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EDGG

Energy Efficiency and Energy Auditing in Bangladesh

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TABLE OF CONTENTS

LIST OF TABLES & FIGURES

ACRONYMS & ABBREVIATIONS

AEA	Accredited Energy Auditor
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
BAU	Business as Usual
BCCSAP	Bangladesh Climate Change Strategy and Action Plan
BDT	Bangladesh Taka
BEEP	Burdens on the Economy due to Environmental Policies
CDM	Clean Development Mechanism
CEA	Certified Energy Auditor
CFL	Compact Fluorescent Lightbulb
CHP	Combined Heat and Power
CO_2	Carbon Dioxide
CRI	Climate Risk Index
CSD	Centre for Sustainable Development
DC	Designated Consumer
DFID	Department for International Development
DSM	Demand Side Management
EA	Energy Audit
EAR	Energy Auditor Regulations
ECR	Environment Conservation Rules
EE	Energy Efficiency
EEA	Examination of Energy Auditing
EEAC	Examination of Energy Auditing Certificate
EEC	Energy Efficiency and Conservation
EIA	Energy Information Administration (US)
EMS	Energy Management Systems
EPS	Environmental Policy Stringency
ESCO	Energy Services Company
FY	Financial Year
GCF	Global Climate Funds
GHG	Greenhouse Gas
GIZ	Deutsche Gesellschaft für Internationale Zesammenarbeit
GDP	Gross Domestic Product
GWh	Gigawatt Hour
ICCCAD	International Centre for Climate Change and Development
IDCOL	Infrastructure Development Company Limited
INDC	Intended Nationally Determined Contributions
IPP	Independent Power Plant
ISO	International Standardisation Organisation
JICA	Japan International Cooperation Agency
KGOE	Kilogram of Oil Equivalent
KII	Key Informant Interview
LNG	Liquified Natural Gas
M&E	Monitoring and Evaluation
MINLAW	Ministry of Law, Justice and Parliamentary Affairs
MCft	Million Cubic Feet per Day
MOPEMR	Ministry of Power Energy and Mineral Resources
Mtoe	Million Tons of Oil Equivalent
MtCo2e	Million Tons of Carbon Dioxide Equivalent
MW	Megawatt
NEED	National Energy Efficiency Database
NGO	Non-Governmental Organisation
NEP	National Energy Policy
NSDS	National Sustainable Development Strategy
OECD	Organisation for Economic Development and Co-Operation
PDCA	Plan Do Check Act Cycle
PSMP	The Power Sector Master Plan
RMG	Ready Made Garments
SEDA	Sustainable Energy Development Agency
SHS	Solar Home System
SREDA	Sustainable and Renewable Energy Development Authority
SMEs	Small and Medium Enterprises
ULAB	University of Liberal Arts Bangladesh
VFD	Variable Frequency Drive

EXECUTIVE SUMMARY

'Energy efficiency is key to ensuring a safe, reliable, affordable, and sustainable energy system for the future. It is the one energy resource that every country possesses in abundance and is the quickest and least costly way of addressing energy security, environmental and economic challenges.'[1]

Bangladesh is at a critical stage in its development, being now listed as a middle-income country, and looking to reach upper-middle income status by 2021. Key to this change is the expanded growth of GDP from its stable 5-6% current growth, to a 7.5 – 8% level which is seen as being integral to the country's continued progress. To reach the next level, Bangladesh will need to overcome a number of constraints to continue on its export-led growth path. These are, (i) insufficient supply of reliable energy, (ii) policies that indirectly stunt the development of economic activities unrelated to ready-made garment exports, and (iii) insufficient security about property and land rights due in part to inadequate registry systems[2]. It is the first of these points that this paper is most interested in. The lack of a reliable electricity supply in Bangladesh has blighted economic development, and the impending shortage of natural gas compounds the difficulties in resolving this issue.

Up until this point, Bangladesh's economic growth has been maintained by labour-intensive industries such as the garment industries. However, economic theory and history of international development shows us that a structural change in the economy is necessary to foster diversification and subsequent growth of high value-added industries. The country will continue to depend on its 'traditional' industries such as Readymade Garments (RMG) but the new industries are predicted to grow and eventually take them over, with the eventual emergence of higher value industries. To facilitate this change – due to the energy intensive rather than labour intensive nature – the energy consumption of the industrial sector is expected to rise rapidly and exponentially.

The issue lies in the reliance on national reserves of natural gas. It is these once vast reserves that have effectively catapulted the country through its economic development in the last few decades. The unit price of which has been kept at a remarkably low level mostly in part by government subsidies. As this resource is becoming harder and harder to access and the levels running low, with the deficit between usage and supply predicted to reach 52% in 2030, the need to look to other fuel sources has become critical. The economic issue is that the unit price of fuel is never going to match what it historically has been under that gas years. This does not even take into account the environmental issue of replacing one the cleaner non-renewables with sources such as coal. Due to the current energy deficit this prediction effectively amounts to a looming crisis.

This is where energy efficiency (EE) becomes an attractive mechanism for change, it is widely seen as being the most cost effective, fastest and most accessible way of reducing energy use. Coupled with the increasingly energy intense industrial sectors, the increasing unit cost, and possible unstable energy security scenario it is a key policy progression. One however that requires a degree of structured and considered and nuanced thought.

