

The study showed that a total of $ 6,268,084 could be saved through energy efficiency/renewable energy intervention in large industries, $ 2,666,761 in medium-scale industries, and $ 88,500 in small-scale industries. The selected industrial sectors also had significant potential for the adoption of renewable energy technologies such as biomass gasifier, steam turbines, solar thermal heating, and biogas. During the course of the interviews researchers found that a few large-scale industries have already invested in renewable energy technologies.

The cost of the energy efficiency intervention options/technologies thus identified was used to calculate the total investment potential in the baseline industry (single unit), which was then used to extrapolate the total investment cost for rest of the industrial units.

The tea sector had the highest investment potential ($ 8.06 million) followed by brick ($$ 2.51 million), cement ($ 1.76 million), paper and pulp ($ 1.63 million), plastic ($ 1.12 million), rolling mills ($ 0.81 million), dairy ($ 0.79 million), steel structures ($ 0.64 million), food and beverage (breweries/distilleries) ($ 0.24 million), tourism (hotels) ($ 0.23 million), cold storage ($ 0.07 million), and poultry/feed ($ 0.04 million).

Total investment opportunity in the selected areas is $ 17,924,296. As presented in Table 19, the investment opportunity has been segregated into large, medium and small-scale industries. The total investment opportunity calculated is $ 10,381,252 (58 percent) in large-scale industries, $ 5,025,152 (28 percent) in medium-scale industries and $ 2,517,892 (14 percent) in small-scale industries.

Sustainable Energy Finance Market Study
for Financial Sector in Nepal

1

Initial interviews with the stakeholders revealed that lack of fiscal incentives for energy efficiency by the government, inadequate marketing of energy efficiency in the industrial sector and lack of assistance to industrial units to make energy efficiency proposals bankable were widely regarded as barriers to financing sustainable energy in industrial units. A literature review and meetings with various industries during this study suggested that investments in energy efficiency interventions could grow with the provision of awareness programs, technical advisory services, and access to favorable financing mechanisms.

Primary interviews revealed that banks -- as the financing institutions- also have limited awareness and knowledge on energy efficiency/renewable energy technologies/projects. Clearly, this was seen as one of the main barriers. Banks informed the study team that sustainable energy financing has not grown in Nepal due to lack of pilot/demonstration energy efficiency projects, inadequate awareness among the industrial users and lack of marketing and information dissemination of these options. Additionally, they added that the reluctance to actively support energy efficiency interventions is partly due to the preference of banks to finance existing clients rather than new ones. Further, higher interest rates due to the liquidity crisis and inadequate capital among the industries have acted as impediments to energy efficiency/renewable energy financing.

The study team found that the major financial mechanisms used in banks in Nepal are corporate financing, consortium financing, and project financing. Looking at the country's industrial sector, the most favorable financing options recommended by the study are: 1) Corporate/consortium finance with a debt-equity ratio of 50:50, 60:40, and 70:30; 2) Project finance; 3) Revolving fund; 4) Guarantee fund; 5) Cluster finance; 6) Quasi-Equity finance. Due to the lack of a mature market of energy service providers, Energy Service Company financing may not be suitable in Nepal for now.

This study recommends pilot projects of energy efficiency/renewable energy technology adoption in industrial units and demonstration of subsequent success and savings to encourage other industrial units to adopt sustainable energy technology. Mandatory energy audits introduced through government policies would identify energy saving opportunities in the industrial units and encourage investment in this regard. The study also recognizes that site-specific and dedicated power generation (though captive plants like micro/small hydropower, renewable biomass based gasification technology and steam turbines) for high energy consumption sectors like rolling mills, steel structures and cement need to be explored further to help establish such successful business models.

The study recommends that the Government of Nepal should introduce fiscal incentives such as soft or low cost loans, tax benefits, grant funds, refinancing, custom duty waiver, depreciation allowance, low interest rate, subsidized funds required for energy efficiency/renewable energy/modernization, carbon financing, subsidy, among others for effective financing of sustainable energy projects.

Further, the banking sector requires training and capacity building of their staff to identify new business avenues in energy efficiency investment and provide assistance for developing energy efficiency/renewable energy loan products. Awareness among industrial users and policy advocacy can augment energy efficiency/renewable energy adoption by the industrial units in the country. Sector-wise study of each industry to establish baseline data and provide information to banks for facilitating sustainable energy financing is also recommended.

Policy and Regulatory Environment

2

Policy and Regulatory Environment

2.1 Overview of Industrial Policy, Energy Efficiency and Renewable Energy Policies

Until the mid-eighties, Nepal followed an active industrial policy with the government directly involving itself in the economy. When Nepal initiated economic liberalization in mid-1985, the Government adopted an open and liberal policy to pave the way for the accelerated economic and social development of the country, through the implementation of Structural Adjustment Programs. The policy is aimed at giving the private sector a dominant role, especially in the field of industry and trade. The liberalization accelerated after the nineties, and sought to modernize the economy and accelerate structural changes by creating an environment appropriate for private sector participation. The government began to withdraw from the economy and policies were implemented to promote private and foreign investment. The government's role has been that of a facilitator providing infrastructure and an environment conducive for investment.

With the view to attracting investment into the industrial sector from both domestic and foreign investors, and making the investment climate more favorable, the Nepal government formulated the Foreign Investment and Industrial Policy, based on which the Foreign Investment and Technology Transfer Act 1992 and the Industrial Enterprises Act 1992 were promulgated (Department of Industry 2005). These Acts were subsequently amended. Table 1 below lists the existing policies, acts and regulations in Nepal relevant to the industrial sector (Refer Annex 4 for details).

Although a draft of the energy efficiency policy was developed during the Environment Sector Program Support in 2004, the final policy never took shape. This explains why Nepal does not have any energy efficiency policy or legislation, or any norms regarding the energy consumption in the industrial sector currently. However, the government is preparing a new energy strategy to promote the power sector.

Table 1 : Policy and Regulatory Environment in Nepal

S. N.	Policies / Acts / Regulations	Provisions
1	Industrial Enterprises Act 1992	• Enacted to provide for issues related to industrial development; to make arrangements for fostering industrial enterprises in a competitive manner through increments in productivity • Provides classification of industries
2	Foreign Investment and Technology Transfer Act 1992	• Provide for matters relating to foreign investment and technology transfer; for making the economy viable, dynamic and competitive through the maximum mobilization of the limited capital, human r esources and other natural r esources.

[1] A programme with assistance from Government of Denmark for the overall management of the brown sector of Nepal

3	Environment Protection Act and Environment Protection Rules 1997	• Spells out provisions for pollution control and environmental protection
4	Renewable/Rural Energy Policy 2006	• Designed to encourage economic and industrial activities based on renewable/rural energy technologies at the community and institutional level
5	Subsidy Policy for Renewable (Rural) Energy 2009	• Spells out capital/price subsidy and its delivery mechanism for installing various new and renewable energy technologies such as micro-hydropower, biogas, solar photovoltaic etc.
6	Industrial Policy 2010	• Aimed at creating industry -friendly and investment conducive environment for natives and foreigners; raising industrial production and productivity; creating more employment opportunities; and facilitating import replacement and export promotion
7	Five Year Plans	• Periodic Five Year Plans are the Government of Nepal's major documents for presenting policies, programs and targets.
8	Perspective Energy Plan/ Renewable	• Addresses policies for renewable energy technologies and highlights the strategies to be adopted for development of

The Government of Nepal has supportive policy framework for overall industrial growth. Periodic five year plans are the government's major documents for presenting policies, programs and targets. The three-year interim plan for the periods 2007-08 to 2009-10 has targeted to achieve 6.3 percent average annual industrial growth rate. Industrial Policy 2010 aims to create an industry-friendly and investment-conducive environment; raise industrial production and productivity; create more employment opportunities; and facilitate import replacement and export promotion. It highlights the extension of state support for the development of infrastructure to industries on a priority basis and special tax holidays for industries in rural and unindustrialized parts of the country. The policy listed information technology, cement, hydropower, vehicle and motor parts, chemical fertilizers, bio- technology, and adventure tourism as high-priority industries.

Industrial Enterprises Act 1992 provides fiscal incentives to industries established in remote or undeveloped areas and those having a minimum impact on the environment. For instance, a rebate of 20 per cent to 30 per cent of the income tax is granted to any industry established in a remote or undeveloped area. A 50 percent reduction on the taxable income is granted to those industries investing in process or equipment, with the objective of controlling pollution or having the minimum impact on the environment. Additionally, after an industry comes into operation, 10 per cent of the gross profit is allowed as a deduction against taxable income on account of expenses related to technology, product development and efficiency improvement.

Further, realizing Nepal's potential for developing various sources of renewable (rural) energy like biogas, micro-hydropower, solar energy, improved water mills, improved cooking stoves, wind energy, etc., the Nepal government and Alternative Energy Promotion Centre's Rural Energy Fund have mobilized efforts to provide subsidies to establish and maintain and deliver rural energy services.

Sustainable Energy Finance Market Study
for Financial Sector in Nepal

2.2 Overview of Government Programs and Plans

Several international donor agencies/countries have launched programs and projects for sustainable industrial development in Nepal. United Nations Development Programme (UNDP), United Nations Industrial Development Organization, Danish International Development Agency (DANIDA), Finnish International Development Agency, Deutsche Gesellschaft Fur Internationale Zusammenarbeit (GIZ) (formerly known as GTZ), Japan International Cooperation Agency, The World Bank, and Asian Development Bank are some of the donor agencies which have already launched various programs or projects in Nepal. The following are projects which have focused on energy efficiency in the industrial sector (Refer Annex 5 for details):

Table 2 : Government Programs and Plans

S.N.	Programs and Plans	Brief Description
1	Nepal-GIZ Energy Efficiency Program (NEEP- Project of GIZ)	NEEP-GIZ is working on 3 components: • Integration of energy efficiency as part of the national energy strategy for efficient use of energy, including biomass • Development of energy efficiency measures for more efficient use of biomass in rural households and efficient use of electricity in urban households, and • Making energy- intensive industrial enterprises more energy efficient and economic
2	Strengthening of Environmental Administration and Management at the Local Level in Nepal	• To improve the state of the environment and to promote environmentally sustainable industrial development and utilization of natural resources in the project area (the Eastern part of Nepal)
3	Energy Sector Assistance Program	• One of the major programs of the Alternative Energy Promotion Centre (AEPC), signed between the Government of Nepal and the Government of Denmark (DANIDA) in March 1999 is to provide decentralized renewable energy services to rural as well as urban communities
4	Biogas Support Program	• One of the major programs of AEPC is to promote Biogas technology which is considered the first beneficiary of the Clean Development Mechanism in Nepal
5	Rural Energy Development Program (REDP)	• With financial and technical assistance from UNDP, REDP is working on the installation of micro-hydropower plants, solar home systems, biogas plants and improved cooking stoves
6	Vertical Shaft Brick Kiln Project,Nepal (VSBK)	• Bilateral agreement between Swiss Agency for Development and Cooperation and the Government of Nepal and to implement energy efficient VSBK technology for brick-making in Nepal
7	Environment Sector Program Support	• Assistance from DANIDA for overall environmental management of the 'brown sector' in Nepal (the

Overview of Selected Industrial Sectors

3

Overview of Selected Industrial Sectors

3.1 Industrial Sectors in Nepal

Industrial development in Nepal is still at an early stage. Industrial production represents a small but growing segment of economic activity. Industry accounts for about 15 percent of Gross Domestic Product (Central Intelligence Agency World Factbook, 2009), and employs only 7 percent of the population (Central Intelligence Agency World Factbook, 2010). The sector grew in financial year 2009-10 from 1 percent to 2.6 percent in the previous year (Ministry of Finance, 2010).

Starting in the 1930s, a number of public enterprises were established by the government with the aim of building an industrial and manufacturing base. Relatively small by international standards, most of the industries established in the fifties and sixties were developed with government protection. Most used agricultural products as raw materials while some were dependent on various inputs imported from other countries, mainly India. Traditional cottage industries, including basket-weaving, cotton fabric production and edible oil production, comprised approximately 60 percent of industrial output. The remainder of industrial output came from modern industries, such as jute mills, cigarette factories and cement plants.

The Government of Nepal initiated the process of privatization, liquidation and termination of public enterprises in 1993. Between then and financial year 2009-10, the government has divested 30 public enterprises through the adoption of various modalities including partial disinvestment of shares, sale of current assets, lease of buildings and land, among others.

At present there are 11 industrial estates including Balaju, Birgunj-Hetauda, Patan (Lalitpur), Nepalgunj, Biratnagar-Dharan (Morang-Sunsari), Pokhara, Butwal, Bhaktapur, Birendranagar, Dhankuta and Gajendra Narayan Singh Industrial District (Ministry of Finance, 2010). The main manufacturing areas are concentrated around urban centres such as the Kathmandu Valley and in the Terai region - Biratnagar and the Birgunj-Hetauda Corridor. At present, as an effect of the transitional political state, poor labor relations, energy shortage and other structural problems, domestic industries have been operating below capacity, leading to a widening of internal disequilibrium between aggregate demand and supply (Nepal Rastra Bank, 2010).

Classification of Industries

Industrial Enterprises Act 1992 classifies industries into seven categories, as pre-sented in Table 3 below.

[2] U.S. Library of Congress (http://countrystudies.us/nepal/44.htm)

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Table 3: Classification of Industries by the Industrial Enterprises Act 1992

SN	Classification of Industries	Description
1	Manufacturing Industries	• Industries which produce goods by utilizing or processing raw materials, semi-processed materials, by-products or waste products, or any other goods
2	Energy-Based Industries	• Industries generating energy from water resources, wind, solar, coal, natural oil, gas, biogas or any other sources
3	Agro and forest-based Industries	• Businesses mainly based on agriculture or forest products such as integrated sericulture and silk production, horticulture and fruit processing, animal husbandry, dairy industry, poultry farming, fishery, tea gardening and processing, vegetable seed farming, mushrooms, vegetable farming or vegetable processing, tissue culture, green houses, bee-keeping, agro-forestry, etc.
4	Mineral Industries	• Industries engaged in mineral excavation or processing thereof
5	Tourism Industries	• Tourist lodging, motels, hotels, restaurants, resorts, travel agencies, etc.
6	Service Industries	• Construction business, public transportation business, hospital, cold storage, etc.
7	Construction Industries	• Involved with the building of roads, bridges, railways, ropeways, trolley buses, as well as industrial, commercial and residential complex construction and operation

Source: Industrial Enterprises Act 1992

In addition, the Industrial Enterprises Act 1992 defines 'Cottage Industries' as traditional, labor intensive industries utilizing specific skills or local raw materials and resources, which are also related to national tradition, art and culture.

On the basis of fixed assets , the Industrial Enterprises Act 1992 classifies indus-tries into three types - small, medium and large scale industries.

Table 4: Industries Based on Fixed Assets

S.N	Industries (Scale)	Fixed Asset
1	Small	Up to Nepali rupees 30 million ($ 417,827.3)
2	Medium	Between Nepali rupees 30 million ($ 417,827.3) and 100million ($ 1,392,758)
3	Large	More than Nepali rupees 100 million ($ 1,392,758)

Source: Industrial Enterprises Act 1992

[3] The fixed assets of an industry consists of the following movable and immovable assets: land and land improvement, physical infrastructure, office, factory building, godown, electric distribution, water distribution system, residential buildings, machinery, equipment and tools, means of transportation, electrical equipment and office equipment, furniture, fixtures, communication systems and equipment, and the expenses incurred on technical consultancy and supervision prior to making investment or during construction.

Sustainable Energy Finance Market Study
for Financial Sector in Nepal

3

Industrial Statistics

With the influx of foreign aid targeted at both the industrial sector and transport and communications infrastructure, a mix of modern industries and cottage industries developed in Nepal gradually. The modern industries are registered with the Department of Industry (DoI), under the Ministry of Industry, while the cottage industries are registered with the Department of Cottage and Small Industries (DCSI). In general, there are more industrial enterprises in the private sector than in the public sector, although most of these are classified as cottage industries (Refer Table 5).

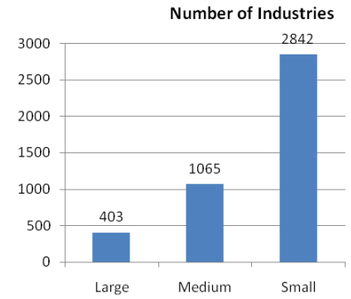
Table 5: Number of Industries Registered with DoI and DCSI up to FY 2009/10

Types of Industries	No. of Industries registered in DoI	No. of Industries registered in DCSI
Agro-based	184	3,595
Construction	37	8,374
Energy Based	62	1,140
Manufacturing	2,080	76,896
Mineral	31	944
Service	1,170	53,946
Tourism	764	10,217
Total	**4,310**	**155,112**

Source: DoI 2009/10; DCSI 2009/10

According to industrial statistics, a total of 4,310 industries registered with the DoI during 2009-10. Of these 403 are large, 1,065 are medium and 2,842 are small-scale industries (DoI, 2009/10). On the other hand, the number of cottage and small industries registered with DCSI till 2009-10 was considerably larger at 155,112.

Figure 1: Number of Industries Registered with DoI by Scale (Up to FY 2009/10)



Source: DoI 2009/10

The total project cost was the highest in large-scale industries ($ 2,862.62 million), while the total fixed cost was the highest in medium-scale industries. However, small-scale industries provided the maximum number of employment in comparison to the large and medium-scale industries. (Refer Table 6 below.)

Table 6: Total Project Cost and Total Fixed Cost of the Industries Registered with DoI up to FY 2009/10

Scale	No. of Industries	Total Project Cost (USD in millions)	Total Fixed Cost (USD in millions)	Total Number of Employment
Large	403	2,862.62	2,521.73	75,196
Medium	1,065	1,112.10	7,492.90	115,500
Small	2,842	548.63	316.43	208,390
Total	**4,310**	**4,523.34**	**3,587.46**	**399,086**

Source: DoI 2009/10

3.2 Introduction to Selected Industry Sectors

This study selected ten industries on the basis of size (in terms of production capacity, and investment), consumption of energy, potential for energy efficiency and renewable energy intervention, and the investment potential. Based on the literature review and discussions with local experts working in the area of cleaner production and energy efficiency, ten industries -- cement, rolling mills, poultry/agribusiness (poultry and feed, dairy, and tea), plastic, cold storage, food and beverage (breweries/distilleries), steel structures, paper and pulp, brick, and tourism (hotels) --have been identified as energy-intensive, and hence with the highest energy efficiency/renewable energy potential in Nepal.

This study took into account data on the number of establishments in each industry from the Central Bureau of Statistics (CBS, 2006-07), instead of the Department of Industry and the Department of Cottage and Small Industries. This is because DoI and DCSI classify Nepal's industryaccording to the criteria (Refer Table 5) of the Industrial Enterprises Act 1992, which does not match the industrial sectors selected for this study (cement, rolling mills, plastic, etc.) (Refer Table 8). Further, all the industries registered with them may not be in operation currently, whereas this study required fully operational industrial units.

Industrial sectors for which there was no data available with the Bureau, the relevant industrial associations were contacted (for example, Association of Poultry Industries, Association of Cold Storage, etc.). CBS 2006-07 provides industrial establishment data based on fixed assets, which is different from that of the Industrial Enterprises Act 1992 (as presented in Table 4). The Bureau follows the following categorization of fixed assets, without classifying industries into small, medium or large:

1. Less than Nepali rupees 10 million (Less than $ 139,275.77)
2. Between Nepali rupees 10 million and 50 million (Between $ 139,275.77 and $ 696,378.83)
3. More than Nepali rupees 50 million (More than $ 696,378.83)

Hence, this study assumes the following:

Table 7: Assumption of Scale of Industries Based on CBS 2006/07 Fixed Assets

S.N.	Industries with Fixed Asset (CBS 2006/07)	Assumption (Scale)
1	Less than $ 139,275.77	Small
2	Between $ 139,275.77 and $ 696,378.83	Medium
3	More than $ 696,378.83	Large

Based on the above classification of industrial scale, Table 8 presents the number of establishments in each of the ten industries selected for this study. In total, there are 1,041 industrial establishments in Nepal of which 74 are large, 171 are medium and 699 are small.

Table 8: Total Number of Establishments in Ten Industrial Sectors

SN	Sector and Sub Sectors	Total Number of Establishments			
		Large	Medium	Small	Total
1	Cement	10	14	1	25
2	Rolling Mills	7	4	6	17
3	Poultry/Agribusiness	16	46	75	137
	a. Poultry and Feed	0	20	25	45*
	b. Dairy	4	9	26	39
	c. Tea	12	17	24	53
4	Plastic	13	36	103	152
5	Cold Storage	0	20	0	20**
6	Food and Beverage (Breweries/Distilleries)	7	15	8	30
7	Steel Structures	15	27	46	88
8	Paper and Pulp	5	0	41	46
9	Brick	1	9	419	429
10	Tourism (Hotels)	NA	NA	NA	97***
	Total	**74**	**171**	**699**	**1041**

*Source: CBS 2006/07; * Association of Poultry Industries; ** Association of Cold Storage; *** Hotel Association Nepal*

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The research team visited a total of 51 establishments from Kathmandu Valley, Biratnagar Industrial Corridor, Birgunj-Hetauda Industrial Corridor, the Eastern parts of Nepal, and interviewed the relevant personnel.(Refer Annex 3.1).

Interviews with entrepreneurs from these sectors revealed that most of the technical personnel working in these industrial units have inadequate knowledge about energy efficiency and renewable energy technologies and concepts. Besides, in the face of the current energy crisis, the management of these industrial units is more concerned with meeting the production demand. Their capital is tied up in some or the other expansion, hence they consider investment in energy efficiency and renewable energy technologies less of a priority.

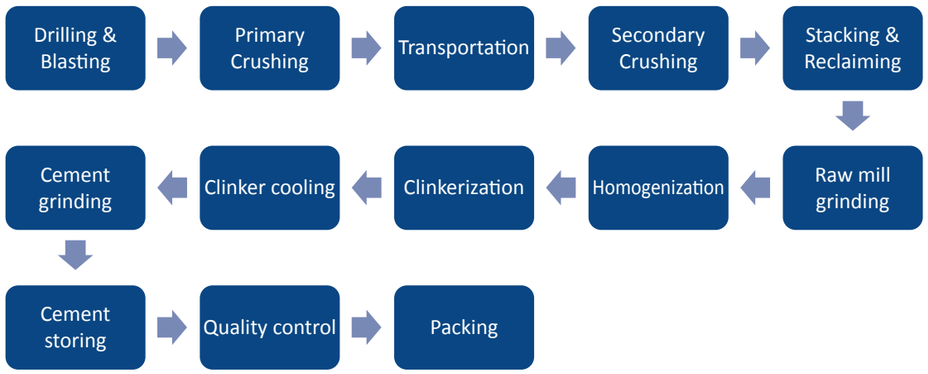
A brief description of each selected industry is presented in the following paragraphs.

3.2.1 Cement

Cement has been used as the main construction material in Nepal for the last five decades, but investment in the industry began to grow only since 1993. There are 25 cement manufacturing plants, most of which have been the result of private investment. Of these, 10 are large, 14 medium and only one is small (Central Bureau of Statistics, 2006-07). The majority of them are clinker-based and a few are mine-based. The clinker-based cement plants either buy clinker domestically or import them from India. The present national demand for cement is estimated to be around 3.5 million metric tons per annum, of which only 44.5 percent is fulfilled by national cement production; the remaining 55.5 percent is imported. The cement industry contributed 3.21 percent to the Gross Domestic Product for FY 2000/01 (United States Agency for International Development, 2003). The industry is estimated to have utilized only 45 percent of the total production capacity (Ministry of Finance, 2010). For this study, the research team visited and interviewed personnel from 7 cement industrial plants.

Products: Ordinary Portland Cement, Portland Pozollana Cement and Slag Ce-ment of different grades.

Manufacturing Process:



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Machinery and Equipment:

The major equipment used in the cement industry is listed below:

Clinker Based	Non-clinker Based
1. Crusher Mill 2. Conveyor 3. Dust Collector 4. Cement Mill 5. Waste Heat Recovery System 6. Ball Mill 7. Air Compressors 8. Materials Handling Equipment 9. Packing Machine	1. Ball Mill 2. Dust Collector 3. Air Compressor 4. Materials Handling Equipment 5. Packing Machine

3.2.2 Rolling Mills

Rolling Mills is one of the most energy-intensive sectors in the Nepalese economy. Raw material for this sector is imported from India in billet form. The primary market for rolling mill products is the construction sector. According to CBS 2006-07, there are a total of 17 establishments in the Rolling Mill sector, out of which seven are large, four are medium and six are small. The research team visited six plants for this study. Rolling mills contributed 4.22 percent to the GDP for the year 2000-01 (USAID, 2003).

Products: Iron bars with different diameters as per construction requirement.

Manufacturing Process:

Machinery and Equipment:

1. Furnace
2. Rolling Mill (Multi Phase)
3. Cutting
4. Thermo Mechanically Treated Iron Bar Production machine

3.2.3 Poultry/Agribusiness

The poultry/agribusiness industry has been divided into the following three categories:

a. Poultry and Feed

The poultry sector contributes around 3 percent to Nepal's GDP and has seen an encouraging growth trend, with total investment surging to $ 334.26 million. The surge in the scope and size of the business is mainly due to the opening of big poultry farms, hatcheries and feed industries. According to the Association of Poultry Industries, there are a total of 45 poultries, from which the research team visited seven.

Most poultries are concentrated in the Chitwan and Dhading districts of Nepal. However, small poultry establishments are scattered in rural areas too where electricity is available. New investors have been focusing on the production of pelleted feed with the use of latest production technology. Small feeds requiring moderate investment are also on the rise. The cost of constructing a feed mill with a high-technology plant and silo (storage tower) facility is estimated to be between $ 2.08 and 3.48 million.4

Products:

1. Hatching eggs
2. Parent bird stock; DOC (day old chick); Broiler DOC
3. Feed

Manufacturing Process:

Machinery and Equipment:

1. Hatchery Units
2. Air Compressor
3. Generator
4. Feed making machines
5. Conveyor belts
6. Water pumps

[4] http://www.thepoultrysite.com/poultrynews/20927/rising-demand-boosts-poultry-meat-industry

Sustainable Energy Finance Market Study
for Financial Sector in Nepal

3

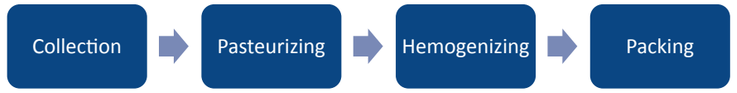
b. Dairy

With an increasing participation of the private sector, Nepal's dairy processing and farming industry is a growing sector (Pradhan, 2005), playing an important role in the national economy. The dairy industry constitutes more than 60 percent of the livestock sector's contribution to GDP. During 2000-01, dairy products contributed 2.6 percent to GDP (USAID 2003). Annual production of milk is 1.35 million metric tons. It is predominantly a smallholder production system. CBS 2006-07 lists 39 dairy plants of which four are large, nine are medium and the rest are small. The research team visited one dairy processing plant for this study.

Products:

1. Milk
2. Yoghurt
3. Ice-cream
4. Ghee
5. Cheese

Manufacturing Process:



Machinery and Equipment:

1. Pasteurizing Unit
2. Collection Tank
3. Boiler
4. Chiller
5. Hot water generator
6. Transformer
7. Cold room
8. Ice-cream maker
9. Water pump

[5] http://www.aphca.org/workshops/Dairy_Workshop/Country%20Sessions/Nepal.doc

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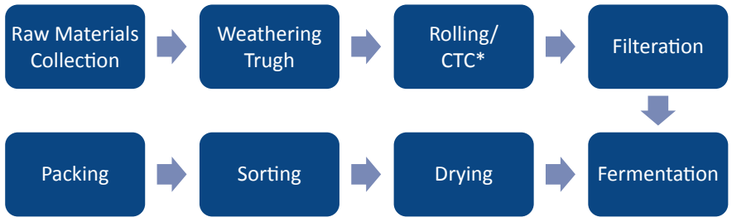
c. Tea

Tea-growing has a long history of nearly 142 years in Nepal. The tea industry produces two distinct type of tea -- Orthodox and CTC (Cut, Tear, Curl). There are a total of 53 tea processing units in Nepal out of which 12 are large, 17 are medium and the rest are small (CBS, 2006-07). The estimated annual production of CTC and orthodox black tea is 10.6 million kg and 1.2 million kg respectively (Karki, 2011). The primary export markets for orthodox tea are Germany, Japan and USA, while India and Pakistan are the main markets for CTC tea. The annual tea production target has been fixed at around 46.11 million kg, of which 65 percent will be orthodox tea (Karki, 2011). The research team visited and interviewed personnel from seven tea processing units.

Products:

1. Orthodox tea
2. CTC tea

Manufacturing Process:



*Rolling is done for orthodox tea and CTC (Curl, Turn and Cut) for CTC tea.

Machinery and Equipment:

1. Rollers/CTC Machine
2. Dryer
3. Sorting Machines
4. Conveyor
5. Boiler/Furnace
6. Weathering Fan

Sustainable Energy Finance Market Study
for Financial Sector in Nepal

3

3.2.4 Plastic

Plastic is another industry that uses a significant amount of electricity during production for heating and cooling of raw materials. It uses raw materials like polyvinyl chloride compounds and polyethylene granules. These are imported from Malaysia, Singapore, Saudi Arabia, Qatar, China, India, Taiwan, Japan, and Indonesia, and are processed in master batches for coloring. During 2000-01, plastic and rubber products contributed 2.98 percent to Nepal's GDP (USAID, 2003). There are a total of 152 establishments of which 13 are large, 36 are medium and the rest are small industries (CBS, 2006-07). The study team visited two plastic manufacturing units.and conducted interviews. For this study,plants producing High Density Polyethylene plastic containers have been considered. Plastic production has decreased in recent times due to load shedding.

Products:

1. Plastic sheets
2. Bags
3. Pouches
4. Woven Fabric
5. Bottles.
6. HDPE Plastic Containers

Manufacturing Process:

Machinery and Equipment:

1. Extruder
2. Injector
3. Molder
4. Compressor
5. Cooling tower
6. Water pump

3.2.5 Cold Storage

Cold Storage falls under the service industries category as per the Industrial Enterprises Act 1992. It operates on a seasonal basis. It stores agricultural products like vegetables, mainly potatoes, fruits, spices, among others. According to the Association of Cold Storage, there are a total of 20 cold storage establishments, all of which are medium-scale. For this study, the research team visited and interviewed personnel from one cold storage plant.

Manufacturing Process:

Products:

1. Storage of fruits, vegetables and meat
2. Ice blocks

Machinery and Equipment:

1. Compressor
2. Cooling tower
3. Receiver
4. Water Pump

3.2.6 Food and Beverage (Breweries/Distilleries)

Various types of establishments fall under the food and beverage industry, including distilleries, breweries, biscuits, noodles, and others. The research team visited five food and beverage plants including distilleries, breweries, biscuit and other food products. However, due to significant differences in the type of product line and amount of energy consumed in these diverse categories, only breweries/distilleries have been considered for calculating energy consumption, saving and investment potential. Out of the 30 total brewery establishments, seven are large, 15 are medium and eight are small industries (CBS, 2006-07).