Bangladesh is not short of well written policy, but frequently the discussion around implementation of these policies is not one of completion. This is not an isolated issue to Bangladesh alone however. This paper looks at the historic policies of recent years, but it is the energy efficiency and conversation master plan that has the most key points. In focus the development of the energy auditing framework (EAR) by SREDA. Energy auditing is seen as the key mechanism for improving energy efficiency in any

[1] https://www.iea.org/topics/energyefficiency/

[2] Bangladesh: Consolidating export-led growth. Country diagnostic study. ADB 2016

given private sector and can provide the source for the development of energy management systems (EMS) and the collection of data to further EE policy development.

As the importance of environmental issues within society has risen over the past decade, the value of effective environmental management has also become more recognised within commerce and business as a key tool in amongst other things developing a streamlined energy efficiency methodology. Notable for Bangladesh, environmental auditing in recent years has transformed to include global warming, resource depletion, recycling and transportation issues as key factors within its mechanisms. The background to the energy auditing framework was born out of the SREDA energy masterplan, and the institution itself. From the masterplan SREDA defines itself as being established in 2012 by the Bangladesh Parliament as a national nodal organisation for promoting demand-side energy efficiency and conservation in the country[3].

The EAR framework in its early stages will undertake energy auditing upon targeted consumers - defined in the document as designated consumers (DC) – who have been selected by SREDA through a rigorous consultation process. The DC will be audited by government accredited energy auditors, who will produce a report which will be fed back to SREDA for analysis. This will be repeated in regular intervals and a report of the all of the DCs will be complied and fed back to the government.

The initial phase is effectively one of data collection, and the DCs were selected as they were industries who were by their nature energy intense. From this point the plan is to role out the framework to cover a larger number of consumers, and to scale up from there.

The initial document was found to be an excellent, and comprehensive policy outline, however when the EAR was passed through to the Ministry of Law, Justice and Parliamentary Affairs there were a number of critical factors that were cut back. Firstly that system of tiering for the energy auditors was removed. Secondly an internal role to the consumers, the 'energy manager' was no longer mandatory, Finally the provision to fine for failure to comply with the auditing process was completely removed. These steps unfortunately took away a lot of the power and effectiveness of the framework, and softened the ability of the regulator to enforce it.

The issue of corporate secrecy has been raised as a significant barrier to the success of the EAR framework, and also the integrity and quality of the data gathered in the process. The removal of some of the regulatory power, compounds this issue. Another factor raised is the level of sophistication required in producing an effective national EE regulatory system. Bangladesh has some excellent educational institutions in the fields of renewable energy and sustainability, but a level of nuanced capacity building is required.

The level of analysis of EE potential in Bangladesh is already extensive, however implementation was been slow for a number of reasons. Complex and non-uniform energy pricing, preference for the continued use of case and inflexibility in changing, the idea that EE is an economic constraint, lack of and weak enforcement measures open to corruption, lack of knowledge development, the lack of coherent strategy, the continued use of traditional methods within industry, lack of data collection and dissemination, lack of access to finance for EE, leading to barrier to access to global funds and knowledge sharing.

Future policy recommendations are firstly to develop and continuously revaluate the EAR framework, as it is an excellent building block and potential catalyst for future EE developments. The considered collection of data, and its subsequent publishing is a proven effective tool in promoting EE and

[3] Energy Efficiency and Conservation Master Plan up to 2030. SREDA 2015

sustainable development. The promotion and facilitation for private investment in EE by the government by supporting capacity building, standardised measurement, private lending, and technology research and deployment. The backing for and encouragement to develop EE human resources to evaluate, implement and monitor. The establishing and continued development of effective enforcement and evaluation measures for EE. The development of the EAR framework to incorporate energy management systems (EMS). Finally, the use of sector wise benchmarking as a tool to ensure that industrial energy intensity and usage is at the desired level.

The government of the Bangladesh has all of the information to design and implement a global standard EE program. It needs to join the growing number of countries developing this future proof technologies, and not be left behind. The market development needs to be facilitated by the GoB to ensure the best start. The energy demand in Bangladesh is expected to increase exponentially over the next decade, and with the change in the national energy mix the use of EE is of critical importance to ensure this development does not become a crisis.

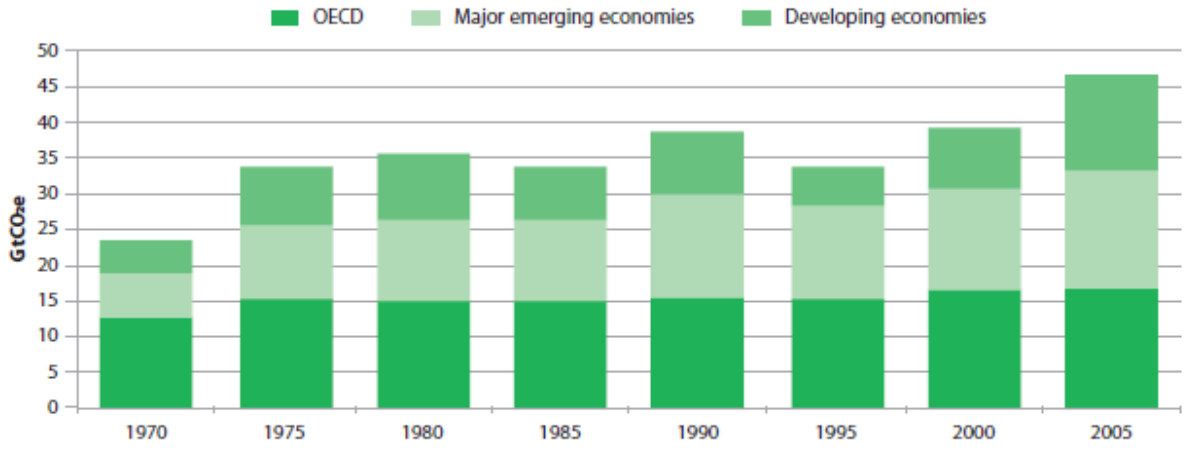
1. INTRODUCTION

1.1 BACKGROUND AND CONCEPTUALISATION OF ENERGY POLICY, SUSTAINABLE DEVELOPMENT, AND GREEN GROWTH WITHIN BANGLADESH

As usefully defined by the OECD, 'green growth is a matter of both economic policy and sustainable development policy. It tackles two key imperatives together: the continued inclusive economic growth needed by developing countries to reduce poverty and improve well-being; and improved environmental management needed to tackle resource scarcities and climate change' [4]. The similarities within this statement and the current economic and environmental scenario within modern-day Bangladesh will not be missed by anyone familiar with the country context. Within the 2008-2009 economic stimulus packages, the concept of green growth started to gain traction globally with a number of different approaches to its implementation.

Some governments approached it from a short-term economic perspective, using the potential to boost employment and incomes through increased investment in green technologies. Other governments approached it from a more environmental perspective using the potential to internalise environmental externalities by mainstreaming sustainable development requirements into economic decision making, integrating factors such as resource pricing and land use/infrastructure choices. A third approach, subscribing to equity and inclusion has more recently been expressed, notably in developing countries such as Bangladesh – the notion that green growth should serve those excluded by the current economic system. As the OECD points out, 'thus there is growing convergence around the notion that the current economic system is not only unsustainable and inefficient in its resource use, but moreover is inequitable in its distribution of costs and benefits'. This is not an issue of just levelling the playing field through breaking down barriers of entry, but developing new opportunities and advantageous positions through modern, economically sustainable, green prospects.

Figure 1.1: GHG Emissions 1970-2005

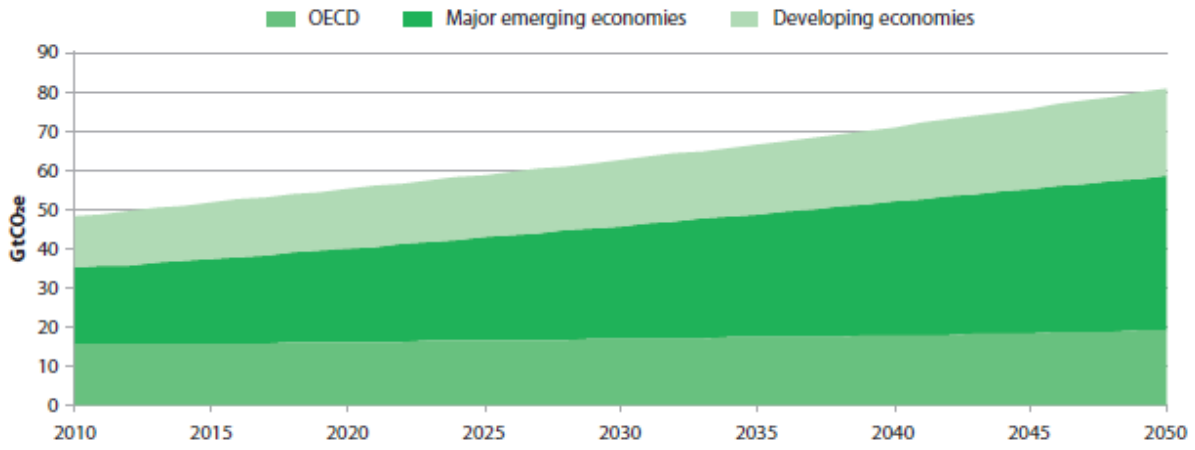


$GtCO_2e$ = Giga tonnes of CO_2 equivalent.

Source: OECD Environmental Outlook Baseline; output from ENV-Linkages.

[4] Green Growth and Developing Countries: A summary for policy makers OECD 2012

Figure 1.2: GHG Emissions by Regions: Baseline, 2010-2050



$GtCO_2e$ = Giga tonnes of CO_2 equivalent.

Source: OECD Environmental Outlook Baseline; output from ENV-Linkages.

In the 'Long term Climate Risk Index (CRI)' covering the period of 1996 to 2015, Bangladesh is positioned within the global top 10 at number 6[5]. Extreme weather and pattern shifts caused by climate change are affecting people globally, but it is the developing countries where this is being felt the most. Bangladesh's carbon emissions account for just 0.35% of the combined emissions of all countries in the world. This does not change the fact that if the world were to fail in taking ambitious action, the cost of climate change to Bangladesh could amount to an annual loss of 2% of GDP by 2050, and 9.4% of GDP by 2100[6]. Although emissions are currently low proportionate to similar sized countries, there is interest in developing its contribution to reduce global emissions as part of international agreements. There is also the understanding that to access the substantial funds and support being offered by the global community to counteract the effects of climate change for the most prone countries, compliance and participation in the sustainability movement driven by prudent domestic economic policy is an imperative.