The overall production of the food and beverage industry is expected to increase. During the 2010-11 alone, the production of beverage has increased by 1,900 kiloliters. In terms of contribution to the economy, malt liquors contributed 4.9 percent to GDP in 2000-01, while distilleries contributed 2.73 percent. Food, beverage and tobacco together contributed 34.85 percent to Nepal's GDP (USAID, 2003).

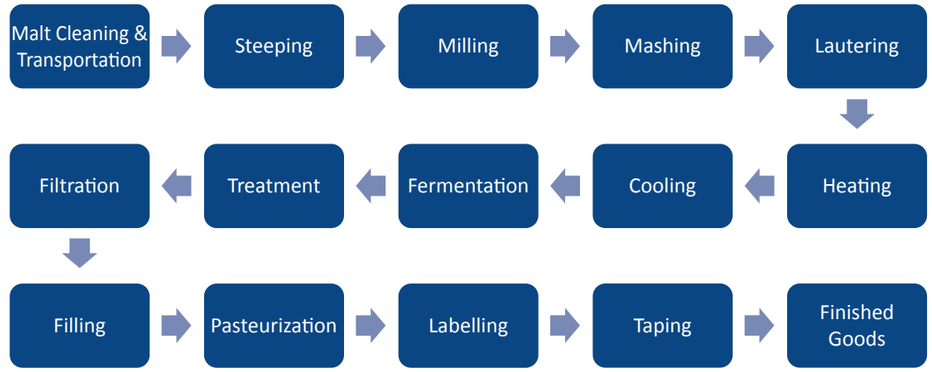
Sustainable Energy Finance Market Study
for Financial Sector in Nepal

3

Products (Brewery):

1. Beer
2. Alcohol
3. Wine

Manufacturing Process of a Brewery:



Machinery and Equipment:

1. Wet Mill
2. Mash Converter
3. Lauter Tun
4. Pre-run vessel
5. Wort Kettle
6. Whirl Pool
7. Plate Cooler
8. Washer
9. Filler
10. Crowner
11. Pasteurizer
12. Labeler
13. Boiler
14. Air Compressor
15. CO2 Recovery Plant
16. Generators
17. Refrigerators
18. Water Treatment Plant
19. Waste Water Treatment Plant

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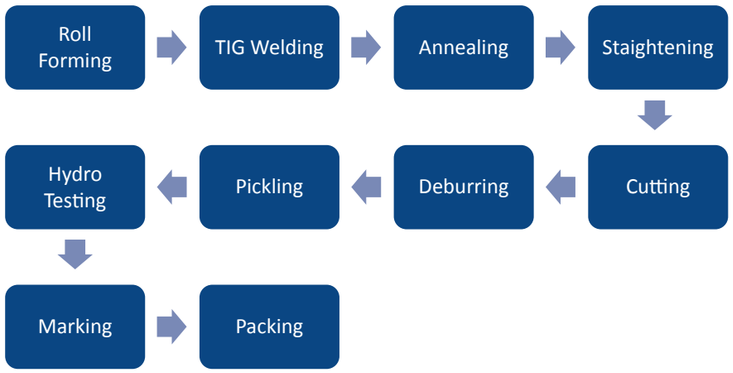
3.2.7 Steel Structures

This industry is one of the major producers of construction material in Nepal.Iron and steel contributed 6.8 percent to GDP during 2000-01 (USAID, 2003). Raw material for the steel structures is mainly imported from India, and the market share of the product is interestingly higher in India than in Nepal. These plants are mainly situated in the Birgunj and Biratnagar industrial corridors. There are a total of 88 steel structure establishments in Nepal, out of which 15 are large, 27 are medium and 46 are small (CBS, 2006-07). A total of seven steel mills were visited and interviewed. Even though steel mills produce a wide range of products including sheets, pipes, wires and others, mills producing only sheets have been considered for this study.

Products:

1. Galvanized pipes
2. Roofing sheets
3. Strips
4. Pipes
5. Channels
6. Steel structures
7. Poles
8. Wires, etc.

Manufacturing Process:



Machinery and Equipment:

1. Welding Mill
2. Furnace
3. Galvanized Iron Plant
4. Compressor
5. Slitting
6. Tube Mill
7. Blower

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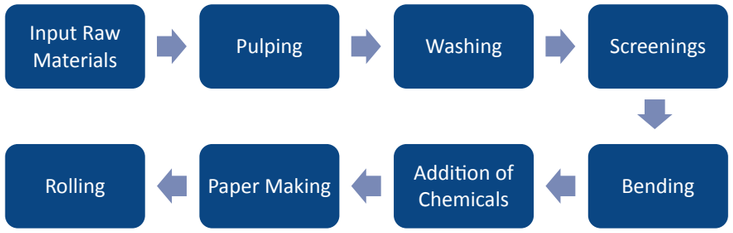
3.2.8 Paper and Pulp

Handmade paper has enjoyed a robust market in the country for the last two decades. To meet the increasing demand, industrial manufacturing of paper started with the establishment of Shree Bhrikuti Pulp and Paper Industry at Gaidakot in 1984. The plant was expanded in 1995 to a capacity of 60 tons/day for writing and newsprint paper. There are only a few large-scale enterprises in this industry, and there is only one enterprise with a co-generation plant. Accroding to CBS 2006-07, there are a total of 46 paper and pulp establishments, of which 5 are large and 41 are small. All of theseare based on the conventional pulping process. The majority of paper enterprises produce writing and printing papers, although Kraft paper packing paper is also produced on a small scale. The production of paper and paper material is likely to decrease according to Economic Survey 2009-10. The research team visited two paper and pulp units for this study.

Products:

1. Pulp
2. Writing and printing paper
3. Kraft paper
4. Packing paper

Manufacturing Process:



Machinery and Equipment:

1. Chipper
2 .Digester
3. Evaporator
4. Washing & Screening
5. Bleaching
6. Soda Recovery
7. Stock Preparation
8. Paper Machine
9. De-aerator
10. Utilities and Others

3.2.9 Brick Industry

The construction sector is the-sixth largest in Nepal, after agriculture, trade, transport/communication, real estate, and education. This sector has , on an average contributed 6.7 percent to the GDP of Nepal over the last five years. It is estimated to have grown by 6.6 percent in the financial year 2009-10, in comparison to 0.9 percent in the previous year. This is due to the rapid growth in real estate, particularly the construction of buildingsfor government offices in and outside of Kathmandu Valley (Ministry of Finance, 2010). People are investing a significant part of their savings in housing and incremental house improvements. The brick industry is the single- most important building material producer in Nepal and is considered to be highly energy-intensive.

The traditional "Bhuse Bhatta" (clamp kilns) used to be the dominant technology for producing bricks in Nepal. With the technology shift initiated in the early fifties, traditional clamp kilns were replaced by Bull's Trench Kilns (BTK) -- first by movable chimneys (MCBTK) and then fixed chimneys (FCBTK). These kilns use coal as the main fuel for firing bricks. The traditional BTK technology has an inefficient fuel burning process, resulting in high consumption of coal during brick firing work, excessive local air pollution and high greenhouse gas emissions.

In response to public pressure and recognizing the need for more energy-efficient processes, Nepal government banned the use of MCBTK in Kathmandu valley, and many brick entrepreneurs have made the shift to FCBTK. MCBTK is still extensively used in other parts of the country, although the government had decided to replace it by the end of 2011 with Vertical Shaft Brick Kiln/FCBTK/Tunnel Kiln.

The brick industry in Nepal is considered an informal sector, low in the industrial pecking order (Heierli and Maithel, 2008, 77). These units are mostly structured as labor-intensive cottage industries which use local raw materials and resources. . Production of bricks during 2006-07 has been estimated to be 3.42 billion pieces (CBS, 2006-07). The market share of VSBK in the country's brick industry is only 5 percent i.e. out of a total of 429 brick kilns in Nepal,only 22 are VSBKs (Prajapati, 2010). There are 10 medium and 419 small-scale brick industries in Nepal. The research team visited three brick units for this study.

Products:

1. Coal fired bricks
2. Roofing tiles

Manufacturing Process:

Machinery and Equipment:

1. Kiln
2. Excavators
3. Pug Mill
4. Molder
5. Generator

[6] Industrial Promotion Board meeting 15/12/2009; 183 minutes; Decision no. 1

3.2.10 Tourism (Hotels)

Tourism represents a small but expanding industry, and is one of the major contributors to Nepal's GDP. Star-rated hotels are the largest energy consumers in this sector. Tourism has been a major foreign exchange earner accounting for 23.9 percent of the country's total foreign exchange earnings (Danish Energy Management, 2011). Tourism contributed 2 percent to GDP until January 2010(Ministry of Finance, 2010).

This study has made estimates only for hotels, as these are the biggest energy-guzzlers. . The large hotels are concentrated mainly in Kathmandu and Pokhara, and the small ones are scattered across several parts of Nepal. Data for 2008 shows that the number of star hotels reached 97 (with the addition of one new star hotel) while the number of non-star hotels reached 647 with the addition of 74 hotels. During this year, the number of hotel beds in non-star hotels increased by 2,381 beds, reaching 19,124, while the number of beds in the star hotels has reached 9,369 (an additional 49 beds from the previous year) (MoF, 2010). The research team visited and interviewed personnel from three hotels.

Machinery and Equipment:

1. Boiler
2. Chillier
3. Motor
4. Compressor
5. Air Conditioner
6. Waste Water Recovery System
7. Waste Filter
8. Cooling Tower

3.3 Energy Demand and Consumption in Industries

The energy-consuming sectors in Nepal have been classified as residential, commercial, transport, industrial and agricultural. Due to the inadequate number of energy-intensive industries in Nepal, the industrial sector ranks third in the total energy consumption pattern of the country.

During the year 2008-09, out of the total energy consumption of 401 million gigajoules, the residential sector accounted for the majority of energy consumption (89.1 percent), followed by transport (5.2 percent), industry (3.3 percent), commercial (1.3 percent), agricultural (0.9 percent), and others (0.2 percent) (Water and Energy Commission Secretariat, 2010). Biomass resources including fuel-wood, agricultural residue and animal waste are the major fuels used in the residential sector. Renewable sources of energy, like biogas, electricity from micro-hydropower plants and solar home systems have been, in recent times, substituting conventional fuels used mainly for cooking and lighting. Commercial fuel sources such as kerosene, liquefied petroleum gas, coal, other petroleum products, and electricity are used in a considerably small ratio, and their use is mainly limited to urban areas.

Table 9: Total Energy Consumption by Sectors 2008/09

S.N.	Sector	Total Energy Consumption by Sectors (2008/09)
1	Residential	89.1 %
2	Industrial	3.3 %
3	Commercial	1.3 %
4	Transport	5.2 %
5	Agricultural	0.9 %
6	Other	0.2 %
	Total Energy Consumption	**401 Million GJ**

Source: WECS, 2010

In terms of consumption by physiographic region, 63 percent of the total energy is consumed in the Terai region, as compared to 29 percent in the Hills and only 8 percent in the Mountain districts (WECS, 2010). Industrial energy consumption was 9.1 million GJ during 1996-97 which increased by about 3.9 percent annually (WECS, 2010). Table 10 presents the historical trend of industrial energy consumption in Nepal.

Table 10: Historical Trend of Industrial Energy Consumption in Nepal

Sector	Years								
	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09
Industrial ('000 GJ)	12998.3	12537.0	11969.5	13715.9	12761.3	16839.8	12791.4	13988.7	13369.8

Source: WECS 2010, p. 88

Nepal's energy resources are broadly divided into three categories: Traditional (all types of biomass resources), Commercial (petroleum fuels, coal and electricity) and Alternative (hydro, solar, wind etc). Table 11 presents the industrial sector's energy consumption by fuel type for the year 2008-09. The total energy consumption in this sector during the year was about 13.4 million GJ, which is about 3.3 percent of total energy consumption (WECS, 2010).

Sustainable Energy Finance Market Study
for Financial Sector in Nepal

Table 11: Industrial Sector Energy Consumption by Fuel Types

S.N.	Type of Fuel	Percentage consumed by Industrial Sector (2008/09)
1	Fuel wood	5.4 %
2	Agricultural residue	10.1 %
3	Coal	57.7 %
4	Electricity	23.2 %
5	HS Diesel	1.8 %
6	Kerosene	0.8 %
7	Petroleum	0.9 %
	Total Energy Consumption	**13.4 Million GJ**

Source: WECS 2010

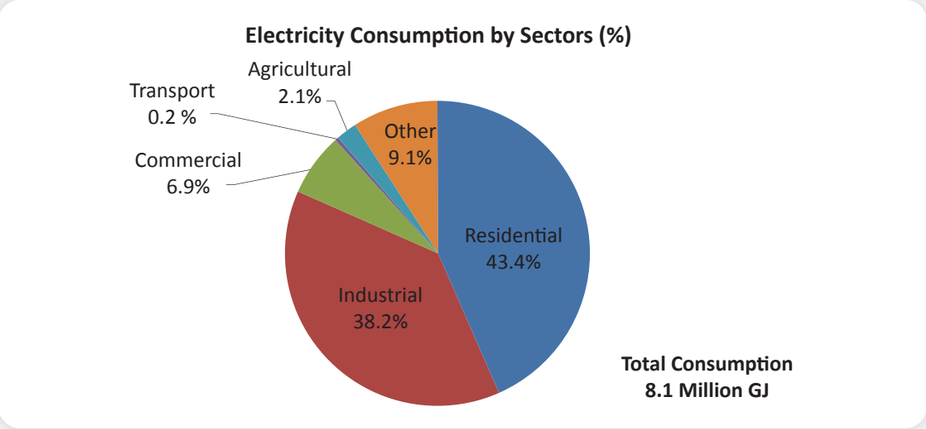
Energy consumption in the industrial sector is primarily driven by the use of boilers and other heating equipment. Hence, coal is heavily consumed by this sector. Other end-uses of energy in this sector are power motive (31 percent), process heating (30 percent) and lighting (2 percent) (WECS, 2010). Coal fuels the boilers and kilns, supplying more than half of the total industrial energy consumed.

Electricity provides about one-fourth of the total industrial energy consumption. It is primarily used for power motives and lighting in this sector. Petroleum usage in this sector is just about 3.5 percent, most of which is used for captive power generation. Biomass resources, particularly fuel-wood and agricultural residue, are still used in the industrial sector for the ignition of fire as well as for heating purposes, sometimes together with coal. Biomass still supplies about 15 percent of the industrial energy requirement (WECS, 2010).

Electricity consumption by Sectors

With the increasing number of customers availing of electricity services from the Nepal Electricity Authority, power and energy demand is increasing exponentially. In 2007-08, the number of customers grew by 9.07 percent as compared to that of previous year. This growth is most significant in residential and industrial sectors than in other development sectors (NEA 2009, as cited in WECS, 2010). The following (Figure 2) shows electricity consumption by sector.

Figure 2: Electricity Consumption by Sectors 2008-09



Source: WECS 2010

Besides, as a result of the problems with various labor unions, security concerns, and political instability, the industrial sector in Nepal is facing an acute energy crisis. Despite having hydropower potential of around 80,000 megawatts, half of which is economically viable, (WECS, 2010), Nepal is a net importer of electricity.

There is shortfall of 525 MW of electricity at present. This year the electricity demand has been 915 MW, but only390 MW of power got supplied(Awasthi, 2011). Out of the total electricity generated in Nepal, 194 MW is being produced by NEA, 87 MW by the private sector, and 108 MW is imported from India (Awasthi, 2011). It is also estimated that the demand for electricity is increasing by about 10 percent every year (about 80 MW) (NEA, 2010). Widespread misuse of electricity and lack of a stable law-and-order situation in many parts of the country contributed to heavy losses (technical and non-technical) during 2009-10, resulting in a net system loss of 26.58 percent (NEA, 2010).

As a result of massive shortfall in the supply of electricity and an ever-growing gap between demand and the installed capacity, the productivity of all industrial and service sectors have been adversely affected (Nepal Rastra Bank, 2010). The central region of the country is most severely affected, as it includes several urban and industrial cities, including Kathmandu, Hetauda, Chitwan, and Birgunj. In this region there is a capacity shortfall of 430 MW of electricity. In the eastern region, it is estimated that 62 MW of electricity could alleviate the load shedding problem (Awasthi 2011).

[7] The electrification rate, at 48 percent in 2006, is one of the lowest in South Asia.
[8] Nepal Electricity Authority reports that the year 2009-10 witnessed a surge in power and energy demand, generation and import. Annual Peak Demand was recorded at 885.28 MW, registering an 8.96 percent growth over the 812.5 MW figure of the previous year.
[9] The load forecast of NEA reports a system peak load of 967 MW for the FY 2010/11.

Sustainable Energy Finance Market Study
for Financial Sector in Nepal

Many traditional and small-scale industries are being closed due to production deadline pressure from the international markets, a trend which could continue in the near future as well. Industries are unable to operate full hours due to insufficient and unreliable power supply, leading to up to 14 hours of daily power cuts. Further, frequent power trips, and fluctuation in the voltage and frequency have had an adverse impact on industries.

Electricity and Fuel Tariff Structures

Nepal Electricity Authority is a government agency responsible for most of the generation, load dispatch, transmission and distribution of electricity in the country. The various tariff structures are provided in Table 12 and 13 below:

Table 12: Tariff Rates of Different Voltage

S.N.		Domestic Consumer	Monthly Demand Charge		Energy Charge (NRs.)	
			NRs.	USD	NRs.	USD
A.	Industrial					
	1	Low Voltage (400/230 Volt)				
		a) Rural and Cottage	45.00	0.63	5.45	0.07
		b) Small Industry	90.00	1.25	6.60	0.09
	2	Medium Voltage (11 kV)	190.00	2.65	5.90	0.08
	3	Medium Voltage (33 kV)	190.00	2.65	5.80	0.08
	4	High Voltage (66 kV and above)	175.00	2.44	4.60	0.06
B.	Commercial					
	1	Low Voltage (400/230 Volt)	225	3.13	7.7	0.11
	2	Medium Voltage (11 kV)	216	3.01	7.6	0.11
	3	Medium Voltage (33 kV)	216	3.01	7.4	0.10

Source: NEA Annual Report 2010

[10] It is reported that in there is an energy demand of 115 MW in the Eastern region of Nepal, and instead of Nepali Rupeess 7/unit charged by NEA, consumers have been paying NRs. 25 per unit of electricity generated from the diesel generator (Kantipur, Tuesday, 02-22-2011, p 11).

Table 13: Time of Day Tariff Rates

S.N.	Supply Level in Domestic Sector		Monthly Demand Charge (per kVA)		Energy Charge (per Unit)					
			NRs.	USD	Peak-Time 18:00-23:00		Off-Peak 23:00-6:00		Normal 6:00-18:00	
					NRs.	USD	NRs.	USD	NRs.	USD
A.	Industrial									
	1	High Voltage (66kV and above)	175.00	2.44	5.20	0.07	3.15	0.04	4.55	0.06
	2	Medium Voltage (33 kV)	190.00	2.65	6.55	0.09	4.00	0.06	5.75	0.08
	3	Medium Voltage (11 kV)	190.00	2.65	6.70	0.09	5.85	0.08	4.10	0.06
B.	Commercial									
	1	Medium Voltage (33 kV)	216.00	3.01	8.50	0.12	5.15	0.07	7.35	0.10
	2	Medium Voltage	216.00	3.01	8.65	0.12	5.25	0.07	7.55	0.11

Source: NEA Annual Report 2010

A tariff rate of Nepali Rupees 5.85/unit ($ 0.08/unit) has been considered standard for all calculations made in this study. This rate is the cost of grid-connected electricity. As most industries are running at normal hours with medium voltage (11 kV), the dollar saving and consumption on electricity is calculated based on this price.

Government-owned Nepal Oil Corporation is the sole agency providing the different petroleum products in the country, such as petrol, high speed diesel, superior kerosene oil, turbine fuel, among others. The following are the fuel tariffs prevailing in Kathmandu, inclusive of VAT. NOC doesn't supply furnace oil, rice husk and coal, and the retail rates for these have been collected from the available vendors and listed in Table 14 below:

Table 14: Fuel Tariff Structure

SN	Items	Price in NRs.	Price in USD ($1 = NRs. 71.80)
1	Diesel (HSD)	68.50/litre	0.9540/litre
2.	Kerosene (SKO)	68.50/litre	0.9540/litre
3.	Furnace Oil*	55.00/litre	0.7660/litre
4.	Rice Husk*	1500/ton	20.89/ton
5.	Coal*	1500/ton	20.89/ton

*Source: NOC, 2011; * vendors*

Almost all the selected sectors and sub-sectors, except Rolling Mills, are using captive plants for power backup during the lengthy power cuts. This has significantly increased the total energy cost due to increase in the consumption of fossil fuels such as diesel and kerosene. Hence, to calculate the total dollar saving for each industry, the total units of electricity and the total amount of fuel consumed is multiplied by the respective tariff rates.

3.4 Important Stakeholders in the Industry Sector

A number of government and non-government organizations, donors and the private sector are working to promote industry and sustainable energy in Nepal. Given below are some of the most prominent of these groups.

Government Institutions:

The Government of Nepal is involved in industrial sector development through several organizations. The important government institutions involved with the industrial sector include:

National Planning Commission

This is the advisory body for formulating the development plans and policies of the country under the directives of the National Development Council. It is mandatory for all central-level annual plans, policies and projects to be approved by the NPC before implementation. The Commission explores and allocates resources for economic development and works as the central agency for monitoring, evaluating and facilitating the implementation of development plans, policies and programs. The Commission prepares a periodic (five-year) development plan of the country which comprehensively outlines national development goals, objectives and strategies.

Ministry of Industry

Ministry of Industry was established as a separate entity in 2008 (formerly Ministry of Industry, Commerce and Supplies) for overseeing industrial development through the formulation of necessary policies, Acts and rules to create employment opportunities, increase industrial production and develop the economy of the country.

The Ministry issues Environmental Impact and Risk Assessment Guidelines that incorporate environmental considerations in industrial development. Guidelines have been developed for zoning and location of industries, and also on how toxic wastes must be handled. The Ministry is developing a comprehensive industrial environmental information system to help achieve sustainable industrial development in the country.

Department of Industry

The Department of Industry was incorporated under the Ministry to expedite and implement the policy, rules and regulations of the government to boost the economy through industrialization. The objective of the DoI is to facilitate the establishment of industries above $ 417,827.29 (Nepali rupees 30 million) in different parts of the country. In addition, the Department facilitates all types of foreign investment and technology transfer, irrespective of investment amount. It issues licenses to prescribed industries and is responsible for the registration of all medium and large-scale industries.

Department of Cottage and Small Industry

DCSI was constituted under the Ministry of Industry in 1974 to promote and foster the development of various kinds of cottage and small industries. It is responsible for boosting industrial productivity of small and cottage industries along with creating an environment suitable for industrial investment and ensuring the execution of national policies.

Ministry of Environment

MoEnv is responsible for formulating the plans and policies related to environment protection and pollution control; issuing pollution standards and monitoring the implementation of those guidelines; making recommendations to the cabinet for the amendment of the Environmental Protection Act, 1997 and Environment Protection Regulation, 1997.

Ministry of Energy

MoE is the line Ministry with primary jurisdiction over the power sector, and is responsible for the development of water resources in Nepal. It also formulates policy with reference to the energy sector.

Water and Energy Commission Secretariat

Created in 1975, WECS is an advisory body to the government. It provides advisory, planning, research and coordination services to the government and other relevant agencies on formulating policies related to rational utilization, control, protection, management, and development of water resources and energy. It also provides advisory services for project implementation. WECS is authorized to conduct comprehensive surveys, investigations and studies, and to formulate short and long-term policy measures. It is the primary governmental organization tasked with energy data collection and analysis, and providing a power demand forecast.

Sustainable Energy Finance Market Study
for Financial Sector in Nepal

Nepal Electricity Authority

NEA is a vertically-integrated government–owned undertaking responsible for most of the generation, load dispatch, transmission and distribution of electricity in the country. It is also the sole buyer of power from Independent Power Projects (IPPs) -- it is a minority shareholder in some IPPs. NEA carries out system planning studies, including demand forecasting and generation planning. Vesting the Authority with all these functions creates potential conflicts of interest, and the anomaly was noted in the 2001 World Bank Strategy Paper. NEA is in the process of unbundling this vertically-integrated structure into business units to improve its operational efficiency. As a step towards this process, NEA has started "internal unbundling" of its three core operational units, i.e., generation, transmission/dispatch and distribution.

Alternative Energy Promotion Centre

AEPC is the Government of Nepal's umbrella organization for renewable energy technology promotion. AEPC was established in November 1996 under the then Ministry of Science and Technology and reports to the Alternative Energy Promotion Development Board. AEPC's areas of work include biomass, micro-hydropower, solar, wind, improved cooking stoves, and geothermal sources of energy. AEPC does not directly implement renewable energy projects but works with the renewable energy industries and non-governmental organizations to provide decentralized renewable energy services to rural as well as urban communities.

Currently, AEPC activities are supported by various donor programs, including Energy Sector Assistance Programme funded by the Danish International Development Agency(DANIDA),the Government of Norway, Biogas Support Program funded by SNV, German development bank Kreditanstalt für Wiederaufbau, , Renewable Energy Development Program funded by the World Bank and UNDP, and Improved Water Mill Project funded by SNV.

The European Union is also one of the funding agencies to the Nepal Government, and has signed an agreement to support and help implement AEPC's renewable energy technology development activities. Through the Centre, the Nepal government has availed of a capital subsidy for installing various renewable energy technologies such as micro-hydropower, biogas, and solar photovoltaic (Promotion of Renewable Energy Energy Efficiency, and Greenhousegas Abatement, 2004).

Industrial Energy Management Project

An increasing number of industries under the government's IEMP are using an energy efficiency audit which helps in saving energy consumption during the production process. A total of 150 units in the industrial estates of Balaju, Patan and other areas have implemented energy-saving measures with the help of the IEMP (Khanal, 2010). The project has plans to expand the energy audit system to newly established factories. However, IEMP gets an annual budget of $ 2,089.13 (Nepali rupees 150,000) which barely supports the energy auditing process of about five industries a year.

3

Business Leaders / Representatives of Chambers and Industry

Federation of Nepalese Chambers of Commerce and Industry

FNCCI is the apex body for the business and industry community in Nepal and is also the member of International Chamber of Commerce. Various industry and business associations, including their regional and district-level organizations, are members of this federation. FNCCI has a significant role to play in all policy-making decisions related to business and industry. It has established a separate division on environment.

District Chamber of FNCCI and Industrial Area/Corridor

FNCCI fans out to the interiors of the country through district chambers, commodity associations and its associate members. These chambers of commerce and industryare effective in implementing programs initiated by FNCCI in the districts. Most of the district chambers regularly organize various workshops and seminars, such as those on management training, productivity, workplace cooperation, labor law, taxation, entrepreneurship development, occupational safety and health among others.

Federation of Nepal Cottage and Small Industries

FNCSI is an umbrella organization of Cottage and Small entrepreneurs of Nepal with a network of 72 district chapters out of the 75 districts in Nepal. Since its inception, FNCSI has been working for the promotion of Cottage and Small Industries through a wide range of activities and services.

Confederation of Nepalese Industry

CNI is a professionally led apex body of mostly large and medium-scale manufacturing and service industries, of Nepal. Its membership base consists of most of the country's big corporate houses and blue-chip companies. Its member companies represent a wide spectrum of industries in manufacturing, information, communication and entertainment, banks and financial institutions, insurance, travel, tourism and hospitality, utilities, infrastructure and construction among others. The primary goal of CNI is to encourage positive competition and competent management, secure domestic and foreign investment, and create employment opportunities in Nepal's industrial and corporate sector.

Solar Electric Manufacturers' Association Nepal

SEMAN is an umbrella organization of Nepalese solar photovoltaic system manufacturing companies. It is a non-profit, non-governmental organization with the objective of developing and monitoring all the solar PV units in Nepal as also to facilitate communication and coordination between solar companies.

Sustainable Energy Finance Market Study
for Financial Sector in Nepal

3

Nepal Biogas Promotion Association

NBPA was established in 1995 as an umbrella organization by the biogas construction companies operating across the country. This too is a non-profit organization established to ensure sustainability of the biogas development program in Nepal. It is one of the certified biogas construction agency for the promotion, coordination, research and extension training, and standardization of biogas technology in the country. At present, NBPA has 97 general members (86 biogas construction companies and 11 appliances manufacturing workshops). All members have different levels of capacities in terms of management, decision-making process, human resources, organizational set-up and range of coverage.

Research Institutions/Universities, Consulting Companies

Centre for Energy Studies, Tribhuwan University

CES was establishedin 1999 under the Institute of Engineering, Tribhuvan University. It works directly with national-level experts in the engineering and energy sectors. CES can play the role of a bridge between national and international organizations involved in the energy sector.

Kathmandu University

KU is an autonomous, not-for-profit, non-government academic institution. It is a research-cum-teaching university in science, management, engineering, medical sciences, arts and education. It has its own Bio-based and Green Energy Laboratory, and Water Power Laboratory.

Institute of Environment and Management

Supported by the Environment Sector Program and the Danish International Development Agency, IEM provides technical training and other capacity-building support as well as awareness-raising programs in the areas of clean transportation, energy efficiency, clean production and other environmental management courses to different groups.IEM launched a demonstration program on Environmental Management system in industries. and on establishing common effluent treatment facilities in the industrial districts to reduce cost for unit industries.

Society for Environmental and Economic Development Nepal Private Limited

SEED-Nepal is one of the country's leading organizations in the field of industrial and urban environment, working for economic development of the deprived and marginalized sections by promoting awareness, advocacy and skill development.Till date it has carried out awareness programs and training on clean production, energy efficiency, environmental management system and compliance, occupational health and safety, pollution control and energy efficiency for brick plants in Lalitpur, Bhaktapur and Birgunj . It has also assisted the Birgunj Chambers of Commerce and Industry in establishing an Environmental cell, and organized Cleaner Production awareness drives in 19 wards of Birgunj.

3

3.5.1 Stakeholder Analyses

Various stakeholders were consulted during the study and their views were sought on promoting sustainable energy. The summary of the views of energy efficiency experts, vendors, and business leaders are summarized below.

Experts and Business Leaders:

According to energy efficiency experts and business leaders, Nepal's industrial establishments were never set up based on the energy efficiency of an industry. They pointed out that key savings in 90 percent of the country's industries are not due to energy efficiency measures, but derived by leveraging loopholes (for example in the taxation system). They observed that industries are not honest and open to sharing information.

The basic impediment is that as there is no energy policy or strategy in Nepal, there is no obligation to comply with any. Not surprisingly, energy efficiency initiatives are totally donor-driven, or initiated by industries conducting energy audit on a voluntary basis. Such units are no more than about 5 percent. A few industries may be interested, but do not know how specifically to go about it as there are no distinct agencies or equipment in the domestic market for these initiatives. Additionally, industries are lacking in knowledge and awareness. Just about one or two industrial establishments contacted experts for assistance on energy efficiency measures. Hence, it is imperative to educate industries and plant operators on energy efficiency and its savings potential .