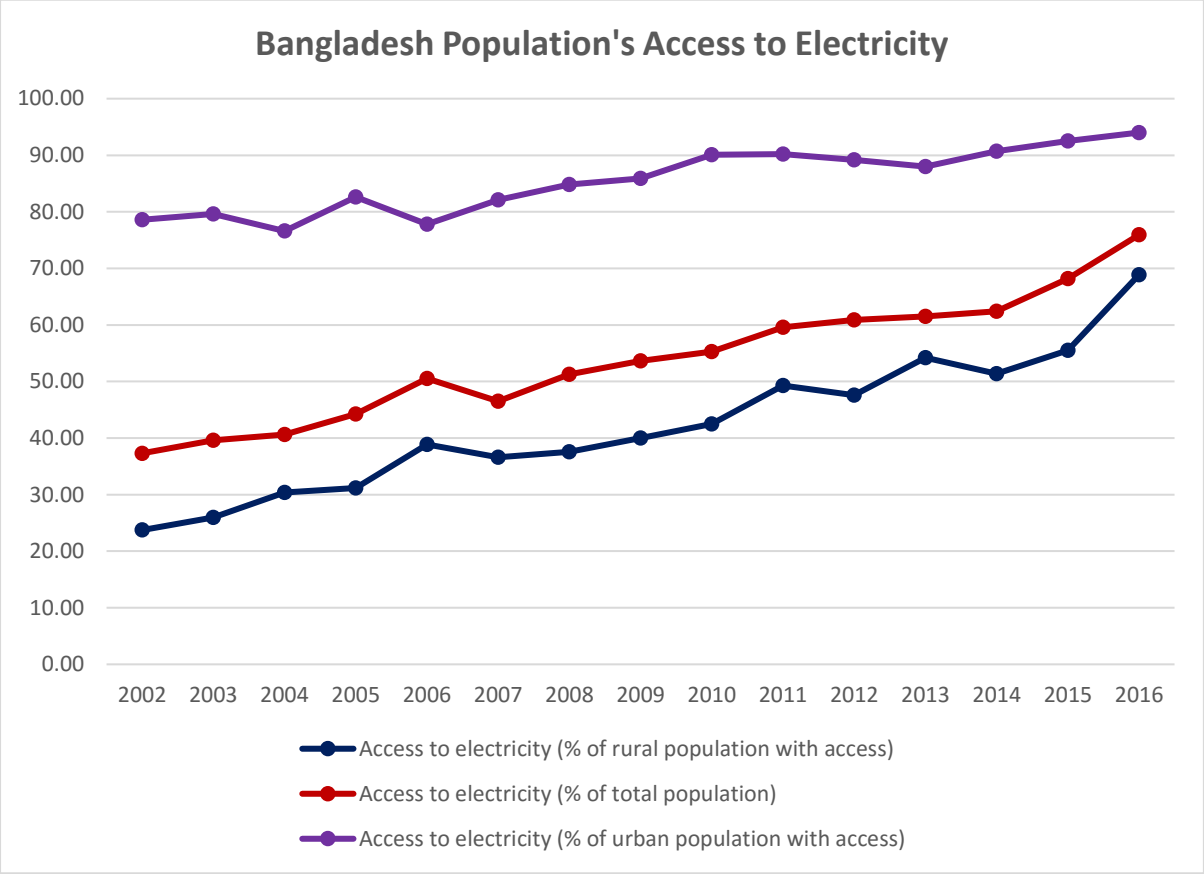
Bangladesh is at a key stage in its development, being now listed as a middle-income country, and looking to reach upper-middle income status by 2021. Key to this change is the expanded growth of GDP from its stable 5-6% current growth, to a 7.5-8% level which is seen as being integral to the country's continued progress. To reach the next level, Bangladesh will need to overcome three key constraints to continue on its export-led growth path. These are, (i) insufficient supply of reliable energy, (ii) policies that indirectly stunt the development of economic activities unrelated to ready-made garment exports, and (iii) insufficient security about property and land rights due in part to inadequate registry systems[7]. It is the first of these points that this paper is most interested in. The lack of a reliable electricity supply in Bangladesh has blighted economic development, and the impending shortage of natural gas compounds the difficulties in resolving this issue. The Government of Bangladesh's Seventh Five Year Plan (7th FYP) reinforces the impetus that is being placed upon ramping up the country's energy supply.

[5] GLOBAL CLIMATE RISK INDEX 2017 Sönke Kreft, David Eckstein and Inga Melchior

[6] https://www.adb.org/news/bangladesh-could-see-climate-change-losses-reach-over-9-gdp-report

[7] Bangladesh: Consolidating export-led growth. Country diagnostic study. ADB 2016