Industries that are already investing in sustainable energy technologies believe they are benefiting by way of reduced energy cost and higher resource savings. Moreover, with the use of renewable energy technologies such as biomass gasifier and solar thermal, they no longer have to rely on the expensive power generated from diesel generators, or the unreliable power supply of the national grid.

What is also needed is a good regulatory environment to address the barriers to adopting energy efficiency/renewable energy technologies. Stakeholders also pointed out the need to publicize case studies of industrial units which have successfully adopted these technologies and benefited from lowered cost and improved productivity so as to encourage others to adopt these measures more actively.

Based on the feedback from energy efficiency experts the research team concluded that about 70 to 80 percent of the low-cost options suggested were feasible. For instance, improvement of power factor, reduction of production temperature, lighting improvement by CFL use, and small things like change of pipes and wire size, were all measures thatunits found useful, simple and cost-effective to implement. This again highlighted the fact that lack of practical information is the primary barrier to the adoption of sustainable energy technologies, that can be easily overcome with right information and a demonstration of the immediate benefits.

Sustainable Energy Finance Market Study
for Financial Sector in Nepal

3

Among other impediments to the adoption of sustainable energy measures are inadequate marketing, high cost of energy-efficiency options, long payback period, high interest rate of banks loans (13 to14 percent), and donor-driven energy efficiency audits. Additionally, the current power crisis and the socio-political scenariodo not favor industrial development and productivity. The lack of security is a concern for most manufacturing industries. At present, many of them are located in the Terai region, which is threatened by lawlessness. In its wake, some big industrial units are making a shift from the Terai belt to the hilly regions of Nepal.

Experts mentioned the need for fiscal incentives like soft loan (at a rate not more than 4 to 5 percent), extended credit period, nominal subsidy, customs waiver for energy-efficiency equipment, and tax benefits. They also stressed the need for careful monitoring after a policy or fiscal incentive provision is initiated. However, the overriding thought is to ease the cost burden through a subsidy, or any other measure..

Experts also suggested exploring "site-specific power generation" -- for example using micro-hydro for tea estates and tourism (hotels and lodges)has a potential in the eastern region, or replacing boilers with solar thermal could be of value across the country. Experts think that commercial complexes are also one of the major sectors for potential energy efficiency savings.

Vendors/Suppliers:

According to vendors and suppliers, the sustainable energy market in Nepal is small and diverse. The country does not have any domestic energy-efficiency equipment manufacturers. Hence, equipment is imported through agents from various countries, including India, China, Japan, Spain, Bangladesh, Singapore, and Australia. The most common energy-efficiency equipment supplied are boilers, steam traps, control valves, steam meters and boiler efficiency maximizers. For renewable energy technologies, the vendors supply biogas plants and solar-based equipment and services (solar panel, battery, controller, solar mono water pump, and solar inverter).

However, the technology providers have inadequate knowledge about the equipment required for industries (type, size and capacity). They also lack technical manpower/service engineers to order new equipment, or to provide after-sales services, especially for more sophisticated technologies.

Lack of policy direction on sustainable energy, and the import of equipment to foster these technologies, is seen as a major impediment. Political instability, lack of investment security and funds crunch are the other problems faced by the technology providers. A cumbersome subsidy mechanism/subsidy reimbursement process, and a fluctuation in the subsidy amount are yet some other obstacles. Vendors are also concerned about inadequate awareness in the market, high payback period, and the small market size as a result.

Despite those hiccups, the vendors of sustainable energy technologies have been able to grow business satisfactorily. Sales of biogas have increased by 15 to 20 percent, while those of solar equipment saw an increase of 30 to 40 percent. A case in point is Solar Home System, which recorded a sale of 10,000 units last year.

3

Since finance is critical to make these technologies viable, most suppliers are collaborating with banks.A biogas plant vendor obtained a loan from Agricultural Development Bank and Clean Energy Development Bank Limited on a collateral basis, tying up with CEDBL and three local cooperatives for biogas plant sales. Solar equipment vendor Lasersun tied up with KUMARI and Bank of Asia for financing . Similarly, other solar vendors too have tied up with banks such as Laxmi Bank, Bank of Kathmandu and CEDBL.

Energy Efficiency/ Renewable Energy Potential in Selected Industrial Sectors

4 Energy Efficiency/Renewable Energy Potential in Selected Industrial Sectors

4.1 Energy Consumption Pattern in Selected Industry Sectors

The industrial sectors selected for this study primarily use commercial energy such as petroleum fuels, coal and electricity. These were also found to use traditional biomass (like fuel-wood, rice husk, etc.) and alternative sources of energy (like solar thermal). Table 15 below presents the energy consumption pattern in the selected industrial sectors.

Table 15: Energy/Fuel Use in Selected Industrial Sectors

S.N.	Industrial Sector	Electricity	Pulverized Coal	Rice Husk	Fuel Wood	High Speed Diesel	Furnace Oil	Kerosene	LPG
1	Cement	●	●			●			
2	Rolling Mills	●	●				●		
3	Poultry/Agri business								
	a. Poultry/ Feed	●		●		●			
	b. Tea	●	●	●	●	●	●		
	c. Dairy	●				●		●	
4	Plastic	●				●			
5	Cold Storage	●				●			
6	Food and Beverage (breweries/distilleries)	●		●		●	●		
7	Steel Structure	●	●	●		●	●		●
8	Paper and Pulp	●		●		●			
9	Brick	●	●		●				
10	Tourism (hotels)	●				●		●	●

Source: Findings from the survey

Sustainable Energy Finance Market Study
for Financial Sector in Nepal

4

The research team found that electricity and High Speed Diesel was used in all the industrial sectors they studied. High Speed Diesel was mainly used for the captive plants as back-up. Pulverized coal was mainly used in energy-intensive sectors like cement for clinker production, rolling mill for billet heating, tea for tea drying, steel structure for galvanizing furnace, and brick industries for firing bricks.

Four out of ten sectors used rice husk as a source of energy-- poultry/agribusiness (tea) for drying processed tea, food and beverage (breweries/distilleries) for steam generation, steel structure for galvanizing furnace (gasifier base), and paper and pulp for steam generation. Fuel-wood was also used in tea processing units for drying and hot air generation, and brick industries for firing bricks. Furnace oil was another form of energy that was used in energy-intensive industries like rolling mills for billet heating, steel structure for galvanizing, food and beverage (breweries/distilleries) for steam generation, and tea for drying. Kerosene was used only in three sectors -- dairy for steam generation and pasteurizing, and tourism (hotels) for hot water generators. Liquefied Petroleum Gas was primarily used in the tourism sector in the kitchens of the hotels and in the steel structure industry for pre-heating.

4.2 Specific Energy Consumption Pattern in Selected Industries

The study team gathered information about the specific energy consumption (SEC) of each of the 10 industrial sectors through interviews, previous study reports and baseline study, and expert views.

Specific Electricity Consumption

Except for the brick industry, all the industrial sectors selected for the study consumed significant amount of electricity. It is used only for lighting purpose in brick kilns and hence usage is nominal, while coal is used as the main fuel for firing bricks. As illustrated in Table 16 below, specific electricity consumption (energy consumed per unit of physical output) was the highest in the plastic sector (3,600 kWh/Ton), followed by pulp and paper (1,612 kWh/Ton). Agribusiness, tea processing also consumed significantly high electricity (710 kWh/Ton).

Specific Thermal Energy Consumption

Fuel consumption for thermal energy was prominent in all the sectors with the exception of poultry and feed, plastic, cold storage, and tourism (hotels). Tea and pulp and paper sectors specifically were the highest consumers of specific thermal energy, followed by cement, rolling mills, steel structure, dairy, food and beverage (breweries/distilleries), and brick. The specific thermal consumption of each sector is listed in Table 16.

Table 16 : Specific Energy Consumption in the Selected Industrial Sectors

SN	Sector and Sub Sectors	Specific Electricity Consumption	Unit	Specific Thermal Consumption	Unit
1	Cement	117	kWh / Ton	1,040,000	kCal/ Ton
2	Rolling Mills	115	kWh / Ton	450,000	kCal/ Ton
3	Poultry/Agribusiness				
	a. Poultry & Feed	*1.5*	kWh / Bird	*Not Applicable*	
	b. Dairy	*119.79*	kWh / hl	*269,000*	kCal/ hl
	c. Tea	*710*	kWh / Ton	*27,187,000*	kCal/ Ton
4	Plastic	3,600	kWh / Ton	*Not Applicable*	
5	Cold Storage	66.7	kWh / Ton	*Not Applicable*	
6	Food & Beverage (breweries/distilleries)	12.13	kWh / hl	52,000	kCal/ hl
7	Steel Structures (pipe)	65.7	kWh / Ton	289,000	kCal/ hl
8	Paper and Pulp	1,612	kWh / Ton	12,560,000	kCal/ Ton
9	Brick	-		298,557	kCal/ Ton of fired brick
10	Tourism (Hotels)	2.87	kWh / Room	*Not Applicable*	

Source: Findings from the survey

Sustainable Energy Finance Market Study
for Financial Sector in Nepal

4.3 Local and Regional (Indian) Norms and International Benchmarks/Best Practices for Selected Sectors

In the absence of an energy efficiency policy or strategy, Nepal does not have any norms regarding energy consumption in the industrial sector. Although a draft of energy efficiency policy was developed in 2004 under the Environment Sector Program Support, aided by Danish International Development Agency for the overall management of the country's brownfield, it did not result in a formal policy.

The government is preparing a new energy strategy to promote the power sector, but its implementation is likely to remain a challenge unless a political consensus is reached. In the meantime, the government is focused on repairing and upgrading the existing generation, transmission and distribution infrastructure. In addition, Deutsche Gesellschaft Fur Internationale Zusammenarbeit (GIZ)and the Water and Energy Commission Secretariat are collaborating on a Nepal Energy Efficiency Program that is working towards making energy efficiency an intrinsic part of the national energy strategy..

The Specific Energy Consumption pattern of selected industrial sectors and sub-sectors has been compared with the international and regional benchmarks/best practices. However, this comparison has some limitations that are given below:

- Plant size: Industrial units in Nepal are considerably smaller in size than the international industries. Energy consumption generally depends on the scale of production -- smaller plants are generally less efficient (United Nations Industrial Development Organization, 2010).
- Management efficiency: The industries surveyed lack efficient management practices, as compared that in developed countries.
- Power Interruption: Nepal is facing daily power cuts lasting 10 to 14 hours, considerably increasing the specific energy consumption in Nepal's industrial sector.
- Comparison unit: The international and regional specific energy consumption norms are primarily given in Giga joules/tons as their industries mostly use fossil fuels such as coal for thermal energy. For a valid comparison of Nepal's industrial sectors, it should also be in GJ/ton. However, that is difficult considering that most of Nepal's industries are running on hydro-generated electricity which cannot be converted into GJ/ton.
- Others: Specific energy consumption also depends on the equipment used in the industry and its efficiency, the quality of raw materials used, the energy source, the quality of fuel, technology, product line and product depth, and ambient temperature.

1. Cement

The world SEC benchmark in the cement sector is 2.9 to 3.0 GJ/Ton (Garnaik, 2009). In India, the primary energy sources for the cement industry are coal and electricity which comprise about 20 to

40 percent of the total manufacturing cost. Thermal SEC is 665 to 995 Kcal/kg of clinker and Electrical SEC is 66 to 127 kWh/Ton of cement (Asthana, Bureau of Energy Efficiency, India). Most of the energy – about 80 percent -- is consumed during clinker production. Another benchmark for the SEC (Electrical) in the cement sector is 90 to 150 kWh/t (IFC, 2007a).

The best operating levels of energy consumption in cement plants in India are 663 kcal/kg clinker and 69 kWh/ton cement which compare well with the international best levels of 650 kcal/kg for clinker and 65 kWh/t for cement (Raina, 2002).

However in Nepal, coal and electricity are used to meet the energy demand of the cement industry. According to the survey, their Thermal SEC is 1,040 Kcal/kg and Electrical SEC is 117 kWh/ton. Both, particularly thermal. don't compare well when compared to the world and Indian benchmarks, mainly because the production process, technology and types of products vary largely. Therefore, thermal energy intervention with available energy efficiency/renewable energy options is recommended.

2. Rolling Mills

The international best practices and norms are not available for rolling mills. According to the survey carried out in the Nepalese rolling mill sector, electrical and thermal SECs are found to be 115 kWh/ton and 450,000 Kcal/ton respectively.

3. Poultry / Agribusiness

a.Poultry and Feed

Energy use in poultry is mainly for lighting, warming and water pumping. The study team found that the electrical energy used per bird varies from 0.52 kWh to 2.18 kWh. Nepal's poultry firms consume about 1.5 kWh/bird (findings from the survey) and this varies in accordance with production scale and operational efficiency of the poultry.

b. Dairy

The Electrical and Thermal SECs are found to be around 120 kWh/hl and 269 Kcal/liter respectively in the country's dairy sector (Environment Sector Program Support, 2003). The international and regional norms/best practices/benchmarks are not available in the sector for comparison.

c. Tea

Eastern Nepal is known for CTC and Orthodox tea production.CTC tea is processed in the lower belt (plain region)and orthodox tea in the upper belt (hilly region). Tea production is basically the process of drying freshly harvested green tea leaves, reducing its moisture content from about 75 to 83 percent down to 3 percent (Asian Institute of Technology, 2002).

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Tea processing is an energy-intensive food processing industry which consumes thermal energy to dry the tea leaves and electrical energy to cut them. Tea production consumes both thermal and electrical energy in the ratio of 85:15 (AIT 2002).

Thermal energy used for the withering and drying processes is produced by burning coal, rice husk, firewood or fuel oil in heaters. The Thermal SEC in Sri Lanka and India varies between 3,826 to 5,881 Kcal/kg of tea (AIT 2002). Accroding to the survey the thermal SEC in Nepal is significantly higher at around 27,187 Kcal/kg of tea. The Electrical SEC too is high at about 710 kWh/ton.

4. Plastic

The Electrical SECin the plastic industry varies from 2,800 to 3,000 kWh/ton (IFC, 2007) during its various processes - injection molding, extrusion, extrusion blow moulding and extrusion and thermoforming. The average electricity consumption norm in the industry is found be higher than the international benchmark at 3,600 kWh/ton. Again the industry's SEC depends on scale of production and product type among others.

5. Cold Storage

Most of the energy consumption in the cold storage industry is that of compressors. Other equipment such as water pumps and lighting consume only 6 percent energy. Compressors are typically of two types: reciprocating and rotary (screw or scroll). Scroll compressors are limited to lower capacity halocarbon systems. Rotary screw and scroll are becoming increasingly popular due to lower maintenance costs. Screw compressors dominate the refrigeration market. This is mainly due to their high reliability -- usually capable of operating over 50,000 hours between overhauls- and the selection of capacities for commercially available equipment.

According to the survey, a cold storage consumes around 66.7 kWh/ton electricity but due to the unavailability of international and regional norms, the comparison of SEC in cold storage is not possible.

6. Food and Beverage (Breweries/Distilleries)

The brewery industry uses both electrical and thermal energy. Globally, the average energy use is found to be 229 MJ/hl of beer, whereas the best practice is 156 MJ/hl (United Nations Industrial Development Organization, 2010). Nepal's beverage industry has an electrical and thermal SEC respectively of 12.13 kWh/hl and 52,000 Kcal/hl, according to the survey. The comparison with global average is impossible because Nepal uses hydropower-based electrical energy, giving the SEC result in kWh/hl that is not comparable to the world unit of MJ/hl .It is also because SEC depends on production scale, product depth and length, and quality of fuel among others.

7. Steel Structures

The global SEC benchmark for the industry in the year 2010 was 1.16 GJ per ton of crude steel for electricity and 16.71 GJ/tcs for fuel (Schumacher & Sathaye 1998). The comparative figures for Nepal's steel industries for Electrical SEC are 65.7 kWh/tcs and 289 Kcal/tcs for thermal SEC.

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Again, Nepal's steel industry has different production processes, efficiency, technology and types of products. The raw materials used are different and imported from India in a billet form.

8. Paper and Pulp

Internationally, the paper and pulp industry consumes 32.00-40.93 GJ/ton energy (Schumacher & Sathye, 1999). Another benchmark gives a detailed breakdown of electrical SEC of the various pulp and paper- making process:

- Kraft pulping, bleached is 600 to 1,200 kWh/t;
- mechanical pulping-ground wood is 1,100 to 2,200 kWh/t;
- mechanical pulping-thermo mechanical is 1,800 to 3,600 kWh/t; mechanical pulping – chemi thermo mechanical is 1,000 to 4,300 kWh/t; paper mill-printing and writing paper, uncoated is 500 to 650 kWh/t;
- paper mill-printing and writing paper, coated is 650-900 kWh/t;
- and paper mill-paper board is 550-680 kWh/t (IFC, 2007b).

According to the survey conducted for this study, the country's industry consumes 1,612 kWh/ton of electrical energy and 12,560 Kcal/kg of thermal energy. The paper industry in Nepal is based entirely on the conventional pulping process. The main energy consumption areas in the paper-making units are screening and drying. The screening units consume electrical energy and forming, pressing and drying units consume both thermal and electrical energy. Other units consume electrical energy for lightening purposes.

9. Brick

Brick firing is an energy-intensive process. According to the Central Bureau of Statistics, a total of about 3.4 billion bricks were produced in Nepal during 2006 (CBS, 2006-7). For this volume of brick production, the total coal consumption adds up to around 93,484,300 kgs (CBS, 2006-7).

In Europe, the brick industry, uses Tunnel Kilns, and consumes 1.5-3 GJ/t energy. The consumption in Indian industries is around 1.5-2 GJ/t. Tunnel Kiln technology is not used in Nepal (United Nations Industrial Development Organization, 2010). The Institute of Environment and Management reports that the country's brick industry consumes around 1.25 GJ/ton of thermal energy (IEM, 2003). This shows that the SEC of the Nepal's brick industry is less than that of the European Tunnel Kiln brick industry, mainly because the brick industry in Nepal uses energy only at the brick firing stage. Manual labor is used for brick molding (and hence does not need a brick extruder machine), and the molded bricks are sun-dried, again reducing energy consumption.

10. Tourism (Hotels)

According to the survey, the electrical SEC is around 2.87 kWh/room. International and regional norms for this industry could not be obtained.

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4.4 Energy-Saving Potential with Energy Efficiency and Renewable Energy in Selected Industries

Due to limited secondary data and the quality of information provided during the interviews, a few assumptions were made to identify the number of industrial units with energy efficiency/renewable energy intervention potential, and to calculate total energy consumption and the energy saving potential in each of the sectors.

Assumptions

The total number of establishments and the production output figures for the selected industrial sectors are based on data from the Central Bureau of Statistics (CBS, 2006-07). Based on primary data collected during the field visits, and consultation with the respective associations of the industrial sectors, 265 out of the 1,041 establishments were estimated to have a good potential for energy efficiency/renewable energy investment. In the rolling mills industry, for instance, there are a total of 17 establishments out of which, seven are large, four are medium and six are small. Based on information gathered from the field visit and previous experience of similar projects, only 11 (seven large establishments and four medium-scale establishments) were estimated to be open to adopting energy efficiency/renewable energy interventions.

As already pointed out, the food and beverage sector consists of a wide range of industrial establishments including distilleries, breweries, biscuits, noodles, other food products. Due to significant differences in the type and amount of energy consumed by each industry in this diverse sector, this study only includes breweries/distilleries for arriving at estimates of energy consumption, saving and investment potential.

Table 17: Number of Industries with Energy Efficiency/Renewable Energy Intervention Potential

SN	Sector and Sub Sectors	Total Number of Establishments	Estimated EE Intervention Potential Numbers			
			Large	Medium	Small	Total
1	Cement	25	10	14	1	25
2	Rolling Mills	17	7	4	0	11
3	Poultry/Agribusiness	137	16	46	0	62
	a. Poultry and Feed	45	0	20	0	20
	b. Dairy	39	4	9	0	13
	c. Tea	53	12	17	0	29
4	Plastic	152	13	36	0	49
5	Cold Storage	20	0	10	0	10
6	Food and Beverage (Breweries/distilleries)	30	7	15	8	30
7	Steel Structures	88	15	27	0	42
8	Paper and Pulp	46	5	0	0	5
9	Brick	429	0	0	30	30
10	Tourism (Hotels)	97	0	15	0	15
	Total	**1041**	**72**	**154**	**39**	**265**

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Methodology

The study team conducted walk-through visits of the selected establishments to collect primary data on energy consumption. The primary data thus collected was based largely on verbal information provided by the company or plant manager, rather than on the official/published data. Verification of this data through a review of previous baseline studies and energy audit reports revealed high levels of inaccuracies. Additionally, secondary data on the energy consumption pattern of large, medium and small-scale industries was not available. Hence, to minimize errors caused by inauthentic or inadequate data, the research team selected one industrial unit from each sector (one with the most realistic and reliable data) as a baseline for further calculations.

For cement, rolling mills, food and beverage (breweries/distilleries), steel structure, and paper and pulp sectors, one baseline data of a large-scale industrial unit from the respective sector was considered. For dairy, tea processing, plastic, cold storage and tourism sector (hotels), one baseline data of a medium-scale industrial unit was considered. For the poultry and brick sectors, one baseline data from a small-scale establishment was considered.

A shortcoming of this method is that a single baseline data (from either a large, medium or small establishment) does not reflect the scenario of all three different scales of an industry. For example, energy consumption of a large-scale industry is considered as the baseline for the cement sector, and should ideally be used to extrapolate energy consumption of only large-scale cement manufacturing unit; the same baseline cannot be used to extrapolate for medium and small-scale cement units. Hence, "total value of output" data for large, medium and smal- scale industries from the Central Bureau of Statistics (CBS, 2006-07) was used to extrapolate the total electricity consumption, with the assumption that the value of output and energy consumption are directly proportional to each other.

Multiplier Factor

The multiplier factors for each industrial sector was calculated based on the total monetary value of output obtained from the CBS 2006-07 data book. This value is obtained by dividing the value of output of a large industry by the value of output of a medium industry; or, in some cases, by dividing the value of output of a medium industry by the value of output of a small industry. For instance, in the case of rolling mills, the total values of output of large, medium and small units are $ 17,504,875, $ 2,821,647 and $ 378,526 respectively. The multiplier factor for this sector is calculated as large: medium leading to the figure 6.20. It is therefore assumed that the total value of output, energy consumption and other expenditures of a medium-scale rolling mill will be 6.2 times less than a large scale one, and 6.2 times more than a small scale rolling mill.

Total Energy Consumption

The respective baselines of each sector were used for extrapolations using a multiplier factor. In the case of rolling mill industry, for instance, energy consumption data for one large-scale industrial unit (say Industry A) was obtained from the survey which was then used to extrapolate energy consumption as well as the energyefficiency intervention potential for 11 rolling mill industries

(seven large and four medium)by using a multiplier factor. The multiplier factor for rolling mills was 6.2 (Large/Medium). Thus, the energy consumption of the medium scale rolling mill industry was computed by dividing the energy consumption of large scale 'Industry A' by the multiplier factor 6.2. The total energy consumption for the remaining nine industrial sectors was obtained through the same process. The energy saving potential for all 10 sectors was computed based on the expertise and discretion of the energy expert undertaking the walk-through visit of the industries.

Energy Saving Potential

Based on the walk-through visit and information provided by production professionals, the potential energy efficiency/renewable energy intervention options for the baseline industry of each sector were identified. Then, energy saving options were suggested to a baseline industry; energy saved through those options was determined and later extrapolated using the multiplier factor to apply to other industries. The methodology for extrapolation is similar to the extrapolation of total energy consumption.

For example, energy efficiency/renewable energy options suggested for a baseline cold storage facility are power factor improvement, load management, replacement of air compressor and reduction in the temperature of evaporation and cooling pond. An Individual energy efficiency/renewable energy option such as power factor management saves 1,330 kWh; all the options together save 33,680 kWh. It was assumed that all cold storages, with reference to energy efficiency/renewable energy intervention potential, are in same condition as the baseline industry. A multiplier factor was used to compute the total energy saving of large, medium and small scale cold storage industries.

The cost of the energy efficiency intervention options thus identified was used to calculate the total investment potential in the baseline industry. Later, this figure was extrapolated to the remaining industrial units to derive the energy efficiency intervention potential for each sector, using multiplier factors.

It was a challenge to find an accurate price for the equipment recommended by the energy expert as the vendors/sellers were reluctant to provide the exact price of equipment when approached formally via email for quotations. Hence, the equipment prices used in this study are based on telephone conversations with energy efficiency vendors (acquaintances of the energy efficiency expert), review of regional practices, web search, and literature review.

The total electricity and fuel consumption, saving and investment potential were also calculated for all the 10 industrial sectors. Summary of total energy consumption and total energy saving potential for all the sectors are presented in Table 18 below.

Table 18: Sector-wise Energy Consumption and Saving Pattern

Particulars	Scale	Sectors											
		Cement	Rolling Mills	Poultry/Agribusiness			Plastic	Cold Storage	Food and Beverage (breweries/ distilleries)	Steel Structures	Paper and Pulp	Brick	Tourism (Hotels)
				a. Poultry and Feed	b. Diary	c. Tea							
	L	10	7	0	4	12	13	0	6	15	5	0	0
	M	14	4	20	9	17	36	10	2	27	0	0	15
	S	1	0	0	0	0	0	0	8	0	0	30	0
Total Electricity Consumption (kWh)	L	239,850,000	20,947,500	-	6,786,629	15,087,524	43,292,702	-	10,091,460	23,652,000	9,492,740	-	-
	M	61,796,679	1,929,469	1,542,498	2,070,000	12,070,000	25,920,000	2,667,930	285,879	1,199,585	-	-	13,050,000
	S	812,334	-	-	-	-	-	-	571,758	-	-	-	-
Total Electricity Saving (kWh)	L	806,490	1,381,919	-	797,429	1,246,761	5,123,030	-	901,614	2,011,860	370,400	-	-
	M	207,790	127,288	108,773	243,225	997,407	3,067,236	336,800	25,542	102,038	-	-	683,355
	S	2,731	-	-	-	-	-	-	51,083	-	-	-	-
Total Thermal Energy Consumption (GJ)	L	13,060,320	344,745	-	63,735	2,418,382	-	-	181,437	455,705	311,790	-	-
	M	3,364,955	31,754	-	19,440	1,934,703	-	-	5,140	23,112	-	-	-
	S	44,233	-	-	-	-	-	-	10,280	-	-	313,448	-
Total Thermal Energy Saving (GJ)	L	1,306,032	22,739	-	10,091	1,362,124	-	-	14,557	28,013	46,674	-	-
	M	336,495	2,094	-	3,078	1,089,697	-	-	412	1,421	-	-	-
	S	4,423	-	-	-	-	-	-	825	-	-	62,690	-
Total Saving (USD)	**L**	**1,319,192**	**631,685**	**-**	**306,052**	**2,225,971**	**417,406**	**-**	**421,219**	**803,393**	**143,166**	**-**	**-**
	M	**339,886**	**58,184**	**8,862**	**93,349**	**1,780,774**	**249,907**	**27,441**	**11,933**	**40,747**	**-**	**-**	**55,677**
	S	**4,468**	**-**	**-**	**-**	**-**	**-**	**-**	**23,865**	**-**	**-**	**60,167**	**-**
Total Investment (USD)	**L**	**1,402,844**	**743,482**	**-**	**606,169**	**4,477,243**	**697,830**	**-**	**192,869**	**631,289**	**1,629,526**	**-**	**-**
	M	**361,439**	**68,482**	**44,030**	**184,889**	**3,583,481**	**417,802**	**69,173**	**33,511**	**32,018**	**-**	**-**	**230,327**
	S	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**10,928**	**-**	**-**	**2,506,964**	**-**

Source: Findings from the survey

Table 19 below presents a summary of the total energy consumption and savings potential of industrial units through energy efficiency interventions, grouped by the size of the industrial units (large, medium and small). It shows that energy efficiency/renewable energy interventions in large industrial units alone could save $ 6,488,842. The potential savings through energy efficiency / renewable energy interventions is $ 2,843,367 in medium-scale industries and $ 88,500 in small-scale industries.

Table 19: Energy Consumption and Saving Pattern of Selected Sector

Particulars	Large	Medium	Small
Total Electricity Consumption (kWh)	369,200,554	122,532,040	1,384,092
Total Electricity Saving (kWh)	12,639,502	5,899,453	53,815
Total Thermal Energy Consumption (GJ)	16,836,114	5,379,104	367,961
Total Thermal Energy Saving (GJ)	2,790,229	1,433,198	67,938
Total Saving (USD)	**6,268,084**	**2,666,761**	**88,500**

Source: Findings from the survey

Carbon Dioxide (CO_2) Reduction

CO_2 emitted by establishments in different sectors due to fossil fuel use is calculated using the emission factors given below (Refer Table 20). Total CO_2 emission is calculated on the basis of reduction in total fuel consumed (coal, furnace oil, and diesel) which include fossil fuel used in captive plants for electricity generation. CO_2 reduction is calculated based on the reduction in fossil fuel consumption due to the adoption of energy efficiency/renewable energy technology . Since the grid-supplied electricity in Nepal is solely based on hydropower, it is not included here for CO2 emission calculation.

Table 20: CO_2 Emission Factor

S. N.	Fossil Fuel	CO_2 Emission factor	Unit
1.	Coal	2.46*	kg/kg
2.	Furnace Oil	3.14**	kg/ltr
3.	Diesel	2.63**	kg/ltr

*Source: * Promotion of Renewable Energy, Energy Efficiency and Greenhouse Gas, 2006;*
*** Intergovernmental Panel on Climate Change Default*

Table 21: Total CO_2 Emission and Reduction

SN	Sector and Sub Sectors	Total ton CO_2 Emission				Total ton CO_2 Reduction				Total ton CO_2 Reduction
		Large	Medium	Small		Large	Medium	Small		
1	Cement	1,476,000	380,287	4,999	1,861,286	147,600	38,029	500		186,129
2	Rolling Mills	28,733	2,647	-	31,380	1,895	175	-		2,070
3	Poultry/Agribusiness	-	-	-	-	-	-	-		0
	a. Poultry & Feed	-	-	-	-	-	-	-		0
	b. Dairy	4,656	1,420	-	6,076	737	225	-		962
	c. Tea	-	-	-	-	-	-	-		0
4	Plastic	-	-	-	-	-	-	-		0
5	Cold Storage	-	-	-	-	-	-	-		0
6	Food & Beverage (breweries/distilleries)	13,255	376	751	14,382	1,063	30	60		1,154
7	Steel Structures	37,981	1,926	-	39,908	2,335	118	-		2,453
8	Paper and Pulp	158	-	-	158	132	-	-		132
9	Brick	-	-	35,496	35,496	-	-	7,099		7,099
10	Tourism (Hotels)	-	-	-	-	-	-	-		0
	Total	**1,560,784**	**386,656**	**41,246**		**153,762**	**38,577**	**7,659**		**199,998**

Source: Findings from the survey

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4.5 Possible Energy-Efficiency and Renewable Energy Options in Selected Sectors

Possible energy-efficiency and renewable energy options were identified for the ten industrial sectors under the following categories: a) no cost / low-cost options, b) medium-cost options (retrofit and energy-efficiency measures), and c) high-cost options.

Most of the low-cost options don't require high upfront investments. For instance, adopting good housekeeping measures could save significant amount of energy and therefore, cost. The options include preventive/scheduled maintenance of plant and machinery, cleaning of drive system, prevention of leakages in compressed air lines, among others. These options have quick payback period of a year or less.

The medium/intermediate cost interventions are generally of the retrofit type, with a slightly longer payback period of 1 to 2 years. The high-cost options mainly involve changing equipment and technology, modifying processes, installing modern technologies like gasifiers, congregation plant, waste heat recovery system, switching from fossil fuel to biomass base energy (Rice husk)among others. These incur higher cost, as compared to low-cost and medium-cost options, and have a payback period of more than 2 years.

Specific energy-efficiency and renewable energy options, along with their investment potential, have been identified for each of the 10 industrial sectors identified for this study (Refer Annex 6).

4.5.1 Renewable Energy Intervention Potential in Selected Sectors

The selected industrial sectors have a significant potential for the adoption of renewable energy technology too. However, this study did not calculate investment potential for these options because feedback received by the study team during interviews indicated that most industries are reluctant to adopt renewable energy technologies due to high upfront cost and long payback period. The industry personnel and vendors interviewed lacked adequate information and confidence both in adopting these technologies.

However, a few large industrial units visited during the study were found to have already invested in renewable energy technologies such as solar thermal, biomass (rice husk) based gasifier, steam turbine, and others. Clearly, they were aware of the renewable energy technologies available in the market and were willing to invest in these.

This was in large part due to insufficient and unreliable power supply, forcing them to opt for more expensive captive plants run by high speed diesel. Combined with the rising price of fossil fuels, industries viewed this as unsustainable and opted for upfront investment on renewable energy technology instead. Although high in initial investment, some industries were convinced these were more cost-effective and energy-saving in the long run. Two examples are presented in Box 1 and Box 2 below.

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Box 1

One of the vendors, during the interview, informed the study team that a private hospital in Kathmandu wanted to replace a 20 kVA diesel generator with a solar home system that could produce 20.21 kWh from 2.78 kW systems. It costs around $ 45,371 at present. Considering their present pattern of usage of diesel in generators the payback period is 4.5 years. Although the payback period is not very high, the upfront cost is very high.

Box 2

OKhanal Poultry Industry of Chitwan is another example of an industry which has adopted renewable energy measures. It has installed a large biogas plant that runs from chicken drop-pings, despite its high upfront cost and payback period. The biogas produced is not used in the industry itself but is distributed to 200 house-holds in the vicinity of the industry for $ 1.39 per household per month. The total cost in-curred to establish the plant and distribution channels was $ 41,782.72 and its payback is 12.5 years.

Table 22 below presents the renewable energy options that are already in use and can be used in different industrial sectors.

Table 22: Renewable Energy Intervention Options in the Selected Sectors

SN	Sector and Sub Sectors	RE options	Time Line	Price (USD)	Pay Back Period	Fuel Replaced	Current Use of RE Technology
1	Cement*	Biomass Gasifer		487,465		Coal/Furnace Oil	No
2	Rolling Mills	-	-	-	-	-	-
3	Poultry/Agribusiness	-	-	-	-	-	-
	a. Poultry and Feed	Biogas	6 months	41,783	9-10 years		Yes
	b. Dairy	Solar thermal heating	9 months	15,320	8-10 years	Kerosene/Firewood	No
	c. Tea	Solar Thermal Heating	5 months	83,565	7-8 years	Reduced the fuel consumption	No
		Biomass gasifier	3 months	139,276	3-4 years	Coal/Furnace Oil/Fire Wood	Yes
4	Plastic	-	-	-	-	-	-
5	Cold Storage	-	-	-	-	-	-
6	Food and Beverage (breweries/ distilleries)	Solar thermal heating	13 months	19,499	5-6 years	Coal/Furnace Oil	Yes
		Biomass Gasifier	7 months	487,465	3-4 years	Coal/Furnace Oil	Yes
		Steam Turbine	NA	NA	NA	Diesel	Yes
7	Steel Structures	Biomass base gasifier	8 months	487,465	1 year	Coal/Furnace Oil	Yes
8	Paper and Pulp	Biomass base Gasifier	6 months	487,465	1 years	Coal	Yes
9	Brick	Solar drying	3-4 months	55,710	7 years	Reduces the coal consumption	No
10	Tourism (Hotels)	Solar Thermal Heating	9 months	30,641	1.2 years	Diesel/Furnace Oil	Yes
		Biogas	6 months	27855	2.30	LPG	Yes

*Source: Findings from the survey; * Based on gasifier implemented by Hulas Steel Indus-tries for two 550 kW*

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4.5.2 Energy Efficiency Intervention Potential in Selected Sectors

Most of the energy efficiency options were identified from the interviews conducted and from the walk-through visits of the industrial units. As for the price of the machinery and equipment, the vendors/sellers were reluctant to provide a quotation with detailed break-down of all the expenses, from import to maximum retail price including taxes. Hence, the prices of the equipment used in this study are based on the telephone conversations with energy efficiency vendors, a review of regional practices, web search and literature review.

Most of the options identified are retrofit interventions rather than new technology installations for new industrial establishments. The energy efficiency intervention options, along with investment potential, have been identified for each of the 10 industrial sectors. The most common retrofit options are presented in Table 23 below.

Table 23: Most Common Energy Efficiency Options

S.N.	Most Common Options	Investment ($)	Payback Period (Month)
1	Installation of capacitor bank for power factor improvement	1,393	24
2	Replacement of rewind and standard motors with energy efficient motors	2,306	15
3	Waste heat recovery system	995,822	156
4	Insulations	5,571	34
5	Optimization of steam distribution system	6,964	20
6	Installation of Air Pre-Heater	5,571	34
7	Replacement of traditional dryers with Energy efficient dryers		
8	Installation of new hot air generators	30,752	3
9	Installation of fluidized boilers	139,276	133
10	Installation of Variable Frequency Drive system	506	4.3
11	Load management system	3,482	28.44
12	Optimization of lighting system	2,786	38
13	Installation of energy efficient compressors	3,482	38
14	Installation of On-Load Tap Changer for regulating transformers (for voltage stability)	16,713	37
	Total	1,214,624	-

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Nepal suffers from a severe deficit in the electricity grid. As a result, most industrial sectors are looking into captive plants such as co-generation plants and other biomass-based technologies (biomass-based gasifiers, low-steam turbine, etc.). This study did not include the investment potential for captive plants. Detailed below are selected case studies of successful energy efficiency/renewable energy projects:

Case I: Diesel Fuel Switch to Solar Thermal

A 4-star hotel had diesel-run boilers that ran for almost 3 hours a day, leading to the consumption of 24 liters of diesel per hour. On the recommendation of energy efficiency suppliers Deveshi Technology Solution Pvt. Ltd, India, the hotel replaced diesel with solar thermal. Clean Energy Development Bank (CEDBL), a pioneer in initiating energy efficiency projects in Nepal, provided debt financing service equivalent to $ 30,641 with a payback period of 1.2 years. It was reported that the fuel switch resulted in a saving of 26,280 liters of diesel consumption. A significant part of hotel's hot water is now solar heated and the hotel is pleased to have realized considerable cost savings of $ 25,072 already.

Source: CEDBL Interview 2011

Case II: Furnace Oil to Renewable Biomass

Hulas Steel Industries Limited, (HSIL) located at Ward No 2, in the Pipara Simara VDC of Bara District, is one of Nepal's most reputable manufacturers of cold rolled sheets, roofing sheets, pipe fittings, steel pipes, steel structures and poles. Under the umbrella of Golchha Organization Group of Nepal, Hulas Steel has more than 28 years of manufacturing experience. HSIL has one furnace in Continuous Galvanizing Line for galvanizing roofing sheets, which is running on fossil fuels for heat generation, emitting greenhouse gas. HSIL installed two 550 kW biomass based gasifiers to generate thermal energy in the furnace for galvanizing roofing sheets. The purpose of the project is to utilize renewable biomass (rice husk) available in the vicinity of the project area for effective generation of thermal energy required for the manufacturing process by replacing fossil fuels. This project is an example of a manufacturing plant switching from fossil fuel to renewable biomass through gasification technology. The total investment was about $ 487,465.2 with significant savings from reduced consumption of fossil fuel. The implementation of renewable energy technology resulted in savings of $ 413,649.03 with payback within 14 months.

Source: Project Design Document of HSIL prepared by Winrock International, 2010

4

Case III: Waste Heat Recovery from Condensate Return

Demonstration Site:

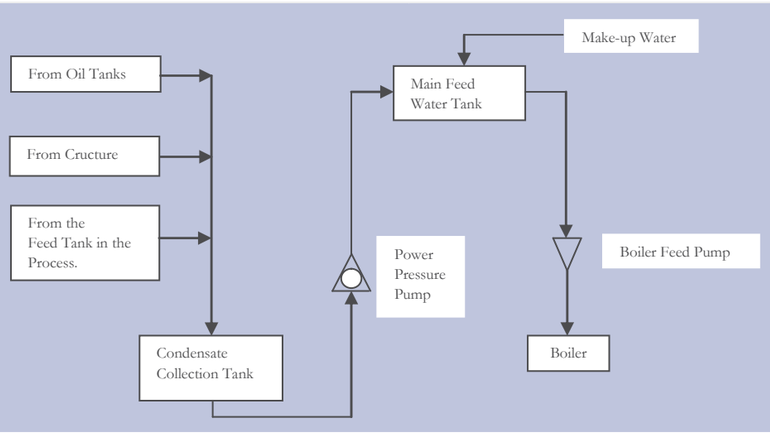
This Soap and Chemical Industry is located in Makwanpur District. Currently, the plant produces two varieties of soaps, laundry soap and toilet soap. Both types of soap are sold in the domestic market as well as exported to India.

Details:

The quantity of recoverable condensate has been estimated at 260 kg/hour at a temperature of about 950C; in addition, some flash steam is also going into the drain. At present the temperature of feed water going to the boiler is about 300C. If this condensate recovery is used as the feed water, the temperature of the mixture feed water (Condensate return + Make-up water) will rise to approximately 420C. Based on an actual calculation, a rise of 120C in feed water temperature will result in a fuel consumption saving of a little more than 2 percent. Increased risk of corrosion is countered through selection of proper materials for piping and tanks. This study was initiated during the Environment Sector Program Support's energy efficiency program which was conducted with assistance from Danish International Development Agency.

Energy Cost and Savings:

Project Implementation Cost (USD)	3,481.809
Annual Diesel Savings (Ltrs)	9,576.00
Waste water (m^3)	1640.000
Waste Water Treatment Cost	16,360.000
Annual Cost Savings (USD)	3,974.003
Simple Payback period (Years)	0.900



Source: Success Stories, ESPS-Energy Efficiency, 2004

Mapping of Financial Industry

5 Mapping of Financial Industry

5.1 Overview of the Financing Sector in Nepal

Given the relatively small and under-developed economic base of the country, Nepal has a reasonably diversified financial sector, as demonstrated by the number and variety of institutions that play an active role in the sector (Ministry of Finance 2011). During the last two-and-a-half decades, Nepal's financial system has grown significantly. In early eighties, there were only two commercial banks and two development banks in the country. The adoption of economic liberalization policy, particularly financial sector liberalization, paved the way for establishment of new banks and non-bank financial institutions in the country.

Central Bank

Nepal Rastra Bank, the Central Bank of Nepal, was established in 1956 to regulate the banking and financial institutions in the country. Based on the NRB Act 2002, NRB can issue directives from time to time to licensed financial institutions to control banking and financial transactions. The central bank may provide banking and payment services to foreign governments, foreign central banks, foreign banks and international organizations or associations, and obtain similar facilities from them.

The Nepalese financial sector is composed of the banking sector and the non-banking sector. The banking sector comprisesf banks and financial institutions licensed by NRB and classified as A, B, C and D class institutions. Commercial banks are "A" class institutions, whereas development banks, finance companies, and micro-finance development banks are classified as B, C and D class institutions respectively. There are some Cooperatives and Non-Government Organizations licensed for limited financial activities as non-classified financial institutions (NRB 2010b).

A total of 271 banks and financial institutions licensed by NRB were in operation by October 2010. Of these institutions, 29 are "A" class commercial banks, 83 are "B" class development banks, 79 are "C" class finance companies, 19 are "D" class micro-finance development banks, 16 are saving and credit co-operatives, and 45 NGOs, as shown in Table 24 below.

Table 24 : Growth of Financial Institutions in Nepal licensed by NRB

Types of Financial Institutions	Mid-July								Mid-Oct*
	1990	1995	2000	2005	2006	2007	2008	2009	2010
Commercial Banks	5	10	13	17	18	20	25	26	29[11]
Development Banks	2	3	7	26	28	38	58	63	83
Finance Companies		21	45	60	70	74	78	77	79
Micro-Finance Development Banks		4	7	11	11	12	12	15	19
Saving and Credit Cooperatives Limited		6	19	20	19	17	16	16	16
Financial Intermediaries Non-Government Organizations (FINGOs)			7	47	47	47	46	45	45
Total	**7**	**44**	**98**	**181**	**193**	**208**	**235**	**242**	**271**

*Source: NRB 2010a; * http://bfr.nrb.org.np/List_Banks_n_Non_Banks.php#home*

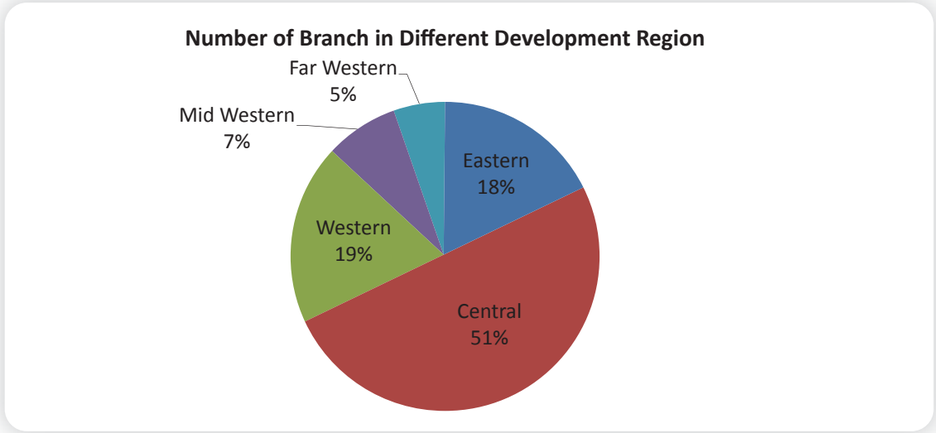
The non-banking sector in Nepal's financial system comprises cooperatives, and saving funds and trusts like Employee Provident Fund, Citizen Investment Trusts, postal saving offices, and Insurance companies, not licensed by NRB.

Commercial Banks:

Commercial banks hold dominant share on the main balance sheet components of the Nepalese financial system. Of the total deposits of $ 9,970.18 million in mid-January 2010, commercial banks cornered 81 percent share. The number of commercial bank branches operating in the country increased from 752 in mid-July 2009 to 850 in mid-January 2010 (NRB, 2010a). Figure 3 below shows the number of commercial bank branches in different development regions of Nepal.

[11] There are currently 31 Commercial Banks operating in Nepal but the latest report has not been published

Figure 3: Number of Commercial Bank Branches in Different Development Regions of Nepal



Source: Nepal Rastra Bank 2010a

Out of the $ 6,499.50-million outstanding sector-wise credit in mid-January 2010, the largest proportion of loans and advances has been to the manufacturing sector (20.60 percent). Other sectors which make up a significant proportion of the total loans and advances are wholesalers & retailers (18.70 percent), finance, insurance & fixed assets (11.62 percent) and construction (10.58 percent). Sectors such as transport, communication & public services (4.96 percent), consumable loans (4.36 percent), other service industries (3.94 percent) and agriculture (2.92 percent) make up a relatively small percentage of the total loans and advances, for the same period.

The outstanding deprived sector credit of commercial banks at the end of mid-January 2010 was $ 221.81 million. The ratio of deprived sector credit to total outstanding of product-wise loans and advances stood at 3.33 percent for the current period, as compared to 2.96 percent in the previous year (NRB, 2010a).

Development Banks:

The total number of development banks increased from 63 in July 2009 to 83 in October 2010. Out of these, 12 are national-level and the remaining are district-level development banks.

The proportion of non-performing loans to total outstanding loans in development banks went from 1.50 percent in July 2009 to 1.04 percent in January 2010. The total amount of non-performing loans by January 2010 is $ 8.15 million; it was $ 8.34 million in July 2009 (NRB, 2010a).

Finance Companies:

The total number of finance companies increased from 77 in July 2009 to 79 in January 2010. The total outstanding amount of loans and advances reached $ 996.46 million in January 2010, an increase from $ 834.56 million in July 2009 (NRB, 2010a).

Micro Finance Development Banks:

As of mid-October 2011, there are 19 'D' class rural and micro-finance development banks in the country. Out of them, five are regional-level rural development banks and the remaining are micro-finance development banks. The total outstanding loans and advances of micro finance development banks increased by 15.9 percent in the period between July 2009 and January 2010, increasing from $ 81.87 million to $ 94.89 million (NRB, 2010a).

Cooperatives and Financial Non-Government Organizations:

The number of financial cooperatives licensed by NRB to conduct limited banking activities and the number of NGOs remained constant for the period between July 2009 and January 2010 -- there were 16 financial cooperatives and 45 NGOs operating during this period (NRB, 2010a).

5.2 Overview of Present Policies for Industrial Finance

The Nepal Rastra Bank Act 2002 (first amendment) gives authorities, powers and duties to Nepal Rastra Bank for the regulation of banking and financial institutions established under the Act. On the basis of this Act, NRB can issue directives from time to time to licensed financial institutions to control banking and financial transactions -- the licensed entities need to take approval the central bank approval while accepting deposits and providing loans.

Various policy measures related to monetary and credit management and foreign exchange were adopted towards the middle of 2009-10 through the mid-term review of monetary policy. Details of the policies relevant to industrial finance are provided in Annex 7. The Table 25 below lists the existing policies and Acts relevant to industrial finance.

Table 25: Present Policies for Industrial Finance

S.N.	Policies / Acts / Regulations	Provisions
1	International Financial Transactions Act, 1998	• Regulates and manages the financial activities of international financial entities
2	Nepal Rastra Bank Act, 2002	• Gives authority, powers and duties to NRB to regulate the banking and financial institutions established under this Act
3	Banking and Financial Institution Act, 2006	• Financial institutions must obtain any movable or immovable property as a security/guarantee
4	Nepal Rastra Bank Unified Directives, 2010	• *Loan Classification and Loan Loss Provision:* Financial institutions can allocate only 25 percent as loan loss provision, if these loans are insured • *Provision of Single Obligor Limit and Sector Limit:* The loan amount for a single project should not cross 25percent of total capital. The limit for export oriented industries, small and medium enterprises, drug, agriculture, tourism, cement, iron and other productive sectors is up to 30 percent. Up to 50 percent is the limit for the hydropower sector, provided the power purchase agreement is signed with the concerned entity (for more than 25 percent) • *Provisions for Consortium Financing:* Two or more than licensed financial institutions can lend to one client. The lead partner is responsible for the due diligence, monitoring and supervision of loan and other activities

Liquidity Crisis

The massive flow of bank credit to real estate and housing led to a financial resource crunch, constraining credit flow to other productive sectors of the economy. The share of credit to the real estate sector rose from 1.1 percent in July 2007 to 9 percent in June 2010 (NRB, 2010). At the same time, the share of credit to the production sector came down from 26.9 percent in July 2007 to 20.7 percent in June 2010 (NRB, 2010). This contraction in credit to the productive sector and excessive credit flow to the unproductive sector increased the risk of financial as well as overall macroeconomic instability. As a result, the banking sector is facing a liquidity shortage.

To minimize the credit concentration risk, a provision has been introduced in 2009-10 under which banks and financial institutions are required to bring down their real estate and housing lending portfolio from 25 percent and 40 percent to 15 percent and 30 percent, respectively by July 15, 2011. A further reduction of the same to 10 percent and 25 percent respectively by July 15, 2012 is also a requirement of this provision (NRB, 2010c). Although NRB has taken formal action to bring down real estate financing, banks are themselves curbing this type of lending.

It has also been reported that the liquidity crisis is a result of frozen land prices, the government's market-distorting decisions and slow spending (The Himalayan Times, 2011b). In addition, due to low depositors' confidence, deposit mobilization of commercial banks did not grow at the rate that it used to in the past years. According to NRB data, commercial banks had Nepali rupees 647 billion in deposits by the end of May. By the end of last fiscal year, they had Nepali rupees 617 billion (The Himalayan Times, 2011a). In the wake of a series of reports that banks are facing a liquidity crisis, the depositors are losing confidence in them (The Himalayan Times, 2011b); the subsequent slowdown in deposit mobilization has fuelled the liquidity crunch further. Adding to this problem is the regulation requiring depositors to show the source of the deposit amount for deposits as small as Nepali rupees 1 million ($ 13,927.58). As a result, people are holding cash instead of depositing it in banks.

The decrease in government spending in the development sector is also perceived to have contributed to the current liquidity crisis. To counter this, the government has recently lifted the limitations on spending allocated budget and made it more flexible.

Nepal Rastra Bank has taken several steps to improve the current financial situation in the country: to avoid systematic risks in the financial system and create financial stability, NRB introduced different provisions such as statutory liquidity ratio, net liquidity ratio and credit deposit ratios in 2009-10; to minimize the risk of excessive credit expansion, a provision was introduced under which banks and financial institutions are required to gradually lower their credit-deposit ratio and maintain it at 80 percent by January 2013 (NRB, 2010); and finally, NRB has been introducing different mechanisms, including refinancing, to minimize the liquidity crisis.

Refinancing

NRB has been providing refinancing facilities for export, sick industries, small and cottage industries and foreign employment. Recently, the existing refinance rates of 1.5 percent, 1.5 percent, 2.5 percent and 1.5 percent respectively on export, sick industry, small and cottage industry and foreign employment have been unified into a single special refinance rate of 1.5 percent. While using this facility, banks and financial institutions cannot charge their clients more than 4.5 percent interest (NRB, 2010).

Considering the situation of inadequate credit flow to productive sectors and contraction of liquidity, NRB made a provision to provide refinance facilities to banks and financial institutions for specified productive sectors. To ensure adequate credit facilities for export-oriented and import-substituting industries, as well as the energy and tourism sectors, NRB has been providing refinance facility at 7.5 percent interest rate to banks and financial institutions against good loans of the respective sectors. Banks and financial institutions cannot charge more than 10 percent interest to the borrowers on such loans (NRB, 2010).

For example, recently NRB opened a 'special' refinancing window for banks and financial institutions to avert any systematic risk caused by the tight liquidity situation. A financial institution can get refinancing facility for up to 60 percent of capital fund at 7 percent interest rate for four months against good loans (The Himalayan Times, 2011a). Financial institutions have also been given incentives in the form of 'special' refinancing facility if their non-performing loans do not exceed 5 percent.

In response to a situation of liquidity contraction, NRB extended the maturity period for repossession and reverse-repossession auctions from the existing period of 28 days to 45 days. NRB also injected total amount of Nepali rupees 135.06 billion through outright purchase auction and repo auction in 2009/10, in addition to the liquidity injected through purchase of $ 1.6 billion from the foreign exchange market in 2009/10.

Single Obligator Limit

The Unified Directives issued by the central bank to licensed financial institutions is crucial for controlling banking and financial transactions. It spells out the provisions of Single Obligator Limit (SOL) and Sector Limit. According to the Unified Directives 2010, the loan amount provided by financial institutions (Class A, B and C) for a single project should not exceed 25 percent of total capital; while 30 percent has been established as the upper limit for export-oriented industries, small and medium enterprises, drug, agriculture, tourism, cement, iron and other productive sectors (NRB, 2010c).

Recently, SOL for the hydropower sector was increased to 50 percent, provided that power purchase agreement is signed with the concerned entity (for more than 25 percent). However, due to the severe liquidity crunch, banks have not been able to fully utilize the SOL provisions. For the big borrowers, banks are primarily utilizing the provision of Consortium Financing where two or more than two licensed financial institutions can lend to one client, firm or industry in order to diversify the risk.

Thus, it is clear that monetary policy plays a vital role in the effective implementation of directives such as maintaining capital adequacy ratio, required reserve ratio, statutory liquidity ratio, net liquidity ratio, credit-deposit ratio and sectoral credit limits to enhance the financial capacity of banks and financial institutions.

5.3 Sampling of Financial Institutions for the Study

For the purpose of this study, 11 financial institutions were selected and interviewed. Out of 11, eight were Class 'A' Commercial Banks and three were Class 'B' Development Banks. The Commercial Banks selected for this study are Nepal Industrial and Commercial Bank (NICB), Bank of Kathmandu (BoK), Himalayan Bank Ltd. (HBL), Kumari Bank Ltd. (KUMARI), Laxmi Bank Ltd. (LAXMI), Nabil Bank Ltd. (NABIL), Commerz and Trust Bank Nepal (CTBN), and Nepal Bangladesh Bank Ltd. (NBBL).Among the Development Banks selected are Clean Energy Development Bank (CEDBL), Ace Development Bank (ACE) and Sanima Bikas Bank (SANIMA). A brief summary of each of the selected banks and financial institutions is given in Annex 8.

The brief financial status of all sampled banks and financial institutions is presented in the Table 26 below. Among the 11 banks selected, NABIL has the highest capital fund, deposits, other assets and total loan.

[12] NRB on June 9, 2011 provided Nepali rupees 500 million ($ 6.96 million) special refinancing under Lender of Last Resort Facility to Vibor Development Bank against good loans for a maximum of six months at 7 percent interest rate, also asking Class B financial institutions to submit liquidity management plan within 15 days. (The Himalayan Times, pg. 1, June 10, 2011)

Table 26: Brief Financial Status of the Sampled Banks

As of Mid-January 2010						*In USD Million*	
SN	**Banks**	**Capital Fund**	**Deposits**	**Fixed Asset**	**Other Asset**	**Total Loan**	**Net profit**
1	NICB	19.39	217.42	3.09	11.90	204.99	2.97
2	BOK	24.26	260.82	10.52	2.73	241.84	3.39
3	HBL	43.45	515.62	12.55	21.28	426.22	4.97
4	KUMARI	22.63	235.23	3.74	13.06	219.07	3.36
5	LAXMI	24.78	233.49	4.79	6.90	210.51	2.29
6	NABIL	43.58	613.14	9.47	35.76	470.65	8.82
7	CTBN	NA	NA	NA	NA	NA	NA
8	NBBL	15.49	131.35	2.12	35.87	130.21	11.26
9	CEDBL	4.75	45.20	1.29	0.84	41.59	0.21
10	ACE	11.28	46.29	1.57	2.77	40.15	0.37
11	SANIMA	12.19	76.47	3.30	2.26	70.56	0.53
Total		**221.80**	**2375.03**	**52.45**	**133.38**	**2055.78**	**38.15**

Source: Banking and Financial Statistics, Mid-January 2010, Annual Reports of Sampled Bank and Financial Institution

Interviews conducted during the study with banks and financial institutions shed light on various issues such as their awareness level and attitude towards energy efficiency/renewable energy financing, credit assessment criteria and risk mitiga-tion strategies, association with bilateral/multilateral institutions, etc. The details are presented in the following paragraphs.

1. Awareness about modernization, energy efficiency and renewable energy measures

The commercial and development banks interviewed had limited knowledge and awareness on energy efficiency/renewable energy measures and modernization in the industrial sectors. Except for the few technologies that the banks are already financing (for example, Vertical Shaft Brick Kiln and Solar Thermal) they were not aware of the wide range of sustainable energy technologies available as potential financing options. One of the reasons for this could be the unavailability of these technologies in the domestic market.

Only two banks explicitly understood the concept of modernization in industries as maximum utilization of the available resources/energy by installing an efficient plant or machinery, thus resulting in maximum output and low waste generation.

2. Attitudes of the Financial Sector and Bankers towards Energy Efficiency

The banks, when given information about energy efficiency/renewable energy technology during

the interviews, expressed their willingness to finance projects in the sustainable energy space, if approached by the clients/industries. Through interactions ranging from officers to the CEOs of the banks, it was clear that they all viewed investment in the energy efficiency/renewable energy sector as a new business avenue with less risk involved. They understood that energy efficiency equipment/plants thus installed would save a significant amount of energy and resource, thus enabling clients/industries to repay the loan on time. Further, the study team discovered that banks consider energy efficiency/renewable energy as an investment in 'green' projects, and thus regard it as contributing positively to the environment, adding to the goodwill of the banks.

However, the banks also highlighted the fact that the technical capability of their staff is not adequate to expand their business in the energy efficiency/renewable energy sector. They also mentioned that with the exception of a few industries which are already involved in sustainable projects, most of the industries in Nepal do not possess the required knowledge and awareness on these technologies that could save them resources.

They were of the view that this is mainly because various energy efficiency/renewable energy technologies and appliances are not available in the domestic market. Besides, with the current economic downturn, industries are opting for cheaper, second-hand machinery and equipment to meet their production demand. Hence, the bankers believed that in order to expand their energy-efficiency sector lending, it is important to make the industrial sector aware of the energy efficiency/renewable energy technologies and its advantages, even in difficult economic times.

CEDBL, a pioneer in initiating energy-efficiency financing in Nepal, said that it is still a new subject in Nepal, and coordination between the banks and financial institutions, industries, and vendors is needed to promote financing in this space. They also pointed out that interest in energy efficiency is low among the industrial users, due to lack of knowledge and awareness about Clean Development Mechanisms and energy efficiency. Clearly, the energy efficiency market can become bigger if industries are educated and encouraged to adopt these measures.

3. Energy Efficiency/Renewable Energy Financing in Financial Institution Portfolios

Based on the interviews conducted, the study team found that banks did not have a specific portfolio for energy efficiency/renewable energy financing and energy efficiency loan products. Banks currently provide financing according to requirement and feasibility of the projects, and as per the Single Obligator Limit. Interviews also revealed that banks are already financing some energy efficiency/renewable energy technologies for thermal applications in the industries, although these are not specifically labeled as energy-efficiency financing. Banks are financing such machineries/retrofits under different titles, such as renovation or modernization, process change, technology upgradation, and change from manual to automatic process.

Besides investment from banks, some industries are also using their own equity to finance energy efficiency/renewable energy machinery, retrofits, renovation or modernization efforts in their industrial units.