Figure 1.3: Access to Electricity

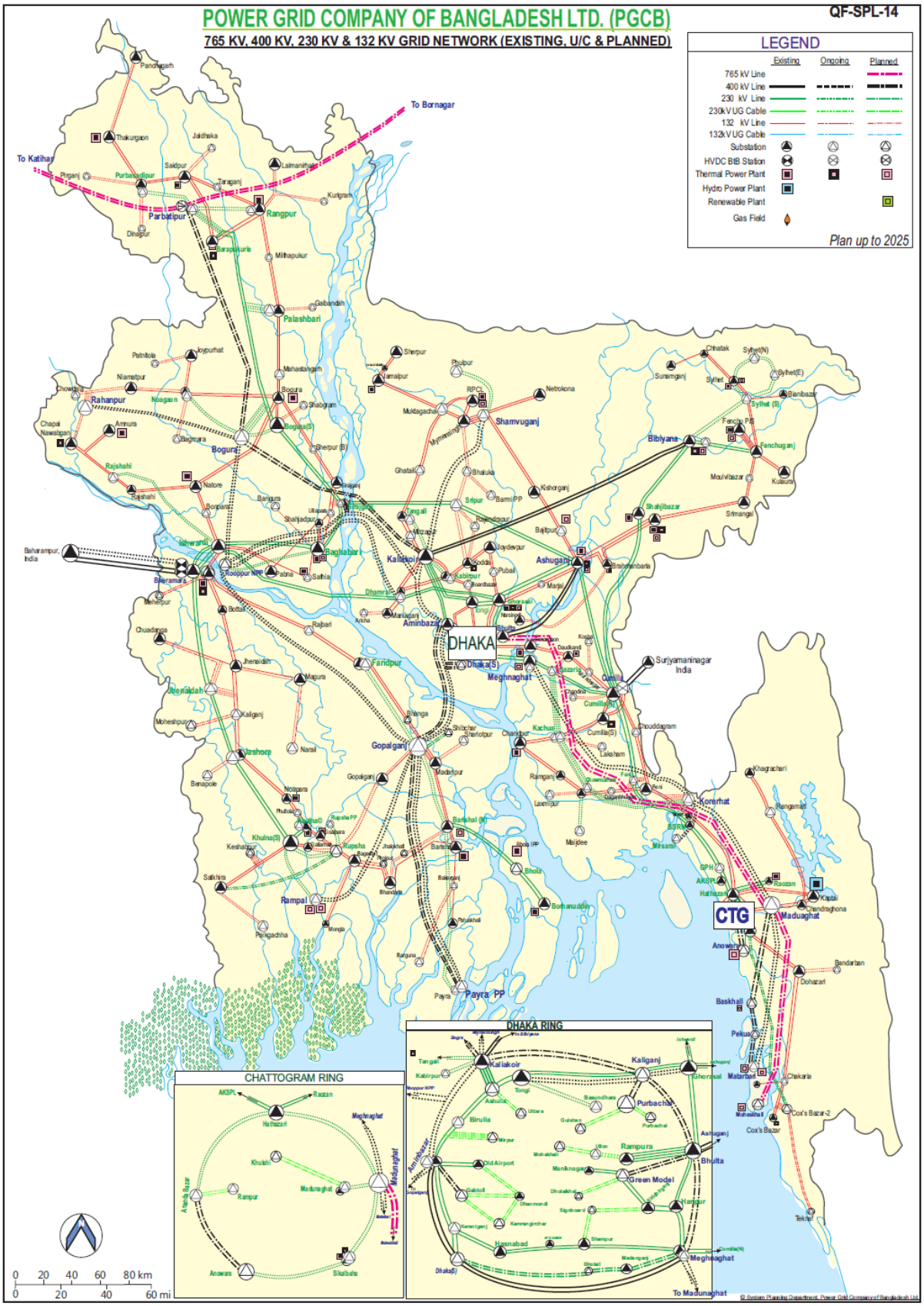


Source: World Bank Data Bank

The Bangladesh Rural Electrification Board (BREB) aims to electrify 100% of all areas that can be given access to the national grid by 2019[8]. Work is already under way and many areas which were previously powered by renewable sources such as solar mini grids or solar home systems are now getting power directly from the grid. Within these areas these solar mini grids are planned to be connected to the national grid, and an organisation called Solshare has been working to link the SHSs into their own mini peer to peer grids.

[8] SREDA, 2018

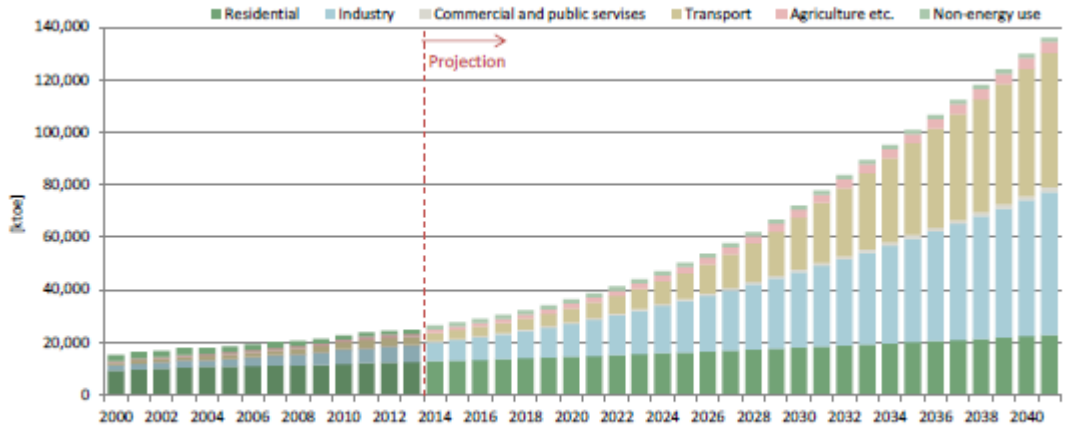
Figure 1.4: Grid Map of Bangladesh



Many commercial companies have worked around the energy deficit through the use of captive generation and the creation of export processing zones, but it is widely perceived that unless the

energy supply gap can be narrowed economic growth will remain constrained. The GoB promoted captive generation by supplying gas for power generation to industries at a reduced tariff. The tariff for captive gas generation was set at 4.18BDT per M^3 as opposed to 5.96BDT per M^3 for the standard gas tariff[9]. This created a scenario of not constraining the development and industrialisation of industry, but also a sub-optimal utilization of gas resources. This was compounded by the fact that the captive generation was small capacity, and frequently being operated in open cycle mode putting pressure on a stretched grid, especially in the industrial cluster zones.