Bank of Kathmandu (BoK), Laxmi Bank (LAXMI), Nabil Bank (NABIL)., Himalayan Bank (HBL), Kumari Bank (KUMARI), Clean Energy Development Bank (CEDBL), and Ace Development Bank (ACE) are already involved in financing at least one of the energy efficiency/renewable energy technologies such as Solar Home System, biogas plant installation, solar thermal, replacement of diesel generator set with rice husk based gas turbine, replacement of fossil fuel-based and biomass-based electricity generation, Vertical Shaft Brick Kiln technology, Compact Fluorescent Light (CFL), and some equipment suppliers.

CEDBL has invested in biogas, Electric Vehicles (EVs) (Safa Tempo), solar thermal and Solar Home Systems (SHS), as well as granted loans to vendors and suppliers of solar and CFLs. They emphasized that the potential pipeline of investments does not exceed the capacity or willingness of banks to finance energy efficiency/renewable energy measures, and that energy related projects never reach the SOL. Table 27 below presents the energy efficiency/renewable energy financing of the various banks.

Table 27: Banks Involved in Energy Efficiency/Renewable Energy Financing

S.N.	Banks	EE/RE Technologies	Amount
1	**NICB**	• N/A	• N/A
2	**BoK**	• Microfinance of SHS in Rolpa District. • EVs • Biogas	• $ 13.92 thousand (Nepali rupees 1,000,000) for SHS
3	**HBL**	• Process change, technology upgradation	• N/A
4	**KUMARI**	• N/A	• N/A
5	**LAXMI**	• SHS	• $ 11.14 thousand
6	**NABIL**	• Financed Rice Husk Turbine to replace Diesel generator in Ghee, oil and soap industries	• $ 487.46 thousand
7	**CTBN**	• N/A	• N/A
8	**NBBL**	• N/A	• NA
9	**CEDBL**	• Replacement of diesel boiler (5000 liters) with solar thermal in Grand Hotel • VSBK project in Birtamod, Jhapa • Financed CFL Trading and Suppliers	• $ 30.64-34.81 thousand • N/A • N/A
10	**ACE**	• Solarification of Hotels • SHS • Sola Tuki	• N/A
11	**SANIMA**	• N/A	• N/A

Source: Findings from survey

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Based on the discussion with banks, their energy efficiency/renewable energy portfolio ranged from 1 percent to 15 percent. Only CEDBL has a specific loan product and loan portfolio for the energy efficiency/renewable energy sector. Out of the total loan portfolio of $ 57.10 million (Nepali rupees 4.1 billion), 15 percent is invested in the sustainable energy sector. Meetings with the banks also revealed that commercial banks such as NABIL, BoK and HBL have 3 percent, 6 percent and 2 percent in their energy efficiency/renewable energy financing portfolios respectively, while ACE and LAXMI have less than 1 percent.

Although the percentage of energy efficiency/renewable energy portfolio seems lower in commercial banks than in development banks, the amount of loan disbursed is higher. For example, 3 percent of NABIL's energy efficiency/renewable energy portfolio amounts to $ 15.46 million (Nepali rupees 1,110,000,000) while 15 percent of CEDBL's portfolio amounts to $ 8.56 million.

4. Incentives needed for Energy Efficiency/Renewable Energy Promo-tion in Industries

The banks interviewed suggested that the government should introduce various incentives to promote energy efficiency/renewable energy/modernization projects in Nepal's industrial sectors. The following fiscal incentives emerged from the interactions for the promotion of energy efficiency in Nepal:

1. Subsidized cost of funds /soft Loan
2. Tax benefit
3. Grant fund
4. Refinancing
5. Custom Duty Waiver
6. Accelerated depreciation

Eight out of 11 banks were of the opinion that providing subsidized funds or soft loans was important for promoting the energy efficiency/renewable energy sector in Nepal. Tax benefits like tax rebate and tax holiday on equipment for these technologies was also recommended by four out of 11 banks. Similarly, creating a pool of funds or grant fund as start-up loan for energy efficiency/renewable energy projects was also recommended, keeping in view the current liquidity crunch. Banks also stressed the need for strong refinancing policies, specifically for sustainable energy technologies, and recommended an increase in the refinancing period (currently it is six months).

Fiscal incentives such as subsidy, custom duty waiver, accelerated depreciation allowance, low cost loans, government financing of energy-efficiency products, among others were also suggested as incentives for promoting energy efficiency/renewable energy.Banks also considered it necessary to make the default insurance more practical and spread increment (difference between the interest rate and the cost of fund).

Six out of 11 banks pointed out the need for structured training and capacity building of the bank staff to identify business avenues for energy efficiency investment; awareness among the industrial

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users; and energy efficiency policy advocacy in order to promote its adoption. Most importantly, they believed that pilot projects showcasing the benefits of adopting these technologies are critical for convincing more and more industrial units to modernize. Interviews with the industrial users, banks, and energy experts revealed that members of the Nepalese industrial sector are reluctant to be the first one to adopt any new technology, but they would be willing to replicate the same if they see the benefits.

5. Loan Portfolio / Sectoral Lending of Banks

Interviews with the banks revealed that each bank has extended financing to at least one industrial unit from the industrial sectors selected for this study, except for plastic and cold storage. Table 28 below presents a sector-wise lending portfolio of the selected banks, based on the interviews conducted.Except for HBL, all 10 banks have extended financing to the cement sector, and eight out of 11 banks have extended financing to the food and beverage sector. Besides the 10 industrial sectors selected for this study, these banks were also involved in financing textile, rice processing and hydropower projects.

Table 28: Sectorial Lending Portfolio of the Selected Banks

	NICB	BOK	HBL	KUMARI	LAXMI	NABIL	CTBN	NBBL	CEDBL	ACE	SANIMA
Cement	•	•		•	•	•	•	•	•	•	•
Rolling Mills		•	•	•	•			•		•	
Poultry/Agribusiness	•		•					•		•	
Plastic								•			
Cold Storage											
Food & Beverage (breweries/distilleries)	•	•	•	•	•	•		•		•	
Steel Structures	•	•	•	•				•		•	
Paper and Pulp					•						
Brick					•	•		•	•		
Tourism (Hotels)	•			•	•			•	•	•	
others	Textile; Rice processing	Hydropower	hydropower			hydropower	hydropower		hydropower	hydropower	hydropower

Source: Findings from survey

Except for HBL, all the banks have extended financing to the cement sector, and eight out of 11 banks have extended financing to the food and beverage sector. In addition to the 10 industrial sectors selected for this study, these banks were also involved in financing textile, rice processing and hydropower projects.

6. Credit Assessment Criteria and Risk Mitigation Measures Adopted by Financial Institutions

The banks informed the research team that before granting any loan or credit, they review their credit assessment criteria and apply risk mitigation strategies, like assessing the credibility and feasibility of the project and customer, personal/cross guarantee, cash flow of the project, collateral requirement (project itself, equipment and additional collateral), market conditions, etc. Based on the frequency with which these were mentioned during the interviews, the credit assessment criteria and risk mitigation strategies are ranked in Table 29 below.

Table 29: Credit Assessment Criteria of Banks

Rank	Credit Assessment	Frequency
1	Project viability/technical and financial feasibility of the project/cash flow of the project	11
2	Borrower profile/client status/credibility of the people involved	10
3	Market/economic scenario	8
4	Fixed assets	8
5	Financial strength	6
6	Management competency/efficiency	5
7	Reinsurance credibility	3

Source: Findings from survey

Project Viability or technical and financial feasibility was the first criteria evaluated by the banks before granting any loan/credit to the clients. Looking at the bor-rower's profile was also high in their list of criteria to be fulfilled before granting a loan, followed by the market/economic condition, fixed assets, financial strength, management competency/efficiency, and reinsurance credibility. Banks are also required, by regulation to go through the Credit Information Bureau to grant a loan, even for loans as small as Nepali rupees 100,000.

Table 30: Risk Mitigation Measures Adopted by Banks

Rank	Risk mitigation	Frequency
1	Project Appraisal / Due Diligence	11
2	Project or additional collateral	10
3	Personal guarantee (based on good network)	9
4	Technical knowledge	8
5	Profitability	6
6	Consortium financing	6
7	Monitoring (field visits, regular contacts, third party information)	5
8	Cross Guarantee	4
9	Default Insurance	2

Source: Findings from survey

To mitigate the risk involved in financing various projects, banks are adopting elaborate risk mitigation strategies. The first thing that the banks consider in the process is the project appraisal/due diligence. Collateral policy is another measure that is adopted by most of banks interviewed during the study. Project assets, the project or equipment itself could be used as collateral, with additional collateral if required. For example, for the real estate sector, land and building could be the collateral.

Personal guarantee is considered vital to mitigate any risks involved. Banks also considered technical knowledge on the projects thus financed as an important factor in risk reduction. Corporate financing is the general practice employed by banks, but to mitigate the risks involved, some banks are go in for consortium financing for big projects. Profitability of the project, monitoring (based on field visit, regular contacts, third party information), cross guarantee, and default insurance of the project are also taken into account for lowering risk.

7. Donor Relations

Table 31 below presents information on the participation of various banks in donor-assisted programs; some of them are in the process of accessing specialized funds from bilateral/multilateral institutions.

5

Table 31: Banks' Participation in Donor Assisted Programs

S.N.	Banks	Participation in Donor assisted programs	Accessing specialized fund from bilateral/multilateral institutions
1	**NICB**	• First bank in Nepal to be provided a line of credit by IFC, under its Global Trade Finance Program	• Recently signed MoU with IFC for SME financing • Also tied up with ADB for trade financing
2	**BoK**	• Worked with Winrock for EV promotion and financed 20 women drivers, where Winrock Nepal was the guarantor and technical support • Worked with USAID in the Business Development Services Marketing Production Services project	• Coming up with venture capital (already signed document with IFC for the SME sector with technical support from GIZ)
3	**HBL**	• Acted as main fund manager for ESPS DANIDA wherein they handled entire fund of Nepali rupees four crores • Development Bank of Germany (KfW) for NEEP project	• N/A
4	**KUMARI**	• N/A	• In the process of contacting and meeting with the owner and financer • 2-3 in pipeline
5	**LAXMI**	• Involved in microfinance activity	• Interaction with USAID for future microfinance activities (in the pipeline)
6	**NABIL**	• DANIDA funded EVs	• N/A
7	**CTBN**	• N/A	• N/A

Source: Findings from survey

Except for SANIMA and CTBN, all nine banks have participated in donor-assisted programs. However, information for KUMARI was not available. NICB, BoK, KUMARI and LAXMI are in the process of accessing funds from various bilateral/multilateral institutions.

Investment Potential and Barriers

6 Investment Potential and Barriers

6.1 Investment Potential and Financing Needs

Primary interviews of the stakeholders revealed that the smaller industries had highest potential for low cost/no cost interventions while the medium/larger indus-tries had potential for adopting technology/equipment changes that would incur higher investment cost.

The study team sampled and conducted interviews with personnel from 51 indus-tries out of the selected industrial sectors and sub-sectors and analyzed the ten-tative investment required to shift from traditional systems to the energy efficiency intervention options.

The energy efficiency/renewable energy intervention options for each sector were identified based on the walk-through visit and on the information provided by pro-duction professionals from the corresponding industries. The cost of the energy efficiency intervention options/technologies identified was used to calculate the total investment potential for the baseline (large establishment, single unit) indus-try, which was then used to compute investment potential for medium and small scale industries in the sector. The single unit investment potential of the large, medium and small scale industry was then used to extrapolate the total invest-ment cost and energy efficiency intervention potential for the remaining industrial units within each sector, using respective multiplier factors.

For instance, in the cement sector, the intervention options were identified for a large scale cement industry (baseline). The energy efficiency options identified for solid fuel saving were waste heat recovery system and installation of a back filter system; for electrical saving, the measures identified were installation of capacitor bank, application of Variable Frequency Drive, replacement of old V-belt with an efficient belt system, and replacement of old motor with an energy efficient mo-tor.

The total cost of the energy efficiency options thus identified is the total invest-ment potential for a large scale unit. This single unit price is used to extrapolate the investment cost in a medium scale cement industry by using a multiplier fac-tor. These single unit investment costs of the large and medium units are then used to compute total investment energy efficiency intervention potential of 10 large and 14 medium scale cement industries. Through this process, the total investment potential in the cement sector was computed as $ 1.76 million.

Similarly, the investment potential for each industrial sector is calculated. The total investment potential for all ten industrial sectors is summarized in Table 32 below. The tea sector had the highest investment potential ($ 8.06 million), followed by brick ($ 2.51 million), cement ($ 1.76 million), paper and pulp ($ 1.63 million), plastic ($ 1.12 million), rolling mills ($ 0.81 million), dairy ($ 0.79 million), steel structures ($ 0.64 million), food and beverage (breweries/distilleries) ($ 0.24 million), tourism (hotels) ($ 0.23 million), cold storage ($ 0.07 million), and poul-try/feed ($ 0.04 million).

Total investment opportunity in the selected areas is $ 17,924,296. As presented in Table 19, the investment opportunity has been segregated into large, medium and small industries. Total investment opportunity in large scale industries is $ 10,381,252 (58 percent), in medium scale industries is $ 5,025,152 (28 percent) and in small scale industries is $ 2,517,892 (14 percent).

Table 32: Sector-wise Total Investment Potential

SN	Sector and Sub Sectors	Number of Establish ments	Estimated EE Intervention Potential Numbers			Single Unit Investment ($)			Total Investment ($)			Total Investment Sector Wise ($)
			Large	Medium	Small	Large	Medium	Small	Large	Medium	Small	
1	Cement	25	10	14	1	140,284	25,817	-	1,402,844	361,439	0	1,764,283
2	Rolling Mills	17	7	4	0	106,212	17,120	-	743,482	68,482	0	811,964
3	Poultry/ Agribusiness	137	16	46	0	524,646	233,538	3,391	5,083,412	3,812,400		8,895,812
	a. Poultry and Feed	*45*	*0*	*20*	*0*	-	*2,202*	*3,391*	*0*	*44,030*	*0*	*44,030*
	b. Dairy	*39*	*4*	*9*	*0*	*151,542*	*20,543*	-	*606,169*	*184,889*	*0*	*791,058*
	c. Tea	*53*	*12*	*17*	*0*	*373,104*	*210,793*	-	*4,477,243*	*3,583,481*	*0*	*8,060,724*
4	Plastic	152	13	36	0	53,679	11,606	-	697,830	417,802	0	1,115,632
5	Cold Storage	20	0	10	0	-	6,917	-	0	69,173	0	69,173
6	Food and Beverage (breweries/ distilleries)	16	6	2	8	32,145	16,755	1,366	192,869	33,511	10,928	237,308
7	Steel Structures	88	15	27	0	42,086	1,186	-	631,289	32,018	0	638,307
8	Paper and Pulp	46	5	0	0	325,905	-	-	1,629,526	0	0	1,629,526
9	Brick	429	0	0	30	-	-	83,565	0	0	2,506,964	2,506,964
10	Tourism (Hotels)	97	0	15	0	-	15,355	-	0	230,327	0	230,327
	Total	**1,041**	**72**	**154**	**39**				**10,381,252**	**5,025,152**	**2,517,892**	**17,924,296**

Source: Findings from the survey

6

6.2 Barriers to Energy Efficiency and Renewable Energy Promo-tion

Nepal suffers from a lack of external investment, both domestic and foreign. This stems from low domestic savings, a small domestic market, severe shortage of regular and quality power supply, labor problems, frequent trade union strikes, high transport and operating costs, and political instability.

Interviews with various stakeholders (primarily industry personnel, bankers, ener-gy experts, business leaders, and vendors) revealed three major barriers to the promotion of the energy efficiency/renewable energy sector- financing, supportive policy, and other miscellaneous factors. Financing of energy efficien-cy/renewable energy was identified as one of the major barriers by most interviewees; interviews with banks revealed that lack of awareness and inadequate technical knowledge about energy efficiency/renewable energy technologies/projects at their end is a critical barrier.

Additionally, banks focus on larger borrowers and prefer to finance existing clients rather than new ones, thus limiting the expansion of credit facilities to possible new sectors/clients such as the energy efficiency/renewable energy sector. Higher interest rate due to the liquidity crisis facing banks also leads to a limited availability of financing options. Inadequate capital in the industries, due to capital tied up in new plant additions or expansion of the industry, makes investment on energy efficiency/renewable energy technology less affordable and less of a pri-ority. Lack of assistance to industrial units to make energy efficiency proposals bankable were also identified as barriers. Further, cumbersome documentation requirements, bureaucratic hassles and delays in processing loan requests restrict credit access for industrial enterprises.

The Government of Nepal does not have any energy policy or strategy to pro-mote the energy efficiency/renewable energy sector. Lack of energy efficien-cy/renewable energy technologies and a reliable service provider for them in the domestic market has led, to higher imports of low efficiency second hand equip-ment. In addition, lack of fiscal incentives by the government for energy efficien-cy interventions, such as soft loans and subsidies also add to the reluctance of industries to adopting energy efficiency/renewable energy measures. Highly sub-sidized energy pricing policies of the government are also viewed as problems- petroleum products (diesel and kerosene) imported from India are available at a subsidized rate in Nepal, hence luring industrial users into using these energy sources rather than energy efficiency/renewable energy measures.

Apart from the financing and policy barriers, interviews with the stakeholders also identified other barriers to promoting energy efficiency/renewable energy: inade-quate knowledge and awareness of energy efficiency/renewable energy technol-ogies and their benefits among the industrial users; absence of pilot/demonstration projects of energy efficiency/renewable energy technology; inadequate energy efficiency/renewable energy financing due to inadequate marketing and information dissemination of energy efficiency/renewable energy options; and finally, the industrial sector's lack of interest and trust in the studies conducted on energy efficiency/renewable energy sector and lack of participation in Clean Development Mechanisms or energy efficiency programs.

6

The summary of key barriers to energy efficiency/renewable energy promotion, as identified through interviews with the stakeholders, are ranked and presented in Table 33 below:

Table 33 : Barriers to energy efficiency and renewable energy Promotion

S.N.		Barriers
1	**Financing**	1. Inadequate awareness and knowledge about energy efficiency/renewable energy technologies/projects among the banks and financial institutions 2. Preference of the banks to finance existing clients rather than new ones; cumbersome documentation requirements; bureaucratic hassles and delay in processing loan requests 3. Capital tied up in new plant additions/expansion of industry (almost every year)/new product or service, hence, investment on energy efficiency / renewable energy is less of a priority[1] 4. High interest rate at the moment due to liquidity crisis 5. Lack of assistance to industries to make proposals bankable 6. Lack of information about existing financing packages/institutions
2	**Policy**	1. Lack of national energy norms 2. Lack of energy efficiency/renewable energy technologies in the domestic market, specific service provider and its energy labelling 3. Lack of financial incentives by government for energy efficiency interventions 4. Irrational (subsidized) energy pricing policies
3	**Others**	1. Inadequate knowledge and awareness of energy efficiency/renewable energy technologies and benefits among the industrial entrepreneurs 2. Absence of Pilot/demonstration projects of energy efficiency/renewable energy technology for replication/adoption in other industrial units 3. Inadequate marketing and information dissemination onf energy efficiency/renewable energy options/measures 4. Lack of trust in studies conducted on the energy efficiency sector among industrial leaders

[13] Observation and findings from the interviews of the industry personnel

Proposed Financing Mechanisms and Approaches

7

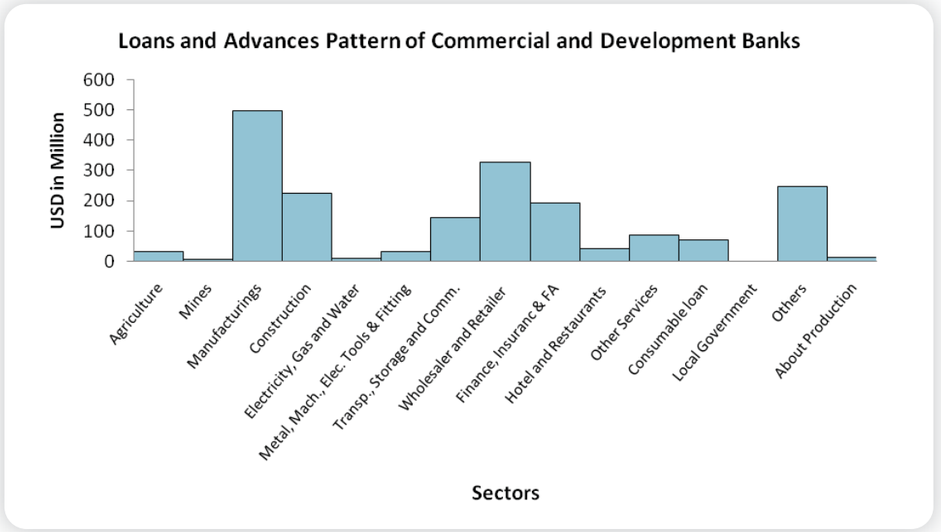
Proposed Financing Mechanisms and Approaches

7.1 Existing Financing Products and Mechanisms

Thanks to the low growth in productive industrial sectors, the majority of lending sectors such as housing, real estate and hire purchase are proving non-productive for the banks. Adverse political-legal, economic, socio-cultural, and technological factors have become a major challenge to the development of investment-friendly projects. The slow growth of government and private sector development projects has reduced economic mobilization in the country. As a result, Nepal is facing a severe Balance of Payment deficit as well as an acute liquidity crisis. The financial plan of many potential investors shows a negative internal rate of return due to high production cost. The current liquidity crisis has increased the cost of funds, although this situation is expected to improve.

Despite this crisis, the banks' largest lending is to the manufacturing sector. Figure 4 shows the sector wise lending pattern of commercial and development banks (Refer Annex 9.1 for details).

Figure 4: Sectoral Loans and Advances of Commercial and Development Banks



Source: Nepal Rastra Bank, 2010a

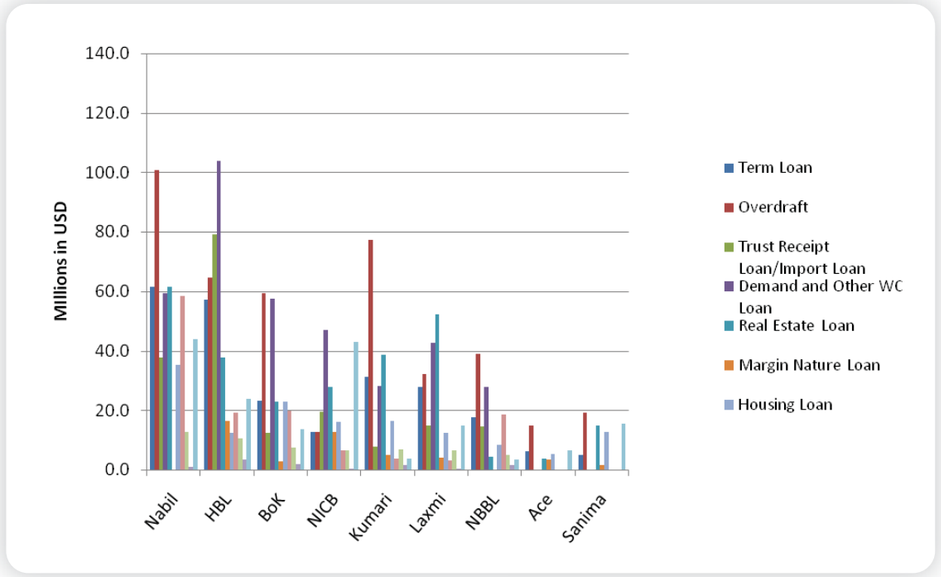
7

The study team learned that commercial and development banks have applied many financial mechanisms to provide loans on the existing financing products. The major financial mechanisms used by Nepalese banks and financial institu-tions are corporate financing, consortium financing and project finance. Interviews with the banks revealed that about 25 percent of the banks' loans are granted for trading purposes, about 2 percent for project finance, and the rest for corporate finance.

The product-wise loans and advances of the sampled banks, as of mid-January 2010, are presented in Figure 4. It shows 11 types of loan disbursement products for the 11 financial institutions selected for this study- term loan, overdraft, de-mand loan, other working capital , bridge gap loan, real estate loan, margin nature loan, housing loan, loan for trading purpose letter of credit (non-funded), bank guarantee, hire purchase loan, deprived sector loan, bills purchased, and other product loans.

Among the 11 financial institutions, NABIL had the highest amount of term loan, overdraft, real estate loan, housing loan, hire purchase loan, deprived sector loan and other product loans. The detailed table is presented in Annex 9.2. Product wise loan and advances for Commerz and Trust Bank and Clean Energy Devel-opment Bank were not available, however, the total amount of loans and ad-vances for CEDBL was $ 41.2 million.

Figure 5: Product-wise Loans and Advances of Sampled Banks



Source: NRB 2010a

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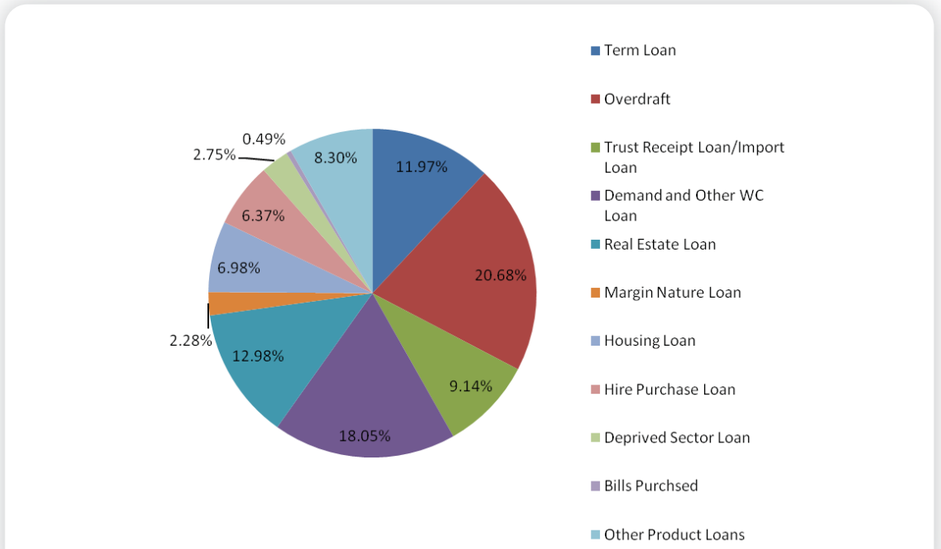
An analysis of the total loan products of banks selected for the study, except for CTBN and CEDBL, showed that the highest amount of loan granted by banks is overdraft (20.68 percent); followed by demand and other WC loan (18.05 percent), real estate (12.98 percent), term loan (11.97 percent), trust receipt loan/import loan (9.14 percent), other product loans (8.3percent), and housing loan (6.98 percent) (Refer Figure 6). Term loan and capital loan were granted primarily for the manufacturing sector.

Figure 6: Loan Products of Selected Banks



Source: NRB 2010a

7.2 Proposed Financing Mechanism

An analysis of the total loan products of banks selected for the study, except for CTBN and CEDBL, showed that the highest amount of loan granted by banks is overdraft (20.68 percent); followed by demand and other WC loan (18.05 percent), real estate (12.98 percent), term loan (11.97 percent), trust receipt loan/import loan (9.14 percent), other product loans (8.3percent), and housing loan (6.98 percent) (Refer Figure 6). Term loan and capital loan were granted primarily for the manufacturing sector.

a) Corporate Financing/Consortium Financing

Calculations show that the tentative investment requirement for the selected sec-tors and sub-sectors is $ 17.92 million. Proportions of the amounts in different scenarios (financing with

debt-equity ratio of 50:50, 60:40, and 70:30) are pre-sented in Table 34 below. Term loans might be appropriate for this investment requirement because when a company goes on renewable energy/energy effi-ciency intervention options, it will save regular energy cost which can be used to repay loan as per loan-amortization schedule. This is a very common financing product in Nepal and practiced by most of the financial institutions in different sectors. This mechanism is suitable for financing plants and equipment for the upgradation or modernization of industries for low cost/no cost, retrofit as well as high cost interventions in all industrial sectors.

As per the regulation of the central bank, banks can lend only 25 percent of their loan portfolio under the Single Obligatory Limit (SOL), so many big projects are now being financed through consortium financing in Nepal. Most of the prominent banks have adopted consortium financing to invest in large projects such as hy-dropower, rolling mills and cement where large debt capital is needed. Table 34 shows the different ratios and options:

Table 34: Proposed Financing Mechanisms for Energy Efficiency/Renewable Energy Intervention Options

Options	Investment Need ($ in millions)	Ratios		Financing ($ in millions)	
		Debt	Equity	Debt	Equity
Option 1	**17.92**	50%	50%	8.96	8.96
Option 2	**17.92**	60%	40%	10.75	7.17
Option 3	**17.92**	70%	30%	12.55	5.37

b) Project Finance

Banks in Nepal have recently started adopting this financing modality. This mechanism is suitable for projects with high investment cost. Hence, it is suitable for cement, rolling mills, steel structures, and tourism (hotels) sectors. Most of the hydropower financing comes under this mechanism where viability, project collateral and cash flow of the project are the main basis for lending. With the establishment of a guarantee fund, limited resource project finance could be adopted for promotion of energy efficiency interventions.

c) Revolving Fund

Revolving fund is another mechanism which is appropriate for all industrial sectors for energy-efficiency intervention. Many industry leaders are still not committed and confident to invest additional investment only in energy efficiency/renewable energy options. One revolving fund could trigger the sector and can be used by most potential industries one by one, thus creating a demonstration effect. Further, this mechanism would help cover the perceived risk d encourage new players to invest in energy efficiency/renewable energy technologies.

d) Guarantee Fund

Guaranteeing the loan of financial institutions by a third party is a reliable and effective mechanism to encourage the industrial sector to invest in sustainable energy interventions. Winrock International has promoted this financing mechanism in the past to bring electric vehicles (EVs) and establish Rural Information Communication Centres. These are two successful case studies in Nepal to support the loan guarantee mechanism. One of the initiatives of IFC in China, "Risk sharing guarantees in China with Industrial Bank," has also shown the positive impact of such a mechanism. This mechanism has proved to be successful in new sectors such as EVs (Refer Case IV) and Information and Communication Technology. Thus, it is appropriate for those sectors or technologies where banks have not yet invested.

Case IV: Nepal Electric Vehicle Loan Fund Supports Women Entrepreneurs and Achieves 100 percent Repayment

While implementing the Kathmandu Electric Vehicle Alliance (KEVA) project in Nepal, Winrock staff members were approached by women entrepreneurs in need of a financing mechanism that would enable them to purchase and operate electric vehicles (EVs), a common form of public transportation in Kathmandu.

Through an internal grant provided by Winrock's Innovation Investment Program, KEVA partnered with venture capital firm Vibor to develop a financing mechanism to provide loans to women entrepreneurs to purchase their own EVs. Winrock facilitated the loan approval through interactions with a commercial bank, established the agreement between the charging station and the bank, organized interaction with women entrepreneurs to disseminate information on the program, and helped the women successfully receive their loan to buy EVs.