Figure 1.5: Projection of Final Energy Consumption (BAU Scenario)

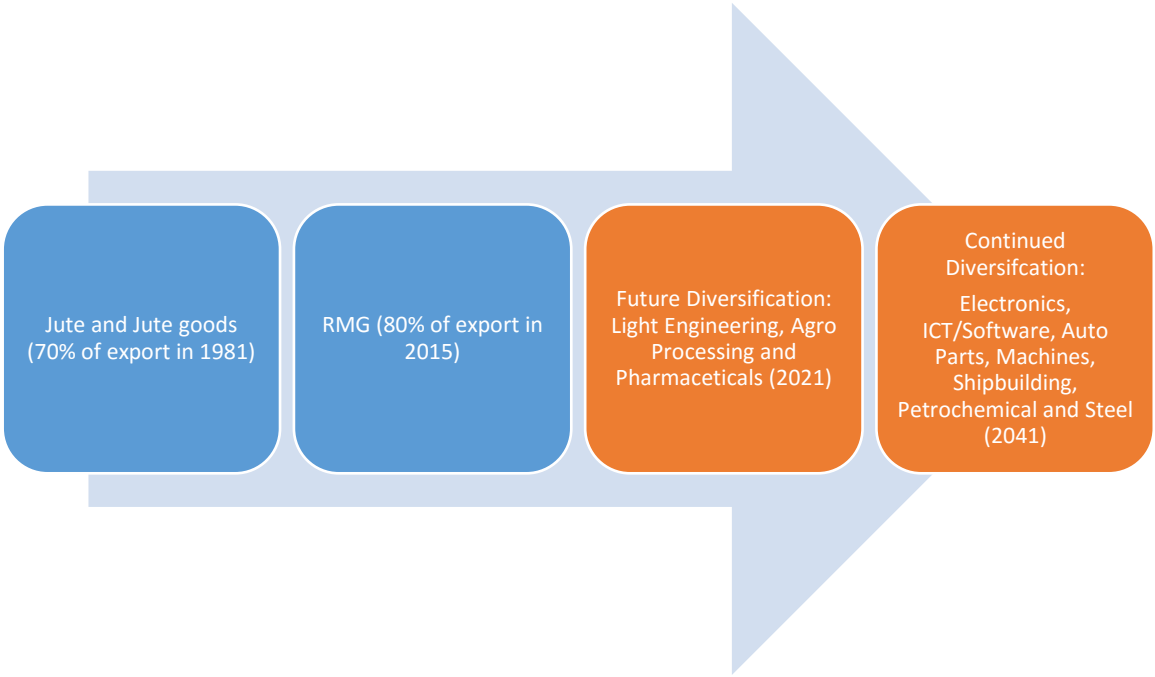


Source: JICA Survey Team

Up until this point, Bangladesh's economic growth has been maintained by labour-intensive industries such as the garment industries. However, economic theory and history of international development shows us that a structural change in the economy is necessary to foster diversification and subsequent growth of high value-added industries. The country will continue to depend on its 'traditional' industries such as Readymade Garments (RMG) but the new industries are predicted to grow and eventually take them over, with the eventual emergence of higher value industries. To facilitate this change – due to the energy intensive rather than labour intensive nature – the energy consumption of the industrial sector is expected to rise rapidly and exponentially. Due to the current energy deficit this prediction effectively amounts to a looming crisis.

[9] ADB Bangladesh Industrial energy efficiency

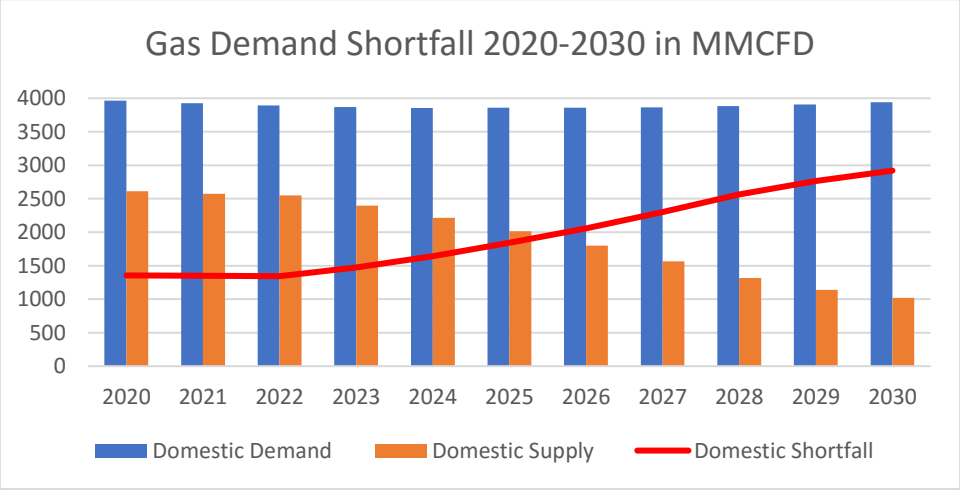
Figure 1.6: Industrial Diversification Over Time



1.2 SIGNIFICANCE OF THIS STUDY

Bangladesh has significant natural reserves of gas, coal and to a much lesser degree, oil. It is gas however that has catapulted the country through its relatively short economic development. The availability and the relatively low unit price of gas has meant it has been and remains to be the predominant source used in electricity generation, industry, and domestic cooking. Due to the rapid population and economic growth in Bangladesh the increasing demand started to outstrip the supply. As demonstrated in the figure below, the shortfall in gas is likely to increase sharply, reaching 52% by 2030.

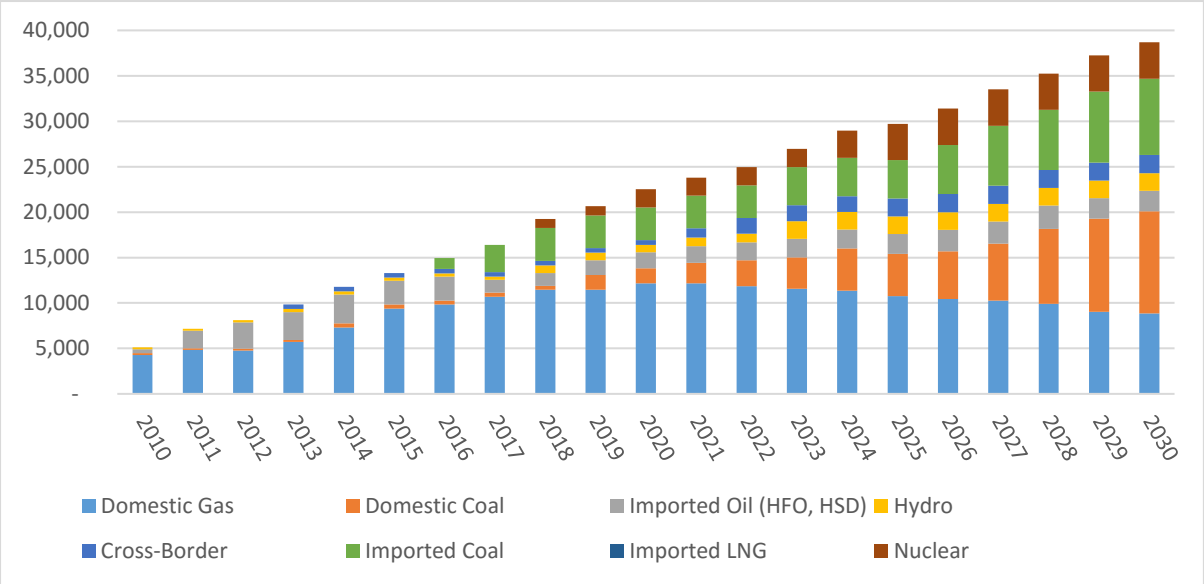
Figure 1.7: Gas Demand Shortfall



The government has taken steps to shift away from its reliance on domestic natural gas. This has included the construction and development of coal fired power stations for generating electricity, and the import of Liquefied Natural Gas (LNG) as an alternative. In addition to this, renewable energy sources are being explored with a significant proportion of which coming from the hugely successful

and much reported Solar Home System (SHS) programmes, solar mini-grids, and the exploration of wind options amongst others.

Figure 1.8: Electricity Supply Expansion Plan



Source: PSMP 2010 (JICA team)

There is a significant amount of work being done on the supply side, some of which is positive in terms of the environment, others not so much. The development of coal power plants in the Southwest of the country near to the Sundarbans and the development of nuclear power in the western region of the country has raised serious concerns. This is magnified by gas – if extracted responsibly – is on the 'better' end of non-renewable energy sources for the environment, and the move away from this as the countries primary energy source will have a significant effect on Bangladesh's carbon footprint[10].

Saying this, the country has a very low per capita CO2 emissions of 0.46 metric tons, compared to 0.9 in Pakistan, 1.73 in India and only just above the 0.44 in Cambodia and 0.28 in Nepal[11]. There is a well-used argument that the country has a very small impact on the environment globally, as countries such as the Unites states have emissions of 16.5, Australia with 15.4, Japan with 9.5, the UK with 6.5 and France with 5.8 respectively. All of these countries are at a much higher level of economic development, and some argue that Bangladesh and other lesser developed nations should have the right to develop without the constraint of monitoring its emissions, burning the cheapest fuel, however dirty it may be, to produce electricity or manufacture goods for example. This paper is not going to argue for or against this argument, simply it will follow the theme set by the current energy

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mix scenario and its economic status. Being, that cheap nationally produced gas is running out, the demand for it is already outstripping supply and this is a growing issue.

The government has used fiscal measures to keep the cost of gas down in recent years, but this is unsustainable in the long run, and therefore, the cost of energy is inevitably going to rise. At the same time, the 100% grid connectivity is a political commitment, and the government is also focused on accelerating economic growth to eliminate poverty by 2031. All of these considerations raise questions on how the country's energy infrastructure will look, going forward. This is where the concept of energy efficiency (EE) fits in: it is widely seen as the most cost-effective and straightforward short-term way of reducing the strain on energy production in a country, with the added benefit of realising lower emissions. This paper will focus on demand side, and the possibilities of achieving efficiencies in the use of energy within the industrial sectors.

EE for Bangladesh is not a new concept, although its application has been uneven. The reasons for this – be they political, economic, or educational – are varied, but due to the strains on the production side, there is significant momentum towards adopting energy efficient solutions. The transition will not be easy, as it must be a top-down approach that also requires the use of tailored solutions for different sectors.

In countries with a more sophisticated EE mechanism, real estate (residential and commercial buildings) has been a sector that has seen significant progress on this front. Regulatory bodies have three main instruments available for maximising energy efficiency in buildings, these are regulations, auditing and certification. The auditing aspect of this is outlined in depth, in the context of the 'Energy Audit Regulations for the Government of Bangladesh 2016' framework document produced by GIZ for SREDA funded by UKAID, which will be covered in detail later in this paper.