To mitigate the risk of loan defaults, Winrock established a guarantee fund with the Bank of Kathmandu (BoK). Winrock learned that the total guarantee fund would be returned because there had been no defaulters. Based on this success, BoK and a local charging station have extended loans to 20 additional women without the need for a guarantee fund. KEVA has improved the income of 20 women entrepreneurs and an additional 20 EV entrepreneurs, provided banks with experience in non-traditional lending sectors, and reduced greenhouse gas emissions from the public transport sector in Kathmandu.

e) Cluster Financing

Cluster financing or bundling the sector in a cluster seems to incur less administration cost and hassle for investors in the industries. Likeminded, different-sized industries in an area can be bundled together so that small and large industries both can benefit from technical and advisory services together. This is one of the best practice models in India implemented by the State Bank of India and Small Industries Development Bank of India (Money Matters, International Energy Agency). The tea and poultry industries in Nepal are primarily concentrated in a certain area and therefore have the potential for cluster financing; tea industries/processing units are concentrated

[14] Mitigating risk to spark private investments in energy efficiency, International Energy Agency

in the eastern region of Nepal (Ilam and Jhapa area), and poultry industries are concentrated in central region (mainly Chitwan area). There are also a range of industries located in a single industrial corridor.

f) Quasi Equity Financing

Quasi Equity Financing is suitable for all high investment sectors. Hence, IFC should consider setting up quasi equity financing mechanism, tol encourage investment by industries. Therefore based on the interviews with financial institutions and industries, the study recommends a combination of a financial tool and technical advisory services for the first batch of projects. These projects will have a demonstration effect and help create champions of energy efficiency projects in selected financial institutes and industries.

g) ESCO Financing

One of the financing mechanisms used widely across the world is Energy Services Company (ESCO) financing. ESCO is a business that develops, installs, and arranges financing for projects designed to improve the energy efficiency and maintenance costs for facilities. ESCOs guarantees achieving at least a specified amount of energy in the energy efficiency projects they implement. Principal services offered by ESCOs include a) designing energy efficiency projects; b) arranging financing for energy efficiency projects developed by the ESCO; c) installing and maintaining energy efficiency equipment associated with the projects; d) monitoring and verifying energy savings. In this process ESCOs assume the performance risk related to guarantee of energy savings. The facility owner pays a certain amount per month upon implementation of projects by ESCOs. However, due to the lack of local service providers and donor-funded capacity building for energy management services, ESCO mechanism is not currently in practice in Nepal. Therefore until Nepal develops a mature market of energy service providers, ESCOs financing mechanism may not be suitable.

7.3 Technical Assistance Needs and Advisory Services

During the course of this study, meetings with financial institutions and industry leaders revealed the need for some successful demonstrative/pilot projects in the area of energy efficiency. In Nepal, most of the industry leaders view energy efficiency initiatives as being donor-driven. While this may be true to an extent, there is also evidence of energy efficiency initiatives taken up by industries themselves. Therefore, a combination of technical advisory and suitable financing mechanism could help strengthen the capacity of financial institutions for sustainable energy financing.

This study recommends that IFC help to organize a few leading banks into a consortium to set up debt financing facility in the areas of energy efficiency . The consortium will receive technical advisory support to help evaluate the first batch of loan requests for energy efficiency financing. The technical advisory services should evaluate the merits of cluster financing to help reduce the transaction cost of processing the loan. To mitigate the risk of the energy financing loans, IFC

Sustainable Energy Finance Market Study
for Financial Sector in Nepal

7

should establish a guarantee fund mechanism or a revolving fund mechanism for the consortium partners.

Most of the banks and financial institutions of Nepal are investing in conventional products in line with the central bank's regulation. The energy efficiency/renewable energy sector is relatively new for all banks and financial institutions. Hence, it is only a matter of time that they gain confidence about financing energy efficiency/renewable energy projects. In addition, there are no mandatory provisions for financing sustainable energy projects in the country.

If initiatives were put in place to provide assistance to banks to create energy efficiency/renewable energy investment units, develop specialized loan products for the sector, and trained bank personnel in sustainable energy financing, then the investment situation could be improved significantly.

A case in point is that of a B class development bank which established a separate energy department along with technical manpower. They are committed to investing in the hydropower sector, and have already financed many hydropower projects, established an equity fund for hydropower financing and are leading a consortium financing for hydropower. Similarly, another B class bank is also financing and leading hydropower financing, by setting up an affiliate entity to carry out due diligence, and arming itself technically by way of hydropower specialists.

In addition to the initial technical support to the financial institutions, IFC should facilitate a few demonstration projects from the industry. For this, IFC should engage industry experts for selected high-potential industries to develop energy efficiency projects. The technical advisory services to the industry will build the confidence of the industry to invest in the proposed interventions. For the first few initiatives, it is essential that the bankers and industry leaders are convinced that investments in energy efficiency/renewable energy interventions will provide acceptable returns. Hence, we recommend the following technical assistance and advisory services:

- Orientation and walk-through audits of energy efficiency/renewable energy initiatives for financial institutions and industry leaders to increase their knowledge base of the sector
- Energy management training for government officials/Nepal Electricity Authority
- Training local consultants in energy auditing with regional consultants
- Capacity building training to private companies for energy management activities
- Energy management intervention with detailed energy audits in selected industrial corridors
- Pilot demonstration of different interventions of energy efficiency/renewable energy options in energy-intensive industrial sectors
- Cost and benefit analysis of 'before' and 'after' interventions to the industry leaders
- Grant assistance for a few initial demonstration projects
- Sector-wise study of each industry to establish baseline data and information to facilitate banks for energy efficiency/renewable energy financing
- Assist banks to develop energy efficiency/renewable energy loan products to increase their confidence in this sector and minimize risk

Conclusion and Recommendations

8 Conclusion and Recommendations

Clearly, energy efficiency/renewable energy interventions have a significant potential to save energy and money in all the industries selected. Most of the energy options identified during the study were of the retrofit type rather than that of installing new technologies. A total investment potential of $ 17.92 million has been indentified in the selected areas. Banks were willing to finance energy efficiency/renewable energy/modernization options in the industrial areas, which is encouraging. Based on the study, the following recommendations have been made so far:

- Demonstration of sustainable energy success stories and identification of potential application in monetary terms. This could be a direct and apparent means to encourage business leaders to finance energy efficiency/renewable energy interventions, as they are currently unaware of environmental and economic benefits of the same.

- Maintain minimum rate of interest (soft loans) and provide long-term financing for industrial sectors for energy efficiency/renewable energy installations.

- Educate/train the plant operators/managers to gain technical understanding of efficient energy usage, efficient technology, renewable energy projects and Clean Development Mechanism opportunities.

- At present there are neither enforced policies/regulations, nor incentives for industries to implement these energy interventions. The government should make energy efficiency audits mandatory for all industries in Nepal, coupled with fiscal incentives.

- A thorough review of the energy efficiency policy and legislation is recommended.

- Encourage active marketing of energy efficiency technologies and equipment with custom tax concession on the import of efficient and pollution-free equipment. Also, tax benefits could have better promotional value.

- Develop a strong monitoring mechanism, after policy implementation, for careful inspection of energy losses in the industries.

- The government should include regulatory measures, such as energy conservation laws, prescribing mandatory or voluntary minimum measures for efficient energy management in industries, and minimum energy efficiency standards. Another tool to promote energy efficiency without mandatory regulations is "voluntary agreements". Furthermore, emission controls or environmental standards may also help "enforce" some forms of energy efficiency investments.

Sustainable Energy Finance Market Study
for Financial Sector in Nepal

8

- It is revealing that the tea estates in Nepal consume higher energy than steel industries. Hence, to aid their power requirement, site-specific power generation units such as micro/small hydropower plants are recommended.

- The Clean Development Mechanism is important for improving the viability of greenhouse gas emission reduction projects through certified emission reduction credits from energy efficiency investments. This could be of significant benefit to the industrial sector.

Study Limitations

Study Limitations

1. Authenticity of the data

   - o No official / published data available for the industrial sector's energy consumption
   - o Reliance on verbal information provided by the company / plant manager

2. Due to electricity / power interruption, power consumption is high but the production level is low compared to the specific consumption of energy

3. Due to time constraint and the large sample size, there was limited time for data analysis

4. Lack of segregated data for the selected industrial sectors

5. Department of Industry provided data on the number of establishments as per the registration and not the number of industries actually in operation. Most of this data was obtained from the Central Bureau of Statistics data book of FY 2006-07.

6. Instead of getting the actual cost for potential energy efficiency intervention from quotations for the equipment/machinery, estimates were gathered from the local suppliers The possible interventions for each sector have been identified based on walk-through visit of the industries

7. Respondents were reluctant to share the data. For example, one steel industry establishment refused to share their energy consumption data

8. Difficulty in getting appointments for the interview - the team had to coordinate with the head office in Kathmandu as well as the industrial corridor. For instance, one of the leading food and beverage industry establishments refused to share information without permission from their corporate office

9. Plant manager and technical person did not have updated data and information, so few persons from administration had to be gathered for updated information

10. Lack of technical knowledge (energy audit, energy saving) among plant operators/ managers

11. Travel time was a limitation to conducting more interviews within the specific time allocated. For example, the visit to one of the cement industries took 3 to 4 hours travel time from the main industrial corridor

12. Interviews with the industrial units were possible only with the help and correspondence from the Chambers of Industries

13. Tight schedule of study duration

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Annex 1

APPROACH AND METHODOLOGY

The principal aspect of this assignment was to estimate the extent of energy sav-ings potential using energy efficiency improvement measures and renewable energy technologies in the industrial units. The second aspect was to estimate investment needed to achieve these energy savings possibilities. Energy saving potential is the extent to which energy (in all forms – electricity, thermal energy derived from HSD, FO, etc.) can be saved using a) energy efficiency improve-ment measures and b) renewable energy sources in an industrial sector under review. The study team estimated the "realizable potential" (which is a realistic estimate).

The team collected all data on pre-selected industry sectors (a. large, b. medium, and c. small scale) available through secondary sources of information as well as sector-specific data. Data collected, inter-alia, includes following parameters:

- Installed capacity
- Average production (capacity utilization)
- Average investment in plant and machinery
- Applicable energy efficiency improvement measures
- Scope of applying renewable energy
- Average investment needed for implementing energy efficiency measures and renewable energy for each sector

The secondary data thus collected, was supplemented by data obtained through primary interviews with the industrial units, and various other stakeholders includ-ing government institutions, banks and financial institutions, business lead-ers/representatives of Chambers and Industry, research institutions/universities, consulting companies, engineering firms/turn-key contractors/experts, energy efficiency and renewable energy equipment vendors and sector experts of Nepal. Structured questionnaires were designed for each stakeholder (Refer Annex 2) and were used during interviews.

The study team scheduled interviews with various stakeholder organizations as per their availability. Most of the corporate offices of industries, associations, government organizations, and banks/financial institutions are located in the capi-tal; hence, it was relatively easy to contact these. However, travelling to the pro-duction houses of the selected industrial sectors for technical data collection, within the given time frame, was a challenge as most of them are located outside Kathmandu, in the Terai region. These interviews provided an overview of the sector and helped the team understand broad energy efficiency and renewable energy possibilities, energy consumption patterns and investment needs in the selected industrial sectors. Hence, interviews with primary contacts was given due priority, as statistical analysis was not appropriate for this study.

The following aspects were given prime importance:

1. Installed capacity and capacity utilization for each of the sectors under re-view: The team was able to get data on 3 broad segments (i) large scale companies, (ii) medium scale and (iii) small scale.

2. Other details such as fuel/energy (electricity, coal, etc.) consumption for each of the 10 selected sectors were gathered through secondary data and verified/moderated through primary interviews.

3. The other data included level of technology present, new technology availa-ble and cost of such technology options. The team was able to get these de-tails for almost all the sectors. Industry associations provided overall distribu-tion of plants/industrial units.

4. Possibilities for using renewable energy sources in the industrial sector was discussed with industry leaders and engineering consultants.

5. Estimates of potential for energy savings using "energy efficiency measures" included the following main components: a) efficiency improvement measures; b) replacement of old plant and machinery and modifica-tion/change in the manufacturing process; c) retrofit select equipment. Simi-larly, energy saving potential using renewable energy options in industrial sectors was also estimated (based on the data obtained through interviews and from secondary sources such as research papers). This estimation was based on empirical calculations of the energy/fuel consumption before and after the energy efficiency/renewable energy intervention. The team made informed assumptions and assessed the "realistic potential" for energy saving and the use of renewable energy sources for these sectors through inter-views of the industry leaders, meetings with the Chamber of Commerce, as-sociations of industry sectors, etc.

6. Data on the ongoing financing activities of the selected banks and financial institutions was also collected, including information on energy efficien-cy/renewable energy financing.

Supporting notes on the Methodology:

The study team analyzed the data and prepared estimates of energy saving pos-sibilities (quantities) for each sector as a result of energy efficiency measures and use of renewable energy. Based on these estimates, total investment needed to achieve these energy savings was estimated. The team made certain assump-tions while arriving at the estimates of investment potential (as explained in sec-tion 4.4). The study team also presented selected financing mechanisms which could be used by banks for lending to energy efficiency and/or renewable energy projects.

Annex 2

QUESTIONNAIRES

Annex 2.1: Instrument for the Plant Manager/Technical Director:

General Information:

Name of the Industry	
Location	
Construction &Operation Year	
Name and Designation	

Questions:

1.	Plant Information:			
a.	What is the plant installation date (year)?			
b.	What are the major equipment manufacturing dates?			
c.	Who are the suppliers of the major equipment?			
2.	Production Data:			
	Types of Products	Capacity of Production	Actual Production	Remark
3.	What are the main stages associated with the production phase?			
4.	Running Time:			
a.	What are the running hours/day?			
b.	What are the running days/year?			
5.	Water Usage:			
a.	What is the total water bill (cost of the water) per month / year?			
b.	What is the price rate of water, thus consumed?			
c.	Do you use any water pump/s? If yes, what is the capacity of the water pump/s?			
6.	Electricity Usage:			
a.	What is your maximum demand for electricity?			
	i. What is the demand charge?			
	ii. Have you been using Time of Day (TOD) meter?			

b.	What is the quality (voltage) and availability of the power supply from NEA?
7.	What are the fuels you have been using?
a.	
b.	What do you use for the back-up power?
8.	Are you familiar with energy and cleaner production audits? If "yes" please scale it based on the discussion?
9.	Preventive measures:
a.	What type of preventive maintenance and measures have you been using?
b.	How frequent have you been using preventive maintenance and measures?
10.	Are there any production interruptions due to machinery breakdown?
11.	Energy Efficiency/Renewable Energy/Modernization:
a.	Was the plant modernized (technology upgrade) recently? If so then when was it carried out?
b.	Have you used any renewable energy/energy efficiency technology?

	Renewable Energy:	Usage	Fiscal Year	Investment cost	Energy saving	Equipment Supplier
	Renewable Energy Type					
	Biogas					
	Boiler					
	Biomass Gasifier					
	Steam Turbine					
	Solar thermal					

	Energy Efficiency:	Usage	Fiscal Year	Investment cost	Energy saving	Equipment Supplier
	Energy efficiency Type					
	Waste Heat Recovery					
	System					
	Energy efficiency Motor					
	Energy efficiency Drive System					
	Technology Change					
	Instrumentation (e.g. flow-meter for furnace)					
	Other if any					

12	Do you have effluent treatment plant in your establishment? If yes, which are the main effluents?
13.	Do you recover water (or any other chemicals) after treatment? Do you have facilities for tertiary treatment?
14.	Can you please comment on your plans for effluent treatment area? What are the expected time span / horizon of implementation of these plans?
15.	How frequent does the government conduct the effluent and emission monitoring?
16.	Can you please indicate the industry norms for energy consumption per ton of production? How do we compare with those norms?
a.	Energy Consumption Norms
b.	Fuel Use Norms
17.	Have you been implementing any Quality Management System (QMS) or Environmental Management System (EMS)?

Sustainable Energy Finance Market Study
for Financial Sector in Nepal

Annex 2.2: Instrument for Finance Manager/Director of the Industry

General Information:

Name	
Designation	
Start Year	

Questions:

1.	Can you please indicate total investment in plant and machinery (excluding land price) made at the time of commencement of business?
2.	What will be investment needed if the same plant is to be set up at today's cost?
3.	Can you indicate the total investment you made towards energy efficiency / renewable energy project that was implemented? (Please refer to answer the Q11).
4.	How was the energy efficiency / renewable energy project financed? (Totally by your company out of cash accruals? OR you took equipment loan for the same?)
5.	Did your company receive any incentives (cash incentives OR interest rate discount) for implementing renewable energy or energy efficiency project?
6.	Are you interested to invest in renewable energy/energy efficiency projects or modernization in future?
7.	If you are interested, what would be approximate investment? (Can you please provide project wise break up?)
8.	If "no", what may be the reason behind it? *(eg. lack of knowledge, less IRR, high initial invest, lack of market, ok with present situation)*

Annex 2.3: Instrument for Owner/CEO/MD of the Industry

General Information:

Name	
Designation	
Start Year	

Questions:

1.	Can you please tell us year of establishment this unit / your business? What according to you are the main challenges in respect of energy / electricity consumption?
2.	Would you invest in renewable energy and / or energy efficiency to improve your overall profitability? Rank: 1-Very Low.....5-Very High:
3	Would you invest in renewable energy and / or energy efficiency to move towards sustainability? Rank: 1-Very Low.....5-Very High
4.	Can you please provide your comments on the outlook of the sector? Do you expect investment in the sector? (based on discussion)
5.	Do you expect rise in installed capacity and hence competition?
	Rise in installed Capacity (Rank: 1- Very Low.....5- Very High) / Rise in Competition (Rank: 1-Very Low.....5-Very High)
6.	Do you think you can increase competitiveness? Do you think energy efficiency / renewable energy can lead to increase in competitiveness?
7.	What are the incentives/policy intervention do you need from the government for investment in energy efficiency/renewable energy?

Annex 2.4: Instrument for the Consultant / Consulting Companies:

General Information:

Name of the Consultant/ Consulting Companies	
Affiliation	
Start Year	

Questions:

1.	What is your professional background?
2.	Did you have any training on Energy Audit? If "yes" who provided the Energy Audit training? *(eg. IFC, CEI, Teri)*
3	Have you conducted any energy audits?
a.	If "Yes"/NO
	i. For how many years have you conducted energy audits?
	ii. Who were the sponsors for Energy Audit?
	iii. Was it for the industries, commercial complex or others?
	iv. What type of industrial sector did you do audit for?
4.	Do you have any follow up regarding the Energy Audit options implementation?
	If "yes", what options, thus suggested, are being implemented?

Name of the Equipment	Rank (1-Very low.....5-Very high)
Boilers	
Transformer	
Furnace	
Gasifier	
Chiller	
Compressor	
Others	

5.	Did you establish any linkage between Energy Efficiency Audit and Renewable Energy Technologies?
6.	Are you familiar with Energy Efficiency, Environment, and Renewable Energy Technology policies?
7.	What are the potential sectors for energy efficiency/renewable energy investments in the industries?
8.	What is your expectation for Energy Audit, Cleaner Production (CP) audits, and Renewable Energy Technology intervention within the industry?

	Rank (1-Very low.....5-Very High)
Financial saving	
Environmental saving	
Energy saving	
Others	

9.	Do you have any equipment for energy audits and environmental monitoring?
10.	Are you familiar with Energy Service Companies (ESCos) concept?
11.	Did you have any international exposure on energy audit (any international audit experience)?
12.	Most of the environmental consultancy/individual consultants are engaged in EIA/energy efficiency but not in Energy audit. In your opinion, what is the logic or barrier behind it? Do you have any suggestion to improve the condition?
13.	Do you need any training to improve this sector from energy audits perspective for energy efficiency intervention?

Annex 2.5: Instrument for Energy Efficiency/Renewable Energy Equipment Vendors

General Information:

Name of the Company	
Affiliation	
Start Year	

Questions:

1.	Can you please inform us all the energy efficiency and / or equipment (type and number) that you are supplying to industries? *(eg. energy efficiency motors, capacitors bank)*
2.	What has been average annual number of units sales (or in terms of average annual sales turnover) of these equipment?
3.	Which is the country of origin of energy efficiency / renewable energy equipment? *(eg. China, Japan, USA)*
4.	What has been the trend in sales (rate of growth of market)? *(eg. increasing, decreasing or steady)*
5.	What is the landed price of energy efficiency/renewable energy equipment? What is the import duty? Can you please provide us with breakup of cost of including elements such as FOB price, freight, Insurance, CIF price, duty, other local taxes and final price?
6.	Have you talked to any bank for tie-up for sales of your equipment?
7.	What according to you is the principal barrier to adopting energy efficiency or renewable energy technology by end user industries? *(eg. awareness, investments, paybacks)*
8.	Can you please indicate main problems you face as vendor of energy efficiency / renewable energy equipment?

Annex 2.6: Instrument for Banks and Financial Institutions

General Information:

Name of the Bank/Financial Institution	
Name and Designation of the Interviewee/s	
Start Year	

Questions:

1.	Are you aware of modernization (energy efficiency/renewable energy) in industries? Rank it: Based on Discussion Very Low:1 Low:2 Moderate:3 High: 4 Very High:5
2.	Can you please indicate sectors which have been borrowing more towards modernization / technology upgrade of plants?
3.	Please provide information on the nature of assistance (e.g. Term Loan, Bridge Loans, Equipment Finance, Working Capital etc.)
4.	Have you provided loans to industrial sector for energy efficiency and / or renewable energy projects / equipment procurement? If Yes average size of loan for modernization projects?
5.	Indicate the credit assessment criteria adopted for capital investment and working capital loans for energy efficiency/renewable energy.
6.	What is the collateral policy of Bank for modernization projects?
7.	Indicate the risk mitigation strategies/measures adopted by your bank.
8.	Can you please indicate whether there is adequate awareness about energy efficiency and renewable energy among industrial users? Very high: 5, High: 4, Moderate: 3, Low: 2, Very Low: 1
9.	Please do indicate if your bank / institution are in the process of accessing specialized fund from bilateral / multilateral institution? May be confidential so no need to mention names of institutions

10.	Have you, in the past, participated in any donor assisted program on renewable energy or energy efficiency project? If yes, can you please provide some details?
11.	Can you please indicate nature of efforts undertaken by your bank to increase pipeline of projects in energy efficiency and renewable energy segments? What according to you is the most effective way to communicate with existing / potential borrowers?
12.	Can you please indicate your views on incentives needed for these segments (renewable energy and energy efficiency) as applicable to industrial sector? (Please note that we are not addressing independent power producers from renewable energy)
13.	Have you provided loans to energy efficiency and / or renewable energy equipment supplier?
14	Can you please indicate average size of total project cost and loan for new projects in the following sectors? (Please try to get this data for all the sectors under consideration of the study: Submit format and collect the information later)

Annex 3

LIST OF MEETINGS CONDUCTED DURING STUDY

Annex 3.1: Industrial Units

S.N.	Name of the Organization	Respondent Name/Designation	Email/Telephone
	CEMENT		
1	Maruti Cements Ltd.	Mr. Anuj Rathi , Executive Director	Ph: 021-524814 info@maruticement.com
2	Gorakhkali Cement Udhyog Pvt. Ltd	Mr. N.P. Sahu, General Manager	pcon@wlink.com.np
3	Bishwakarma Cement Pvt. Ltd.		
4	Shalimar Cement Pvt. Ltd,	Mr. Girdhari Agrawal, CEO	
5	Manasa Cement		
6	Shuva Shree Jagdamba Cement Mills Pvt. Ltd.	Mr. Alok Agrawal, Manager	
7	Mittal Cement Industry		
	ROLLING MILLS		
8	Himal Iron & Steel Pvt. Ltd	Er. Gopal Shrestha, M.Tech, IIT,Chief-Central Office, Parwanipur	Ph: 051-580081 himalpurchase@wlink.com.np
9	Ashok Steel Industries Pvt. Ltd	Mr. H.D. Roy, Production Manager Mr. G.S. Srivastava, Manager (PSNL & Admin)	Ph: 977-53-520044 hd_roy@rediff.com; asisteel-jpr@ntc.net.np; ashoksteeljpr_brj@wlink.com.np
10	Pashupati Iron & Steel Pvt. Ltd	Mr. Ashok Murarka, CEO	Ph: 021-527275 murarka_brt@wlink.com.np
11	Saakha Steel Industries Pvt. Ltd	Mr. Prem B.Shrestha, Administrative Officer	Ph: 01-4434921 sakhason@mos.com.np
12	Hama Iron & Steel Industries Pvt. Ltd.	Mr. Tej Prasad Jaisi, Plant Manager	hamasteel@info.com.np
13	Jagadamba Steel	Mr. Sulav Agrawal, Executive Director	Ph: 977-1-4111822, 4111897 sulav@mos.com.np
	POULTRY/AGRIBUSINESS		
14	Valley Poultry Pvt. Ltd.	Dr. KB Bohara, Managing Director	vpoultry@wlink.com.np
15	Pancharatna Groups of Poultry Industries	Mr. Til Chandra Bhattarai, Managing Director	
16	Lekali Poultry Farm	Mr. Krishna Bolakhe, Proprietor	
17	Pashupati Poultry Breeding Farm	Mr. Kuldip Shrestha	
18	Pro Bio-Tech Industries Pvt. Ltd.	Mr. Pradyot Mandal, GM – Works Dr. Dinesh Gautam, CTO	pbtfact@nimbudnepal.com ; dinesh.gautam@nimbusnepal.com
19	Anmol Feed Industries	Mr. Bohara	
20	Om Chabo Biro Feed Industries Pvt. Ltd.	Mr. Vijay Manandhar, Technical Officer	
21	Modern Tea Industries Pvt. Ltd.	Mr. Manoj Shrestha, Executive Director	Ph-023-522455 manoj_shrestha39@yahoo.com
22	Nepal Small Tea Producers Ltd.	Mr. Dilip Rai, Chairman	Ph: 00977-27-540 227 sakurachiya@hotmail.com
23	Kanyam Tea Estate	Mr. Purna Dhakal, Product Manager	
24	Jagdamba Tea Processing Pvt. Ltd;	Mr. Bhakti Adhikari, Director	jagadambatea@hotmail.com; bhakti@ntc.net.np

25	Danfe Tea Industry	Mr. Chandi Parajuli, President	Ph: 977-23-456435
26	Parajuli Tea Industry	Mr. Chandi Parajuli, President	Ph: 977-23-456435
27	Gorkha Tea State	Dr. Uday Chapagain, Director	
28	Nepal Dairy Pvt. Ltd.	Mr. Arniko Rajbhandary, Chemical Engineer	Ph: 4220674 ndicecream@wlink.com.np
	PLASTIC		
29	M.M. Plastic Udyog Pvt. Ltd.	Mr. Keshav	
30	Plastic Industries Pvt. Ltd.	Jay Krishna Lama	Balaju Industrial district, Balaju Kathmandu
	COLD STORAGE		
31	Ram Janaki Cold Store		
	FOOD AND BEVERAGE (BREWERIES / DISTILLERIES)		
32	Gorkha Brewery, Nawalparasi	Mr. Tanka Kafle,	info@gorkhabrewery.com
33	Himalayan Distillery Ltd.	Mr. Sanjay Kumar Singh, Maintenance Manager; Mr. Harish Chandra Kandel, Asst. Manager (Admin)	Ph: 5522010 sanjayhdl@rediffmail.com; hdibrj@wlink.com.np; harishkandel@yahoo.com
34	Rijal Tashi Industries Pvt. Ltd	Mr. Bishnu Neupane , HOD (Purchase)	Ph: 01-4470558 ritash_ita@wlink.com.np
35	Kwality Biscuits Industries Pvt. Ltd.	Mr. Ghanashyam Kabra	
36	Dabur Nepal Pvt. Ltd.	Mr. Naveen Kumar Shrestha, Head-HR	Ph: 977-51-5800037 naweens@dabur.com.np
	STEEL STRUCTURE		
37	Bhagawati Steel Industries Pvt. Ltd	Mr. Vikas Sharma, General Manager; Mr. B.K. Jha, Manager, Mr. Narayan Kafle, Manager Production	Ph: 051-524894 vikas@msgroup.com.np ; bst@ntc.net.np; bstproduction@msgroup.com.np
38	Rajesh Metal Crafts Nepal	Matadin Verma, General Manager	rmcbrj@mail.com ; rmciip@gmail.com
39	Pioneers Electro cables Private Limited	Mr. Birendra Dev, Senior Engineer	Ph: 977-21-530935 pec@sardaonline.com
40	Mainawati Steel Industries Pvt. Ltd.	Mr. Durga Prasad Singh, General Manager, Er. T.C. Gupta, Executive Director	Ph: 977-25-540404 mainawati_duhabi@nns.com.np; mainawati_brt@wlink.com.np global@wlink.com.np
41	Hulas Wire Industries Limited	Mr. Mukesh Kothari, Mr. Sant Shrestha, Electrical In-Charge	Ph:021-420117hwi@golchha.com; santshrestha@rediffmail.com
42	Aarti Strips Pvt. LTD	Mr. Roshit Unnithan, CEO	Ph: 00977-21-421261 roshit@aartistrips.com.np
43	Hulas Steel Industry	Mr. Arvind Kumar Jha, Plant Manager	
	PAPER AND PULP		

44	Shree Bhrikuti Pulp and Paper Nepal Ltd.	Dr. J.P. Semwal, Managing Director Mr. A.K. Thakur, General Manager (Technical) Mr. K.B. Sharma, Vice President Mr. Sanjeev Shrivastava, Electrical Manager	Ph: 056-501006 bhrikuti@wlink.com.np drsemwal@gmail.com
45	Arvind Pulp and Paper Mills	Mr. Jagadish	
	BRICK INDUSTRY		
46	Janaki Itta, Charpane,	Mr. Jagannath Khanal	
47	Tri-Shakti Itta Bhatta Udhyog Pvt. Ltd	Mr. Rajendra Maharjan, Director	Ph:977-1-5250576 shb@enet.com.np
48	Laxmi Itta Udyog		
	TOURISM (HOTELS)		
49	Hotel De l' Annapurna	Mr. Anjan Badgami, Chief Engineer	anjan.badgami@annapurna.com.np
50	Hotel Shangrila	Mr. Khalid K. Ansari, Chief Engineer	Ph: 4412999 ce@hotelshangrila.com
51	Soaltee Crowne Plaza Hotel	Mr. Rajan Pradhan, Director Business Development and Projects, Mr. Sailesh Kumar Jha, Chief Engineer	Ph: 4273999 rpradhan@soaltee.com.np; shailesh.jha@scp.com.np

Annex 3.2: Bank and Financial Institutions

S.N.	Name of the Organization	Respondent Name/Designation	Email/Telephone
1	Laxmi Bank Limited	Mr. Nirmal Dahal, Head-Credit Risk	Ph: 4444684 nirmal.dahal@laxmibank.com
2	Nabil Bank Ltd.	Mr. Rabindra Tuladhar, Relationship Manager Mr. Sanjay Nepal, Senior Relationship Manager, Corporate Banking; Mr. Deepak Shrestha, Head-Infrastructure and Project Financing Ms. Namita Dixit, Sr. Relationship Manager-Infrastructure and Project Financing	Ph: 4227181 rabindra.tuladhar@nabilbank.com; sanjay.nepal@nabilbank.com ; deepak.shrestha@nabilbank.com; namita.dixit@nabilbank.com
3	Himalayan Bank Limited	Mr. Anup Maskay, Executive Credit Officer Mr. Rajesh Bhattarai, Manager-Corporate Mr. Rabindra N. Pradhan, Head-Risk Management Department Corporate Office	Ph: 4227749 anup@hbl.com.np; rabindra.pradhan@himalayanbank.com
4	Bank of Kathmandu Ltd.	Mr. Pushpa Raj Bhandari, Executive Manager (Business); Mr. Vijay Kumar Gurung, Relationship Manager-Development Credit Unit	Ph: 4414541 pushpa.bhandari@bok.com.np; vijay.gurung@bok.com.np
5	Kumari Bank Ltd	Mr. Radhesh Pant, Chief Executive Officer Mr. Sanjay Poudyal, Head-Corporate Strategy and Development Mr. Bikas Khanal, Head-Credit Risk Management	Ph: 977-1-4221311 radhesh.pant@kbl.com.np; sanjay.poudyal@kbl.com.np; bikas.khanal@kbl.com.np
6	Nepal Industrial and Commercial Bank	Mr. Sashin Joshi, Chief Executive Officer	Ph: 01-4262277 sashin@nicbank.com.np
7	Commerz and Trust Bank Nepal	Mr. Anal Raj Bhattarai, Chief Executive Officer	Ph: 4446150 info@ctbn.com.np
8	Nepal Bangladesh Bank Ltd.	Prabinkar Adhikari, Dy. Manager, Corporate Credit	Ph: 977-1-4783975/76 Prabinkar.adhikari@nbbl.com.np
9	Sanima Bikash Bank Limited	Mr. Kumar Lamsal, Chief Executive Officer Mr. Nishes Pokhrel, Asst. Relationship Officer Mr. Samik Dhungana, Asst. Relationship Manager	Ph: 977-1-4428979 kumar@sanimabank.com; samik.dhungana@sanimabank.com; nishes.pokhrel@sanimabank.com
10	Clean Energy Development Bank Ltd.	Mr. Manoj Goyal, Chief Executive Officer	Ph: 4671444 / 4671666 info@cedbl.com
11	ACE Development Bank	Mr. Narendra N. Pradhan, Manager Mr. Suyog Shrestha, Asst. General Manager	Ph: 4441110 narendra@ace.com.np; suyog@ace.com.np

Annex 3.3: Donors' Programs

S.N.	Name of the Organization	Respondent Name/Designation	Email/Telephone
1	SEAM/N (Program funded by Finland Government)	Mr. Bikrant Bikram Chand, Deputy Team Leader	bikrant@seam-n.com.np ; bikrant.chand@gmail.com
2	Vertical Shaft Brick Kiln Project	Mr. Urs Hagnauer, Program Manager Mr. Suyesh Prajapati, Program Coordinator	Ph: +977-1-5521970 urs.hagnauer@vsbk.org.np suyesh@vsbk.org.np

Annex 3.4: Business Leaders/Representatives of Chambers and Industry

S.N.	Name of the Organization	Respondent Name/Designation	Email/Telephone
1	Federation of Nepalese Chambers of Commerce and Industry (FNCCI)	Dr. Uttam Kunwar,	
2	Confederation of Nepalese Industries (CNI)	Mr. Megh Nath Neupane, Director General	Ph: 977-4243711 neupane_mn@hotmail.com
3	Chamber of Industries, Morang (CIM)	Mr. Dinesh Golchha, President Mr. Som Adhikari,	Ph: 021-525712 cim-brt@bcn.com.np
4	Birgunj Chamber of Commerce and Industries (BiCCI)	Mr. Manoj Upadhyay, Officer	Ph: 977-51-522290 bicci@usnet.com.np

Annex 3.5: Research Institutions/Universities, Consulting Companies

S.N.	Name of the Organization	Respondent Name/Designation	Email/Telephone
1	PACE-Nepal Pvt. Ltd./SEED-Nepal Pvt. Ltd	Mr. Amar Manandhar, Executive Director	
2	Kathmandu University	Mr. Bivek Baral, Asst. Professor, Department of Mechanical Engineering	977-011-663736

Annex 3.6: Government Institutions

S.N.	Name of the Organization	Respondent Name/Designation	Email/Telephone
1	Department of Industry	Mr. Gopal Lal Amatya, Director	amatya_24@yahoo.com
2	Ministry of Industry	Mr. Bishnu Prasad Aryal, Director General, Mr. Kamal Manandhar, Project Chief	Ph: 977-1-4246112 docsi@wlink.com.np; bishnuyadu@hotmail.com manandhar_kamal@hotmail.com
3	Department of Forests	Mr. Ram Nandan Shah, Under Secretary	Ph: 977-1-4227574 ravisasi2@hotmail.com
4	Water and Energy Commission Secretariat (WECS)	Mr. Deepak Kumar Kharal, Mr. Suresh Shrestha	
5	Alternative Energy Promotion Centre (AEPC)	Mr. Narayan Pd. Adhikari, Engineer	Ph: 5548468 narayan_621@yahoo.com; narayan.adhikari@aepc.gov.np

Annex 3.7: Engineering Firms/Turn-key Contractors/Expert

S.N.	Name of the Organization	Respondent Name/Designation	Email/Telephone
1	Ekta Engineering & Marketing Pvt. Ltd	Mr. Gambir M. Dangol, Director Mr. Raju Dali , Managing Director	Ph: 4247676 ekta@ecomail.com.np
2	Rural & Alternative Energy Pvt. Ltd.	Mr. Krishna Chandra Subedi	
3	Suryodaya Urja Pvt. Ltd.	Mr. U.K Kharel, Director	Ph: 4379000 uma@suryodaya.wlink.com.np
4	Lasersun Energy Pvt. Ltd.	Mr. Puskar Bhandari, CEO Mr. Binod Thapa, Executive Director	
5	Gham Power Nepal Pvt. Ltd.	Ms. Moon Pradhan, Director, Sales and Marketing Mr. Avishek Malla, Product Development Engineer	Ph: 4004545 moon@ghampower.com avishek@ghampower.com
6	Pragati Bio-gas Company	Mr. Krishna Chandra Subedi, Managing Director	energypragati@enet.com.np
7	Finaccess (Expert)	Mr. Sanjay Shah, Executive Chairman	sanjay@finaccess.com.np
8	Individual Expert	Gyanendra Pd. Upadyay	

Annex 4

RELEVANT LAWS AND REGULATIONS: INDUSTRIAL POLICY, ENERGY EFFICIENCY AND RENEWABLE ENERGY POLICIES

1. Industrial Policy 2010

The 1992 Industrial Policy embarked upon encouraging liberalization in the economy by increasing efficiency and productivity. One of the major objectives of the Industrial Policy of 1992 is to privatize public sector industries.

The Government of Nepal recently endorsed the new Industrial Policy 2010 which replaces the 18 year old industrial policy. The revised Industrial Policy 2010 has been already formulated and implemented. It is aimed at creating an industry-friendly and investment-conducive environment, raising industrial production and productivity, creating more employment opportunities, and facilitating import replacement and export promotion, among other things.

The Policy highlights the extension of state-support for the development of infra-structure to industries on a priority basis, and special tax holidays for industries in rural and unindustrialized parts of the country. It recognizes and allows sub-contracting of production; and it states provisions for differential tariff rates for raw material import of finished goods and promotional incentive packages for export industries, particularly the small and medium enterprises. The policy listed infor-mation technology, cement, hydropower, vehicle and motor parts, chemical ferti-lizer, bio-technology and adventure tourism as high priority industries, and agri-culture, forest-based, ayurvedic, and homeopathic medicine manufacturing, min-eral and handicrafts as priority industries.

It also states the development of an Industrial Investment Protection Fund to min-imize and compensate for non-business and non-commercial risks. Investment Promotion Fund, Technology Development Fund, Small and Cottage Industries Development Fund etc. will be formed in collaboration with the private and public sectors.

2. Industrial Enterprise Act, 2049 (1992)

Industrial Enterprise Act, 1992 is enacted to provide for issues related to industrial development - to make arrangements for fostering industrial enterprises in a competitive manner through increments in productivity, and by making the envi-ronment for industrial investment more congenial, straightforward and encourag-ing.

Industrial Enterprise Act 1992 (section 3) classifies industries as: a) Manufacturing Industries, b) Energy-Based Industries, c) Agro and Forest-Based Industries, d) Mineral Industries, e) Tourism Industries, f) Service Industries, and g) Con-struction Industries.

Section 4 defines 'Cottage Industries' as labor intensive industries utilizing specific skill or local raw materials and resources, which are related to national tradition, art and culture.

Section 5 defines 'Small Industries' as industries with a fixed asset of up to an amount of $ 417.82 thousand; Section 6 defines 'Medium Industries' as industries with a fixed asset between $ 417.82 thousand and $ 1392.75 thousand; and Sec-tion 7 define 'Large Industries' as industries with a fixed asset more than $ 1392.75 thousand.

The Industrial Promotion Board has the authority to provide measures for control-ling environmental pollution induced by the industry (Section 13).

[15] Last amended by the Financial Act, 2065 (2008)

Section 15 and 16 of this act mention the facilities and concessions accorded to industries, while Section 17 details the constitution of the One-Window Committee for the purpose of making available facilities and concessions to be enjoyed by any industry under this Act.

Any industry, established in remote, undeveloped and underdeveloped areas, is granted a rebate of 30 percent, 25 percent, and 20 percent of the income tax re-spectively and 35 percent, 25 percent, and 15 percent of excise duty respectively for a period of 10 years from the date of operation.

Facility of 50 percent reduction on the taxable income is granted to those indus-tries investing in process or equipment, with the objective of controlling pollution or having a minimum impact on the environment (Section 15).

After an industry comes into operation, 10 percent of the gross profit is allowed as a deduction against taxable income on account of expenses related to tech-nology, product development and efficiency improvement.

On recommendation of, with the decision of the council of Ministers , and by noti-fication published in the Nepal Gazette, additional facilities may be granted to any National Priority Industry or any industry established in Nepal by the way of in-vention therein.

3. Foreign Investment & Technology Transfer Act, 2049 (1992)

This is an act created to provide for matters relating to foreign investment and technology transfer, for making the economy viable, dynamic and competitive through maximum mobilization of the limited capital, human resources and other natural resources. According to this Act, 1992, 'foreign investment' means follow-ing investment made by a foreign investor in any industry: investment in share (equity), reinvestment of the earnings thus derived, and investment made in the form of loan or loan facilities.

Section 3 of this Act mentions that permission of the Department of Industry or Department of Cottage and Small Industries shall be required to obtain foreign investment or technology transfer. However, no permission shall be granted for making foreign investment in the industries set forth in the Annex of the Act (Cot-tage Industries, Arms and Ammunition Industries, Poultry Farming, Atomic Ener-gy, etc.) provided that permission may be granted for the transfer of technology in such industries. DoI itself has the authority to approve investment up to $ 6.96 million. If the investment is more than $ 6.96 million, DoI should take permission from the Board of Directors.

4. Five-Year Plans

Periodic five-year plans are the Government of Nepal's major documents for pre-senting policies, programs and targets. The objectives of the country's energy policy are defined and updated in five-year plans. However, Nepal currently has no 'national energy strategy'.
From the Sixth Five-Year Plan (1980-1985) onwards, the government has sup-ported the development and further dissemination of Renewable Energy Tech-nologies. Nepal entered into planned energy development from the 7th Five-Year Plan (1985-1990).

[16] The Foreign Investment and Technology Transfer Policy is waiting for the final approval. The proposed policy has emphasized flow of foreign investment by bringing procedural simplification in technology transfer in order to be competitive in World Market for utiliz-ing the comparative advantage of the private sector (MoF, 2010).

The Ninth Plan (1997-2002) mainly focused on doubling the contribution of the manufacturing sector to GDP to 20 percent by making the manufacturing sector more competitive and market-oriented. Some of the thrust areas were tourism-based industries, energy-oriented industries, local non-metallic mineral industries, agro-based industries, and leather-based industries.

For the industrial sector, the Tenth Plan (2002-2007) spelled out some policies such as- to set up mechanism for easy availability of financial resources, to channelize investment to undeveloped/underdeveloped regions of the country, to encourage foreign investments, and to encourage local and newly developed technologies for the industrial development.

The Tenth Plan (2002-2007) has specifically identified targets in renewable ener-gy technology, such as installation the of additional 200,000 biogas plants, 10 MW of electricity through small hydropower, 52,000 Solar Home System with the capacity of 3.5 MW etc.

The Three-Year Interim plan (2007/08-2009/10) targeted to achieve 6.3 percent average annual industrial growth rate and to ensure investment of $ 654.59 million during the plan period with annual domestic investment of $ 167.13 million and foreign investment of $ 48.75 million.

Both the Tenth Plan and the current Three-Year Interim Plan are concerned ex-clusively with the electricity sector. The Three-Year Interim Plan has been formu-lated, and targets to give an additional 15 percent of the population access to electricity service through the national grid as well as through off-grid mecha-nism.

5. Environment Protection Act (EPA) 1997 and Environment Protection Regulation (EPR) 1997

The EPA and EPR 1997 are the milestones legally set for environmental protec-tion which influence the industrial sector. As per EPA 1997 and EPR 1997, vari-ous projects and industrial establishments are mandated to undertake the Envi-ronmental Impact Assessment (EIA) and Initial Environmental Examination (IEE) studies and get approval. The Ministry of Environment (MoEnv) is the final au-thority for the approval of EIA reports, while line agencies (e.g. Department of Cottage and Small Industries, Department of Industries) are responsible for the approval of IEE.

Additionally, EPA 1997 (section 7) provides authority to the MoEnv to take action on pollution control at the operation stage. EPR 1997 has mandatory provision for provisional or permanent pollution control certification for 55 industries (Refer An-nex 2.2) . EPA 1997 (Section 15) has a provision for providing concession and facility to any industry, enterprise, technology or process which has a positive impact on environment protection. EPA 1997 (section 17) makes polluters liable for creation/disposal of pollution (sound, heat or wastes) and supports the com-pensation to any person or organization who suffer any loss or damage from such activities.

[17] http://practicalaction.org/file/Energy%20Poverty%20Study_Unpublished%20version.pdf
[18] Section 6 of EPR 1997 has provision of IEE or EIA report submission for the estab-lishment of any industrial sector as listed under Schedule 1.B. (for IEE) and Schedule 2.B. (for EIA) (Refer Annex 2.1).
[19] Sub rule 1, Rule 16 of chapter 3 of EPR 1997

Industries Requiring Initial Environmental Examination and Environmental Impact Assessment

S.N.	Industrial Sector	Initial Environmental Examination	Environmental Impact Assessment
1	Cement	Establishment with a production capacity of 30 metric ton per hour based on lime-stone and with a production capacity of 50 metric tons per hour based on clinker	Establishment with a production capacity of more than 30 metric tons per hour based on lime-stone and with a production capacity of more than 50 metric tons per hour based on clinker
2	Rolling Mills	Establishment having investment of total fixed capital exceeding Nepali rupees 1 million	
3	Poultry/Agribusiness	Establishment of Dairy processing industries	Medium and large tea industries which use large quantities of fire-wood
4	Plastic	Establishment of plastic industry (based on waste plastic as raw material) Establishment of plastic processing industries (except processing waste materials) having investment of total fixed capital exceeding Nepali rupees 1 million	
5	Cold Storage	Establishment having investment of total fixed capital exceeding Nepali rupees 1 million	
6	Food and Beverage (Breweries / Distillerries)	Establishment of food processing having investment of total fixed capital exceeding Nepali rupees 1 million	Establishment of distilleries equipped with boiling and fermentation facilities with a production capacity of more than 50 hundred thousand liter per day Establishment of breweries and wineries equipped with fermentation facilities with a production capacity of more than 50 hundred thousand liter per day
7	Steel Structures		
8	Paper and Pulp	Establishment, except traditional cottage industries, with a production capacity of 100 metric tons per day	Establishment with a production capacity of more than 100 metric tons per day
9	Brick Industry	Establishment with a production capacity of 2 million units per year	Establishment with a production capacity of more than 2 million units per year
10	Tourism (Hotels)	Establishment and operation of hotel with 50 to 100 beds	Establishment and operation of hotel with more than 100 beds Establishment of hotels, resorts, etc inside forest areas, national parks, sanctuaries, conservation area, buffer zones and environmental conservation zones.

Note: Section 6 of EPR 1997 has provision of IEE or EIA report submission for the establishment of any industrial sector as listed under Schedule 1.B. (for IEE) and Schedule 2.B. (for EIA).

Industries Requiring Certificate of Pollution Control

SN	Industrial Sector	Requirement for Pollution Control Certificate
1	Cement	Relating to cement based on lime stone or clinker
2	Rolling Mills	Relating to metallic (including remolding, rerolling, and fabrication)
3	Poultry/Agribusiness	Relating to Milk processing Relating to poultry feed
4	Plastic	Relating to plastic (based on waste plastic) Relating to plastic processing (except scarp processing)
5	Cold Storage	Relating to cold storage
6	Food and Beverage (Breweries / Distilleries)	Relating to Food processing Relating to production of liquor through blending process and distilleries with facilities of boiling and fermentation Relating to brewery and winery with facilities of fermentation
7	Steel Structures	Relating to electroplating and galvanizing
8	Paper and Pulp	Relating to pulp or paper except traditional cottage industries
9	Brick Industry	Relating to bricks, tiles, etc.
10	Tourism (Hotels)	

Source: Sub rule 1, Rule 16 of chapter 3 of EPR 1997

6. Perspective Energy Plan/Renewable Energy Perspective Plan of Nepal

PEP can be credited with setting a milestone in 1995 by comprehensively chart-ing out the country's energy management with a 25-year perspective. The REPPON, supplementing the achievement of the PEP, detailed the development of renewable energy technologies with a 20-year perspective considering medium and high growth scenarios. Although neither PEP nor REPPON have an official status as being government-policy documents, together with the Five-Year Plans, they set the scene for Nepal's policy framework on renewable energy technology development (Promotion of Renewable Energy, Energy Efficiency and Green-house Gas, 2004, 8).

PEP for Nepal has mostly addressed renewable energy technology policies and highlighted the strategies to be adopted for the development of clean energy re-sources for the betterment of rural mass. However, most of the policies enumer-ated in the previous plan documents need to be fully verified, developed and im-plemented to realize goals of overall rural development. The plan has also clearly stated the policy options available, such as improving efficiency in energy produc-tion and use, shifting the fuel mix, and reducing the rate of deforestation and in-creasing afforestation to reduce Carbon Dioxide emissions.

The REPPON estimates that consumption of petroleum products will increase (from 29.2 million GJ in 1998/99) with the annual growth rate of 7.5 percent in the current trend. It also focuses on the potential of renewable energy technologies to meet the energy need of the people in a more sustainable manner. Other gov-ernment Acts and Policies including the Hydropower Policy,

Industrial Enterprises Act, Finance Acts, Vehicle and Transport Management Act, Subsidy Policy for Renewable Energy Technologies etc. are all positive towards renewable energy technologies. In spite of this, institutionalizing the energy efficiency component needs to be prioritized.

7. Rural Energy Policy, 2006

This policy embarked upon increasing employment and productivity through the development of rural energy resources and integrating it with social and economic activities. It stresses the encouragement of economic and industrial activities based on rural energy technologies. It also highlights the integration of mini and micro-hydro projects with small-scale industry and encourages the operation of projects at community and institutional level. In order to make maximum use of surplus electricity, this Policy proposes making arrangements for increasing the consumption of unused low-priced electricity as per a dual tariff system, especial-ly in small and cottage industries. It encourages the development of industries for manufacturing and producing equipment and materials to be used in the rural energy sector. It also encourages the use of rural energy in diversifying produc-tive end-uses for industry, food processing, lighting, etc.

8. Subsidy Policy for Renewable (Rural) Energy 2009

Realizing the great potential of various sources of renewable (rural) energy like biogas, micro-hydropower, solar energy, improved water mill, improved cooking stove, wind energy, etc. in Nepal, the government and AEPC's Rural Energy Fund has mobilized efforts to provide subsidies to establish and effectively main-tain and deliver rural energy services.

The Government of Nepal formulated the Renewable Energy Subsidy Arrange-ment in 2009 to successfully facilitate the existing subsidy and delivery mecha-nism and expand alternative technologies in Nepal's neediest rural sector (Refer Annex 2.3). The government and AEPC coordinate with a number of private or-ganizations to attract donors, banks, investors and private entrepreneurs to pro-mote alternative energy technologies and administer effective use of grant funds.

[20] According to the policy document 'Rural Energy' means energy that is environmental friendly and used for rural households, economic and social purpose such as Micro and Mini Hydro, Solar Energy, Wind Energy, Biomass Energy, etc. Rural energy is also known as Renewable Energy.

Annex 5

GOVERNMENT PROGRAMS AND PLANS

A. Ongoing Programs and Plans

1. Nepal GIZ Energy Efficiency Program

NEEP-Project of GIZ is working in Nepal with the following stated objective: 'The energy use for domestic and productive purposes in Nepal is more efficient'. GIZ is working with Nepal in three components: 1) on integration of energy efficiency as part of the national energy strategy for the efficient use of energy, including biomass, 2) development of energy efficiency measures for more efficient use of biomass in rural households and the efficient use of electricity in urban house-holds, and 3) making energy intensive industrial enterprises more energy efficient and economic.

Its partner agency is the Water and Energy Commission Secretariat which acts as an Executive Agency from the government for the program for coordination with all Implementing Agencies namely, the Nepal Bureau of Stand-ards and Metrology, the AEPC, the Nepal Electricity Authority and the Federation of Nepalese Chambers of Commerce and Industries. WECS is also an implementing agency for one component of NEEP. The implementation period of this program is from September 2009 - January 2014.

Energy Efficiency Centre under the institutional umbrella of FNCCI is established to implement component three of the project. In order to enable fast track and early demonstration achievements the German contribution will support up to 40 energy audits for eight industry sectors.

2. Strengthening of Environmental Administration and Management at the Local Level in Nepal

The Government of Nepal and Government of Finland started the development co-operation project called SEAM-N in autumn 2001. The second phase of the SEAM-N project started from 2008 August and ran up to July 2011. The overall objective of the Project is to improve the state of the environment and to enhance environmentally sustainable and industrial development and utilization of natural resources in the project area. The industrial corridor, especially the area between the Biratnagar and Itahari, is one of the most polluted areas in the country.
Major activities of SEAM-N Project Phase 2 include:

- Establishing and strengthening environmental administration- building planning and management capacity of the District Development Commit-tees, municipalities and Village Development Committee of the Project area
- Promotion of better use of industrial sources- production increment, envi-ronmental management tools and techniques to maintain secured working place and improved environment conditions.
- Establishment of appropriate baseline for implementing environmental monitoring methods.

[21] http://www.devex.com/en/projects/energy-efficiency-programme-in-nepal

The project area locates in the following Districts in the Eastern Nepal:

DDC	Municipality	VDC
Sunsari	Dharan, Itahari, Inaruwa	Duhabi, Sonapur, Khanar, Hansposa, Madhesa, Bho kraha, Bhadgaon Sinbari, Bharoul
Mora ng	Biratngar Sub - Metropolitan City	Hattimuda, Dadarbairiya, Tankisinuwari, Katahari, Sijuwa, Tetariya, Bhogateni, Bahuni
Jhapa	Bhadrapur, Mechinagar, Damak	Charpane, Duwagadhi, Anarmani, Bahundangi
Dhankuta	Dhankuta	Parewadin, Pakhribas, Bhedetar, Dadab azzar
Illam	Illam	Kanyam, Sakhegunj, Jitpur, Danabari
Panchthar		Phidim, Tharpu, Ravi, Yasok

Source: SEAM-N Project Brochure, 2010

3. Energy Sector Assistance Programme

ESAP is one of the major programs of AEPC that was signed between the Gov-ernment of Nepal and the Government of Denmark (DANIDA) in March 1999. AEPC does not directly implement renewable energy projects but works with the renewable energy industries and non-governmental organizations to provide de-centralized renewable energy services to rural as well as urban communities.

The ESAP is currently looking after National Biomass Energy Components, Solar Support Programme and Mini Grid Support Programme. Besides these programs, the ESAP has been giving institutional support to the rural energy sector and providing financial assistance to rural energy investments through the Rural En-ergy Fund. AEPC works closely with ongoing national level renewable energy projects like the Biogas Support Programme and the Rural Energy Development Programme, being represented in these organizations at the Coordination Com-mittee and Board levels respectively.

AEPC is the executing agency of the program and it is implemented by the ESAP Programme Office. The components are implemented at field level by communi-ties, private commercial sector and by International Non-Governmental Organiza-tions (I/NGOs). AEPC/ESAP has been supported by about 10 regional service providers scattered in different regions of the country to promote Improved Cook-ing Stoves, Mini/micro hydro plants and SHS. Similarly, about 26 pre-qualified registered solar manufacturing companies have been found supporting AEPC/ESAP to promote SHS in different rural regions of the country.

4. Biogas Support Programme

BSP was started in July 1992 with support from the Dutch government. It has been successful in scaling up the number of plants from around 6,000 when it started to some 217,429 plants as of mid-July 2009 covering 72 districts (in 75 districts) of Nepal where 93-98 percent of constructed plants are in operation (AEPC, 2009). Due to its excellence in performance in the biogas sector, BSP has received ISO 9001:2008 certification, and many awards. BSP is a first Clean Development Mechanism project in Nepal. It has qualified 72 private biogas companies to install the biogas plants. Around 1,235,000 people directly benefit from biogas and more than 13,000 people have good job placements. Nepal has overtaken India in terms of per capita biogas plants and is quickly catching up with China.

5. Rural Energy Development Programme

There are around 2000 micro-hydro plants built and operated by organizations outside the NEA system. REDP started its pilot program from five districts in Au-gust 1996 with the financial and technical assistance of UNDP. Currently the third phase of the program, effective from September 1, 2007, is spreading over 40 districts of rural Nepal.

Till the end of December 2010, REDP has achieved impressive results: 307 mi-cro-hydro projects commissioned (5546.2 kW), 3099 SHS installed, 811 toilet attached biogas plants installed, and 14,255 improved cook stoves installed (AEPC, 2009). In addition to the hardware installed, the program has also made substantial achievements in social capital building through community organiza-tions, institutional strengthening through the creation of NGO Support Organiza-tions, and the creation of the Rural Energy Development Section.

6. Vertical Shaft Brick Kiln Project/Nepal

Vertical Shaft Brick Kiln (VSBK) is an energy efficient and cleaner technology used for firing clay bricks. This technology was introduced in Nepal by the Swiss Agency for Development and Cooperation (SDC) - through their program called VSBK/Cost Effective Social and Environment - Friendly building material (VSBK/CESEF) Project Nepal. In 2003, the Government of Nepal signed a bilat-eral agreement with SDC to implement VSBK technology transfer implemented by the Department of Cottage and Small Industry (DCSI). The market share of VSBK in Nepalese brick industries is only 5 percent i.e. only 22 VSBKs out of total of 429 brick kilns in Nepal (Prajapati, 2010).

Sustainable Energy Finance Market Study
for Financial Sector in Nepal

B. Past Programs and Plans

7. Environment Sector Program Support

ESPS, with five different components, was launched in 1998 particularly focusing on the so-called brown sector. ESPS, with assistance from DANIDA, has been strengthening the overall environmental management of the brown sector in Ne-pal through concerned ministries.

ESPS was launched with the participation of three ministries – Ministry of Indus-try, Ministry of Environment and Ministry of Labour and Transport. Key stake-holders like FNCCI, Federation of Nepalese Cottage and Small Industries and Trade Unions are also involved in decision making in the work planning of the program. Cleaner Production in industries, introduction of Energy Management Systems in industries, energy efficiency programs, development of common ef-fluent treatment facilities in industrial districts, Occupational Health and Safety of work places, training on various fields of environmental management, and devel-opment of environmental standards and their compliance are the major areas of this project.

ESPS' Cleaner Production program promoted and implemented programs that reduced MVA and MWh use by industrial plants and thereby reducing water re-quirements. There are also indirect reductions in electricity requirements. In the Bhairahawa-Butwal area ESPS programs reduced electricity use by 8.7 MVA and 386 MWh per annum, saving Nepali rupees 4.7 million (ADB, 2004). It was esti-mated that the energy efficiency measures recommended for the 174 industries in Nepal audited by ESPS/DANIDA - Energy Efficiency program could potentially avert 48,000 tons of CO2 emissions annually - an improvement in Brick Kiln tech-nology alone could save between 30-50 percent fuels (Promotion of Renewable Energy, Energy Efficiency and Greenhouse Gas, 2004, viii).

Annex 6

POSSIBLE ENERGY EFFICIENCY AND RENEWABLE ENERGY OPTIONS IN SELECTED INDUSTRIAL SECTORS

Sectors	Interventions		
	No Cost / Low Cost	Intermediate / Medium	High Cost
1.Cement	1. Preventive/ Scheduled Maintenance of the Plant and Machinery 2. Improvement of housekeeping system 3. Introduction of OHS management system, Resource Management system, and Cleaner Production system within the plant 4. Improvement of compressed air system and prevention of leakages in compressed air lines 5. Cleaning of Drive System 6. Optimization of capacitor banks for maintaining the Power Factor at optimum level	1. Installation of the Load Management System 2. Installation of Variable Frequency Drive 3. Optimization of Lighting System 4. Installation of auto air fuel ratio system 5. Plugging of leakages and installation of slip power recovery system for PH fan 6. Replace V-Belts with Clogged/Synchronous Belt Drives 7. Effective utilization of hot exit gases 8. Load Optimization of Drive Systems (Shuffling of Drive System)	1. Installation of Dust Collector system 2. Installation of Gas Conditioning system 3. Installation of ESP and Fabric Filter Combination 4. Improved horizontal flow as well as open to top ESP 5. Installation of Waste Heat Recovery System (Recuperator) 6. Co-Generation Options 7. Use of VRM in place of conventional ball mills, external recirculation system for VRMs, high efficiency separators in grinding circuits, etc 8. Installation of precalcinators and five or six stage pre-heaters with low pressure drop cyclones, use of new generation coolers, etc. 9. Installation of Auto Lime Feeding System 10. Improvement of insulation of the rotary kiln (with good quality bricks) 11. Application of Electrostatic Pre-

			cipitator (ESP) system for (dust from chimney)
2.Rolling Mills	1. Preventive/Scheduled Maintenance of the Plant and Machinery 2. Improvement of housekeeping system for raw materials and fuels 3. Introduction of OHS management system, Resource Management system, and Cleaner Production 4. Improvement of compressed air system and minimize the compress air leakages. 5. Cleaning of Drive System	1. Replacement of Old (Rewind) motors with energy efficiency motors 2. Improvement of Insulation (Ceramic Insulation) 3. Installation of Capacitor Banks for power factor improvement 4. Installation of the Load Management System 5. Installation of Variable Frequency Drive (VFD) 6. Load Optimization of Drive Systems (Shuffling of Drive System) 7. Optimization of Reheating temperature with application of temperature control system 8. Application of Combustion Gas Analyzer for combustion analysis. 9. Replace traditional V-belts with efficient belt system. 10. Optimization of Lighting System	1. Installation of auto Air Fuel Ratio Burner 2. Fuel Switching (Switching the Furnace Oil based furnace with pulverized coal based furnace) 3. Switching from Transformer system to Sub-Station system to improve the Power Quality 4. Installation of Waste Heat Recovery System (Recuperator) 5. Installation of Data Logger
3.Poultry/Agribusiness	1. Preventive/ Scheduled Maintenance of the Plant and Machinery 2. Improvement of housekeeping system for raw materials and fuels 3. Introduction of OHS management system, Resource Management system, and Cleaner Production	1. Replacement of Old (Rewind) motors with energy efficiency motors 2. Installation of Variable Frequency Drive (VFD) 3. Optimization of Water Pump system 4. Optimization of	1. Installation of Waste Heat Recovery System (Recuperator) 2. Installation of Auto Packaging and Filling System 3. Replacement of Traditional Boilers with Fluidized Bed Boiler

	4. Cleaning of Drive System 5. Minimize the steam leakages with regular preventive maintenance.	Lighting System 5. Load Optimization of Drive Systems (Shuffling of Drive System) 6. Optimization of capacitor banks for maintaining the Power Factor at optimum level 7. Replace V-Belts with Clogged/Synchronous Belt Drives 8. Installation of Auto Blow Down System 9. Optimization of Steam Distribution System (Steam Traps, Piping, Headers) 10. Insulation of Flanges and Valves with Insulation Jackets	4. Installation of condensate recovery system. 5. Installation of Economizer for steam generation system 6. Installation of Air Pre-Heater (APH) for Boiler 7. Optimization of Blow Down System (for manual) 8. Fuel Switch to Rice Husk 9. Application of renewable energy technology- Gasifier- for thermal application
4.Plastic	1. Preventive/ Scheduled Maintenance of the Plant and Machinery 2. Optimization of packaging heaters' capacity. 3. Improvement of compressed air system and Pneumatic equipment (Location, piping and water drain system) 4. Improvement of lighting system with efficient lead based industrial lights	1. Insulation of extruder heaters 2. Installation of capacitor banks to improve the power factor 3. Optimization of the drive system and motor loading 4. Optimization of refrigeration system. 5. Optimization of the water pumping system with efficient pumps.	1. Installation of UPS system to ensure power reliability for production loss reduction. 2. Installation of efficient refrigeration system (like inverter base technology)
5.Cold Storage	1. Preventive/ Scheduled Maintenance of the Plant and Machinery 2. Introduction of OHS management system, Resource Management system, and Cleaner Production 3. Regular cleaning of cooling tower to prevent algae formation.	1. Replacement of Old (Rewind) motors with energy efficiency motors 2. Improvement of Insulation 3. Installation of VFD 4. Improvement of the Chiller 5. Installation of air	1. Replacement of old traditional refrigerator system with efficient direct drive compressors and inverter based refrigeration system. 2. Installation of deicing system in evaporators.

		curtain for doors. 6. Optimization of capacitor banks for maintaining the Power Factor at optimum level	
6.Food and Beverages (Breweries/ Distilleries)	1. Preventive/ Scheduled Maintenance of the Plant and Machinery 2. Improvement of housekeeping system 3. Introduction of Occupational Health and Safety OHS management system, Resource Management system, and Cleaner Production 4. Improvement of compressed air system 5. Optimization of compressed air system with well-designed piping and drain system	1. Replacement of Old (Rewind) motors with energy efficiency motors 2. Improvement of Insulation (Ceramic Insulation) 3. Installation of Capacitor Banks for power factor improvement 4. Optimization of furnace temperature with proper instrumentation control. 5. Installation of Variable Frequency Drive (VFD) 6. Optimization of Water Pump system 7. Replace V-Belts with Clogged/Synchronous Belt Drives 8. Application of Combustion Gas Analyzer for combustion analysis 9. Load Optimization of Drive Systems (Shuffling of Drive System) 10. Optimization of Steam Distribution System (Steam Traps, Piping, Headers) 11. Insulation of Flanges and Valves with Insulation Jackets	1. Installation of Auto Air Fuel Ratio Burner 2. Improvement of Insulation for reheating furnace (Ceramic Insulation) 3. Fuel Switching (Biomass based Gasifier system) 4. Installation of Waste Heat Recovery System (Recuprator) 5. Installation of Auto Packaging and Filling System 6. Replacement of Traditional Boilers with Fluidized Bed Boiler 7. Installation of Economizer for Boiler 8. Installation of Air Pre-Heater (APH) for Boiler 9. Installation of Auto Blow Down System
7.Steel Structures	1. Preventive/ Scheduled Maintenance of the Plant and Machinery 2. Improvement of house-	1. Replacement of Old (Rewind) motors with energy efficiency motors	1. Installation of auto Air Fuel Ratio Burner 2. Improvement of

	keeping system for raw materials and fuels 3. Introduction of OHS management system, Resource Management system, and Cleaner Production 4. Improvement of compressed air generation and distribution system. 5. Load Optimization of Drive Systems (Shuffling of Drive System) 6. Cleaning of Drive System 7. Optimization of compressed air system	2. Improvement of Insulation (Ceramic Insulation) 3. Installation of Capacitor Banks for power factor improvement 4. Installation of the Load Management System 5. Installation of Variable Frequency Drive 6. Optimization of Water Pump system 7. Optimization of Reheating temperature with application of temperature control system 8. Application of Combustion Gas Analyzer for combustion analysis 9. Installation of efficient compressors with good control system.	Insulation for reheating furnace (Ceramic Insulation) 3. Fuel Switching (Fuel based to biomass based technology) 4. Switching from Transformer system to Sub-Station system improve the Power Quality 5. Installation of Waste Heat Recovery System (Recuperator) 6. Application of efficient welding transformer and welding machine with energy saver
8.Paper Mills	1. Preventive/ Scheduled Maintenance of the Plant and Machinery 2. Improvement of housekeeping system for raw materials and fuels 3. Introduction of OHS management system, Resource Management system, and Cleaner Production 4. Improvement of Compressed Air System 5. Cleaning of Drive System 6. Optimization of capacitor banks for maintaining the Power Factor at optimum level	1. Replacement of Old (Rewind) motors with energy efficiency motors 2. Steam Recovery of Blow Tank 3. Installation of Capacitor Banks for power factor improvement 4. Installation of the Load Management System 5. Installation of Variable Frequency Drive (VFD) 6. Load Optimization of Drive Systems (Shuffling of Drive System) 7. Optimization of Water Pump system	1. Installation of the Co-Gen System 2. Installation of auto Air Fuel Ratio Burner 3. Fuel Switching 4. Installation of Waste Heat Recovery System (Recuperator) 5. Installation of Vacuum Washing System 6. Application of Combustion Gas Analyzer for combustion analysis 7. Installation of Economizer for Boiler 8. Installation of Air

		8. Optimization of Reheating temperature with application of temperature control system 9. Optimization of Lighting System 10. Optimization of Blow Down System (for manual) 11. Optimization of Steam Distribution System (Steam Traps, Piping, Headers) 12. Insulation of Flanges and Valves with Insulation Jackets	Pre-Heater (APH) for Boiler 9. Installation of Auto Blow Down System
9.Brick Industries	1. Preventive/ Scheduled Maintenance of the Plant and Machinery 2. Improvement of housekeeping system for raw materials and fuels 3. Introduction of OHS management system, Resource Management system, and Cleaner Production 4. Optimization of Capacitor Banks for maintaining the Power Factor at optimum level 5. Optimization of Coal Feeding System 6. Optimization of Brick Stacking / Setting during loading 7. Capacity building / Awareness generation of the Firemen 8. Improvement of Insulation	1. Replacement of Old (Rewind) motors with energy efficiency motors 2. Installation of Capacitor Banks for power factor improvement 3. Installation of the Load Management System 4. Installation of Variable Frequency Drive (VFD) 5. Optimization of Water Pump system 6. Optimization of Lighting System	1. Fuel Switching 2. Switching from Transformer system to Sub-Station system improve the Power Quality 3. Gas Conditioning 4. Pulse Energisation 5. Installation of Waste Heat Recovery System (Recuperator) 6. Installation of Data Logger 7. Application of Combustion Gas Analyzer for combustion analysis
10. Tourism (Hotels)	1. Preventive/ Scheduled Maintenance of the Plant and Machinery 2. Improvement of housekeeping system for raw materials and fuels 3. Introduction of OHS	1. Replacement of Old (Rewind) motors with energy efficiency motors 2. Steam Recovery of Blow Tank 3. Improvement of	1. Fuel Switching 2. Switching from Transformer system to Sub-Station system improve the Power Quality

	management system, Resource Management system, and Cleaner Production 4. Improvement of compressed air system 5. Cleaning of Drive System 6. Optimization of capacitor banks for maintaining the Power Factor at optimum level 7. Improvement of Insulation	Insulation of Walls, ceiling, doors, and windows 4. Installation of Capacitor Banks for power factor improvement 5. Installation of the Load Management System 6. Installation of Steam Traps 7. Installation of Variable Frequency Drive 8. Load Optimization of Drive Systems (Shuffling of Drive System) 9. Installation of Data Logger 10. Optimization of Water Pump system 11. Optimization of Reheating temperature with application of temperature control system 12. Application of Combustion Gas Analyzer for combustion analysis 13. Optimization of Lighting System 14. Optimization of Blow Down System (for manual) 15. Optimization of Steam Distribution System (Steam Traps, Piping, Headers) 16. Insulation of Flanges and Valves with Insulation Jackets 17. Installation of Occupancy Sensor	3. Gas Conditioning 4. Pulse Energisation 5. Installation of Waste Heat Recovery System (Recuperator) 6. Installation of Auto Packaging and Filling System 7. Installation of Biogas Plant 8. Replacement of Traditional Boilers with Fluidized Bed Boiler 9. Replace the Central-air conditioning system with Split Air Condition System 10. Replacement of Traditional Chiller with energy efficiency Chillers 11. Improvement of Air Fuel Ratio Burner 12. Installation of Air Pre-Heater for Boiler 13. Installation of Economizer for Boiler 14. Installation of Auto Blow Down System 15. Installation of Biogas Plant 16. Replace traditional Fluorescent light with LED lights

Annex 7

RELEVANT LAWS AND REGULATIONS: PRESENT POLICIES FOR INDUSTRIAL FINANCE

Nepal Rastra Bank Act 2002

Nepal Rastra Bank, the central bank of Nepal was established based on the Nepal Rastra Bank Act 1955. The NRB Act 2002 (first amendment) gives authorities, powers, and duties to NRB to regulate the banking and financial institutions established under this Act. The NRB based on this Act can issue directives from time to time to licensed financial institutions to control the banking and financial transactions. The licensed banking and financial institutions should take approval from NRB while accepting deposits and providing loans.

Among the various functions of the NRB, it will represent Nepal in international organizations and associations on the matters such as monetary policy, foreign exchange policy, and the balance of payment, bank supervision and other related matters. The Bank may provide the services of banking and payment to foreign government, foreign central banks, foreign bank and international organizations, or associations, and obtain similar type of facilities from them.

Nepal Rastra Bank Unified Directives 2010

All, banking and non-banking, financial institutions licensed by NRB are mandated to follow the rules and regulations declared through Unified Directives of the NRB while conducting any financial transactions (NRB, 2010).

Loan Classification and Loan Loss Provision: The financial institutions are to classify their loans as Performing Loan if they are pass loans but for more than 3 months' default loan, they have to classify it as Non-performing Loans. For the doubtful loan of Deprived Sector Lending, all licensed financial institutions can allocate only 25% as loan loss provision, if these loans are insured.

Provision of Single Obligor Limit and Sector Limit: According to the NRB Act 2002, the loan amount provided by financial institutions (Class A, B and C) for single project should not cross 25 percent of total capital. Up to 30 percent limit has been established for the export oriented industries, small and medium enter-prises, drug, agriculture, tourism, cement, iron and other productive sectors. Up to 50 percent limit has been established for hydro power sector, provided that power purchase agreement is signed with the concerned entity (for more than 25 percent).

The maximum loan limit for small business , solar home system, biogas or other renewable energy technologies, provided by a 'D' class financial institution, should not cross $ 835.65 for a client/group. For the micro enterprise loan, up to $ 2089.14 limit has been set and this loan amount should not be more than 25 percent of total financing need. However, NRB has directed to all licensed finan-cial institutions to reduce their real estate and residential housing lending portfolio to 15 percent and 30 percent respectively by July 15, 2011. The sectoral limit has not been established for other sectors.

Provisions for Consortium Financing: According to the NRB Act 2002 (Section 79), two or more than two licensed financial institutions can lend to one client, form, or industry. The consortium

[22] According to the NRB Directives, small business or micro enterprises means involvement of less than 10 people.

Sustainable Energy Finance Market Study
for Financial Sector in Nepal

should select one lead partner and in its lead-ership they should give final lending decision to the client within 90 days of loan application. The lead partner is responsible on the due diligence, monitoring and supervision of loan and other activities.

Monetary Policy of Fiscal Year 2010/11

As per the Nepal Rastra Bank Act, 2002, the NRB has been formulating and pub-licly announcing annual monetary policy since 2001/02. The Monetary Policy of NRB for FY 2010/11 shows that for the Industries the lending rate of Commercial Banks is 8.0 – 13.5 percent per annum.

To mitigate the adverse situation of the ailing industries, the sick industry re-finance facility commenced from FY 2002/03 is continued in FY 2010/11 (up to $ 27.85 million as provisioned by the Monetary Policy). The refinance rate has been reduced to 7 percent (prevailing bank rate) from 7.5 percent. The banks and financial institutions cannot charge more than 10 percent interest to the borrowers on such loan.

Banking and Financial Institution Act, 2006 (BAFIA, 2006)

According to the BAFIA 2006, all licensed institutions should supply credit as di-rected by Nepal Rastra Bank Unified Directives 2010 and credit policy deter-mined by the board of licensed financial institution. Before supplying the credit, licensed institutions shall obtain any movable or immovable property accepted to it as a security or an appropriate guarantee in a manner to safeguard its interests before supplying loans to any sector (Section 56). If the borrower fails to repay credit within the time-limit stipulated or misused the credit amount, the financial institution may recover its principal and interest by auctioning or disposing the property pledged to it, or any collateral or security deposited with it, by the bor-rower (Section 57).

International Financial Transactions Act, 1998

The act was enacted to develop Nepal as a center for international financial transactions to foster the economic development of the nation and globalization of international financial markets. This act regulates and manages the financial activities of international financial entities.

An international financial entity interested to carry out international financial transactions shall be required to obtain a license from the Accreditation Commit-tee (section 3). However, they should have been registered duly in their country and engaged in international financial transaction for at least three years (section 4). The capital or property of any entity shall not be subjected to nationalization (section 8).

[23] NRB 2010/11. Monetary policy
[24] NRB 2010/11. Monetary policy. P. 18

Annex 8

BRIEF SUMMARY OF SAMPLED BANK AND FINANCIAL INSTITUTIONS

Commercial Banks

1. Nepal Industrial and Commercial Bank Ltd.

NICB commenced operations on 21 July 1998 from Biratnagar. The Bank was promoted by some of the prominent business houses of the country. The current shareholding pattern of the Bank constitutes of promoters holding 51 percent of the shares while 49 percent is held by the general public. NICB has over 34,000 shareholders. The shares of the Bank are actively traded in Nepal Stock Ex-change with current market capitalization of about $ 146.14 million.

NICB was the first commercial bank in Nepal to have received ISO 9001:2000 certification for its Quality Management System standard in the year 2006. The Bank has recently been certified under the upgraded ISO 9001:2008 standards for the Bank's Quality System on Commercial Banking Activities for the first time in Nepal. Furthermore, NICB became the 1st Bank in Nepal to be provided a line of credit by International Finance Corporation (IFC), an arm of World Bank Group under its Global Trade Finance Program, enabling the Bank's Letter of Credit and Guarantee to be accepted/ confirmed by more than 200 banks worldwide. It has recently signed MOU with IFC for SME financing. Besides, it also tied up with ADB for trade financing.

2. Bank of Kathmandu Limited

BoK started its operation in March 1995 with an objective to stimulate the Nepa-lese economy. BoK has today become a landmark in the Nepalese banking sec-tor by being among the few commercial banks which is entirely managed by Nepalese professionals and owned by the general public. BoK aspires to induce modern technologies of banking that adds value to customer service, following strict risk control mechanisms etc.

Regarding the nature of financing, BoK provides bridge loan, consortium financing and is coming up with venture capital for SME sector with technical assistance from GIZ and has signed document with IFC.

Dugar, Golcha and Maruti are few big industrial clients of BoK. Till date, it has provided loan for the hydropower, cement and agro-industrial sector. Besides, BoK has also financed renewable energy sector (SHS, Biogas). It was also in-volved with ESAP (DANIDA) for community based SHS installment and with IFC for SME financing (venture capital project). It was also involved with micro-financing of SHS, about $ 13.92 thousand in Rolpa district of Nepal.

In the past, it has worked with USAID in the Business Development Services Marketing Production Services Project and also worked with GIZ for Electric Ve-hicles promotion thus financing 20 women drivers, where Winrock Nepal was the guarantor, and the technical support was provided by GIZ.

3. Himalayan Bank Limited

HBL was established in 1993 in joint venture with Habib Bank Limited of Pakistan. HBL is one of the leading banks in the primary banking activities with the highest deposit base and loan portfolio amongst private sector banks. HBL has already invested in the rolling mills, steel structures, poultry/agro business and food and beverage sectors and is in the process to finance feed industry. Regarding the energy efficiency/renewable energy sector, HBL has financed solar thermal technology and EVs batteries.

HBL was the main fund manager for ESPS (DANIDA) project wherein they han-dled the entire fund amounting $ 557 thousands. It is also associated with KfW for NEEP project.

4. Kumari Bank Limited

Kumari Bank Limited came into existence as the fifteenth commercial bank of Nepal by starting its banking operations from April 03, 2001 with an objective of providing competitive and modern banking services in the Nepalese financial market. The bank has paid up capital of $ 18.18 million of which 70 percent is contributed from promoters and remaining from public.

KUMARI has been providing wide - range of modern banking services through 28 points of representations located in various urban and semi urban part of the country, 19 outside and 9 inside the valley.

It has already provided pure project financing and consortium financing service to the cement, steel, rolling mills, tourism (hotels), food and beverage (breweries / distilleries) and hydro power projects. It mentions that it is in process of accessing the specialized fund from 2-3 bilateral/multilateral institutions.

5. Laxmi Bank Limited

Laxmi Bank was incorporated in April 2002 as the 16th commercial bank in Ne-pal. In 2004 Laxmi Bank merged with HISEF Finance Limited, a first generation financial company which was the first and ever merger in the Nepali corporate history. The Bank's shares are listed and actively traded in the Nepal Stock Ex-change.

Laxmi Bank's award winning Annual Reports has set the standards for quality, presentation and disclosure for the Nepalese corporate sector to follow since 2005. Laxmi Bank promotes a separate life insurance company – Prime Life In-surance Limited which came into operation in 2009. The promoters' group repre-sents 55.42 percent, Citizen Investment Trust has 9.02 percent, and general pub-lic has 35.56 percent shares.

Till date, Laxmi Bank has provided financing to the cement, paper and pulp, rolling mills, tourism (hotels), brick, steel structure, and food and beverage (breweries / distilleries) sectors. Besides, it has also financed about $ 11.14 thousand for SHS. Laxmi Bank has also joined hands with USAID for upcoming microfinance activi-ties.

Sustainable Energy Finance Market Study
for Financial Sector in Nepal

6. Nabil Bank Limited

Nabil Bank Limited, the first foreign joint venture bank of Nepal, started operations in July 1984. NABIL was incorporated with the objective of extending international standard modern banking services to various sectors of the society. Pursuing its objective, NABIL provides a full range of commercial banking services through its 47 points of representation across the kingdom and over 170 reputed corre-spondent banks across the globe.

It has already provided term loans, working capital, equipment financing and bridge loan in the cement, brick and food and beverage industries. Besides, it has also financed about $ 487.46 thousand in Ghee, Oil and Soap industries to replace Diesel generator with rice husk turbine. It was involved in financing EVs funded by DANIDA and is currently working with KfW.

7. Commerz and Trust Bank Nepal

CTBN is a 'A' Class commercial bank licensed by NRB, established in 2010 with an objective to provide full-fledged banking services in national arena. With strong capital base propelled by authorized capital of Nepali rupees 3 billion ($ 41.78 million) and issued capital of Nepali rupees 2 billion ($ 27.85 million), the bank is committed to contribute in the economic development of the country. CTBN provides various products such as micro lending, corporate lending, trade business, equity finance, etc. CTBN also supports projects related to energy in-frastructure, and public private partnership (PPP) through specialized unit.

CTBN has provided loans in the cement and hydro power sector and has also approved Nepali rupees 500,000 ($ 6,963.78) for SHS financing.

8. Nepal Bangladesh Bank Ltd.

NBBL was established in June 1994 with an authorized capital of Nepali rupees 240 million ($ 3.34 million) and paid up capital of Nepali rupees 60 million ($ 835,654.60) as a Joint venture bank with IFIC Bank Ltd. of Bangladesh. With a network of 17 branches and a corporate office, the bank commands the largest network amongst the joint venture commercial banks in Nepal.

Development Banks

9. Clean Energy Development Bank Limited

CEDB established in 2006 in a joint venture with FMO-Netherlands, is the first national level development bank and perhaps the only Bank in Asia to have a focused developmental agenda towards harnessing the nation's abundant natural resources in addition to uplifting the standards of living of Nepalese people.

CEDB with the help of USAID came up with an innovative product, i.e. the CEDB Hydro Fund (CHF). This product raised $ 3.2 Million from the general public and as of today it stands extremely successful with over 100 MW worth of projects under various stages of development. It has recently signed an agreement with FNCCI, as per the Public Private Partnership model, for the development of micro & small hydropower projects, ranging from 1 to 10 MW in capacity, in 45 districts across Nepal that is to be accomplished by the year 2014.

It has been actively utilizing its in-house capability brought in by its energy experts for due diligence and feasibility studies of medium and small hydro power projects. It has inked an agreement with the renowned Dragon Capital Limited, a company based in Vietnam, for Mekong Brahmaputra Clean Development Fund ($ 100 million) for equity investment in hydropower projects. The agreement envi-sions identifying, assessing and financing quality hydropower projects in Nepal and Bhutan.

It has attempted to resolve the underlying constraints in funding options for hydel projects through local financial intermediaries in Nepal (that is limited to invest-ment capabilities of a single 50 MW project or a total setup of 100 MW) by gaining access to debt financing support for large hydel projects through the international financial community. Accordingly, CEDB is in the process of financing $ 27.85 million on its part to the 16 hydel power projects portfolio and is the lead bank in 12 of these projects.

CEDB has signed an agreement with IFC, a member of the World Bank Group, to train staff members to improve their skills when evaluating proposals on energy efficiency and renewable energy financing, as well as product development and marketing. It also involves engineering due diligence for energy efficient projects, benefits from IFC's initiatives in Nepal on energy auditor development, market potential studies and targeted awareness with training activities related to sus-tainable energy finance.

In addition, CEDB has been working closely with GIZ-SHPP, AEPC, SNV and various domestic and international donors and funding agencies for the develop-ment of clean energy production and uses. It has entered into an agreement with the Asian Development Bank (ADB) for the development of Carbon Reductions and its trading.

For the Sustainable Real Estate Development, CEDB established a subsidiary, Clean Developers Private Limited (CDPL). This project is set to redefine the benchmarks of group housing by being in the process of receiving the first 'Gold Standard' Leadership in Energy and Environmental Design certification from US Green Building Council in Nepal. CEDB has already channeled its loan, amount-ing $ 30.64 – 34.81 thousand, towards the tourism (hotels) sector in Grand Hotel for replacement of diesel boiler of 5000 liter capacity with solar thermal. Similarly, it has financed energy efficient VSBK technology in Birtamod, Jhapa and fi-nanced Compact Fluorescent Lamps trading and suppliers. Besides, CEDB has also financed about $ 40-60 million on the mine based cement industry of capaci-ty 1200 tons per day.

Sustainable Energy Finance Market Study
for Financial Sector in Nepal

10. Ace Development Bank Limited

Ace Development Bank Ltd. has been a leading player in the financial market of Nepal. It was founded in August 1995 as Ace Finance Company Ltd. and was upgraded to Ace Development Bank Ltd., a fully-fledged category "B" develop-ment bank in 2007.

Over the years, customers and regulators have been in appreciation of the many financial products and innovations developed by ACE. Its diversified risk asset portfolio has served the economy in every sector as have the wide choices of deposit account schemes. ACE's wholesale banking initiatives have assisted numerous commercial banks and private enterprises with risk management con-cerns such as debentures and rights.

ACE has been providing term loan, working capital, bridge loan, and demand loan (with payment guarantee) in tourism (hotels), steel structure, cement, rolling mills, poultry/agro business, and food and beverage (breweries / distilleries) sectors. Besides, it has also financed for solarification for hotels. However, it has not yet accessed any funds from bilateral/multilateral institutions.

11. Sanima Development Bank Limited

Sanima Bikas Bank Limited was established in 2004 by the enterprising and dy-namic Non Resident Nepalese with a vision to mobilize required resources for the national development process.

SANIMA is the first private sector national level Development Bank in the country to be capitalized at $ 4.46 million. The current shareholding pattern of the Bank constitutes of promoters holding 70 percent and general public holding 30 percent.

The Bank has been in forefront in the country for mobilizing its resources in fi-nancing hydro power projects. It has a capital structure as: Authorized capital –$ 29.25 million, Issued capital – $ 28.02 million and paid-up capital – $ 11.22 million.

SANIMA is involved in financing the industrial sector - for cement and hydropow-er project (small hydro). The normal / average size of the project loan granted by the bank is about $ 278.55 thousand, while one of the hydropower was approved of $ 2.78 million (25 percent out of $ 11.14 million). The project financing is based on cash flow, and project itself could be collateral for this kind of project. Howev-er, the type of financing is 'equity financing' for the hydropower project (where 30 percent equity is the standard form).

The bank however has no experience with the bilateral and multilateral institutions or donor assisted projects at present.

Annex 9

LISTS OF TABLES

Annex 9.1: Sector wise Loan and Advances of Sampled Banks and Financial Institutions

As of Mid-January 2010										*USD in million*	
	Sector	**NICB**	**BoK**	**HBL**	**KUMARI**	**LAXMI**	**NABIL**	**NBBL**	**CEDBL**	**ACE**	**SANIMA**	**Total**
1	Agriculture	6.72	0.96	12.33	6.57	1.98	2.96	0.60	0	0.23	0	**32.35**
2	Mines		0.43		5.09		0.14	0.14	0.23	0	0	**6.03**
3	Manufacturing	62.02	51.55	176.22	34.89	10.62	126.28	36.92				**498.50**
4	Construction	31.64	24.58	25.15	23.32	5.72	67.95	21.91	0.99	9.8	12.79	**223.85**
5	Electricity, Gas and Water	1.03	4.12	1.98	2.15	0.83	1.41	0.22				**11.74**
6	Metal Productions, Machinery and Electrical Tools and Fitting	0.27	0.85	12.15	3.19	0.1	4.98	3.04	1.74	5.42	0.13	**31.87**
7	Transportation, Storage and Communications	3.45	24.72	12.65	16.63	5.09	60.54	13.77	2.71	0.42	5.94	**145.92**
8	Wholesaler and Retailer	34.79	64.03	56.13	18.42	18.02	93.41	24.61	4.53	3.11	10.04	**327.09**
9	Finance, Insurance and Fixed Assets	14.05	33.03	32.89	36.35	6.06	34.88	8.31	7.35	4.51	15	**192.43**
10	Hotel and Restaurants	2.24		13.55	3.26	3.8	11.42	7.32				**41.59**
11	Other Services	4.39	17.19	16.37	9.03	3.83	22.49	7.01	2.27	1.03	3.85	**87.46**
12	Consumable loan	0.67	1.56	33.9	20.74	0.14	1.38	4.43	0.26	1.15	7.97	**72.20**
13	Local Government					0.8			0	0.21	0	**1.01**
14	Others	43.99	20.65	36.38	41.01	26.57	44.42	12.16	1.82	10.72	8.63	**246.35**
15	About Production								3.34	3.55	5.7	**12.59**
	Total	**205.26**	**243.66**	**429.7**	**220.66**	**83.55**	**472.27**	**140.42**	**25.24**	**40.15**	**70.06**	**1930.97**

Source: Banking and Financial Statistics, Mid-January 2010, Annual Reports of Sampled Bank and Financial Institution

Annex 9.2: Product wise Loan and Advances of Sampled Banks and Financial Institutions

As of Mid-January 2010								*USD in million*		
Particulars	**NABIL**	**HBL**	**BoK**	**NICB**	**KUMARI**	**LAXMI**	**NBBL**	**ACE**	**SANIMA**	**Total**
Term Loan	61.6	57.3	23.2	12.7	31.4	27.9	17.8	6.2	5.1	243.2
Overdraft	100.6	64.7	59.2	12.8	77.4	32.1	38.9	15.0	19.3	420.1
Trust Receipt Loan/Import Loan	37.6	79.3	12.4	19.3	7.7	14.9	14.5	0.0	0.0	185.7
Demand and Other WC Loan	59.5	103.8	57.5	47.2	28.2	42.8	27.8	0.0	0.0	366.7
Real Estate Loan	61.6	37.6	22.9	28.0	38.5	52.1	4.4	3.8	14.8	263.7
Margin Nature Loan	0.0	16.5	2.8	12.8	5.1	4.1	0.0	3.4	1.6	46.4
Housing Loan	35.2	12.5	22.8	16.2	16.4	12.3	8.5	5.2	12.7	141.8
Hire Purchase Loan	58.5	19.3	19.8	6.5	3.6	3.0	18.6	0.0	0.0	129.4
Deprived Sector Loan	12.8	10.6	7.6	6.5	7.0	6.5	4.9	0.0	0.0	55.8
Bills Purchased	0.9	3.5	1.8	0.3	1.6	0.2	1.6	0.0	0.0	9.9
Other Product Loans	43.8	23.7	13.8	42.9	3.8	14.8	3.5	6.5	15.6	168.5
Total Loans and Advances	**472.3**	**428.9**	**243.7**	**205.3**	**220.7**	**210.7**	**140.4**	**40.1**	**69.1**	**2,072.3**

Source: Banking and Financial Statistics, Mid-January 2010, Annual Reports of Sampled Bank and Financial Institution

Note: Product wise loan and advances for CTBN and CEDBL was not available but the total loans and advances for CEDBL was $ 41.2 million.