Realising the full economic potential of energy efficiency is a complex, and often constrained process. The various players have differing and often conflicting motivations. In corporate investment decisions energy efficiency is often not a key decision-making factor, other than in times of crisis when it is often too late. In these times where energy demand far outstrips supply, restricting services in nearly all cases is the only outcome, and at a great cost. An effective, nuanced, and targeted energy efficiency strategy at a national level will require a thoughtful planned approach.

2. BANGLADESH ENERGY EFFICIENCY POLICY REVIEW

2.1 BRIEF HISTORY FOR DEFINITION, OF BANGLADESH'S ENERGY EFFICIENCY POLICY AND ITS PLAYERS UP TO 2018

A statement that you hear often in Bangladesh is that it is a country with no shortage of well written policies; it is the implementation of these where the problems begin. This is not an isolated problem for Bangladesh alone; conceiving an idea is often easier than putting it into practice. The energy sector is no different in having some well-constructed policy strategies. We have selected the most relevant policy documents produced in the last 20 years, and although policy enacted before this time often is still the most current, we have chosen to focus on the most recent.

It is important to highlight that some of these policies have not been given final ministerial or parliamentary approval yet, and some policies that were written before the timeframe that has been defined below is still in place, however as EE is the focus of this paper, it is only the more recent publications that are relevant.

Table 2.1 is list of the policy papers and plans that have been explored and analysed in this paper, although other sources have also been used:

Table 2.1: List of Policies Reviewed

National Energy Policy	2004
Renewable Energy Policy of Bangladesh	2008
The Sixth Five Year Plan (2011-2015)	2011
Perspective Plan of Bangladesh (2010-2021) Vision 2021	2012
The National Sustainable Development Strategy	2013
Intended Nationally Determined Contributions	2015
The Seventh Five Year Plan (2016-2020)	2015
Energy Efficiency and Conservation Master Plan up to 2030	2015
Power System Master Plan	2016

2.2 NATIONAL ENERGY POLICY 2004

To situate the policy within near history it is important to outline the short-comings of the previous iteration, as defined in the contextual chapter of the paper.

- A shortage of capital being allocated to systematic surveying, research and exploitation of energy resources resulted in an unbalanced development of energy resources in different areas of the country, and within sub-sectors of the energy sector.
- Due to a shortage of capital the systematic development of power generation, transmission and distribution projects was not achieved.
- Private sector participation in energy sector development programmes was not given the necessary attention.
- Development of energy intense sectors had been constrained due to an under-capacity and unreliable power generation system.
- Energy agencies were not operated and managed efficiently.
- Energy prices had not been set on a rational basis.
- Unplanned and inefficient use of fuels are contributing to environmental degradation.
- Adequate attention was not given to the needs of rural areas.
- Adequate attention was not given to undertake systematic research programmes to develop indigenous technological capabilities.

- Adequate attention was not given to develop trained manpower for the efficient management of the sector.

From this standpoint the government formulated and undertook the first National Energy Policy (NEP) in 1996 to ensure that the energy scenario was improved. Due to rapid national and global advances and opinion changes in the field of energy it was decided to update the NEP. The objectives of the revised version are outlined below.

- To provide energy for sustainable economic growth so that the economic development of activities of different sectors are not constrained due to a shortage of energy.
- To meet the energy needs of different zones of the country and socio-economic groups.
- To ensure optimum development of all the indigenous energy sources.
- To ensure sustainable operation of the energy utilities.
- To ensure rational use of total energy sources.
- To ensure environmentally sound sustainable energy development programmes resulting in a reduced environmental impact.
- To encourage public and private sector participation in the development and management of the energy sector.
- To bring the entire country under electrification by the year 2020.
- To ensure reliable supply of energy to the people at reasonable and affordable prices.

2.3 RENEWABLE ENERGY POLICY OF BANGLADESH 2008

Written by the Ministry of Power, Energy and Mineral Resources (MPEMR) as a development to the ideas laid out in the Bangladesh Governments Vision and policy statement 2000, which aims to bring the entire country under electrical service by 2020. Highlighted in the policy as a pre-amble is Article 16 of the constitution of the People's Republic of Bangladesh 'to remove the disparity in the standards of living between the urban and rural areas through electrification and development'. It highlights three main factors in the then perceived transition of the energy sector:

1. A decline in fossil fuel availability, the predicted gradual extinction in the next few decades and the resultant price volatility due to demand-supply gap.
2. The need to drastically cut global emissions for mitigating climate change (80% reduction by 2050).
3. The need for energy security.

There is a realisation within the policy report that efficient utilization of renewable energy resources is yet to assume a commercial dimension, and the need for rational policy dissemination being essential. The objectives of the policy are listed below:

- Harness the potential of renewable energy resources and dissemination of renewable energy technologies in rural, peri-urban and urban areas.
- Enable, encourage and facilitate both public and private sector investment in renewable energy projects.
- Develop sustainable energy supplies to substitute indigenous non-renewable energy supplies.
- Scale up contributions of renewable energy to electricity production.
- Scale up contributions of renewable energy both to electricity and to heat energy.
- Promote appropriate, efficient and environment friendly use of renewable energy.
- Facilitate the use of renewable energy at every level of national usage.
- Create an enabling environment and legal support to encourage the use of renewable energy.
- Promote clean energy for a Clean Development Mechanism (CDM).
- Achieve the targets for developing renewable energy resources to meet 5% of the total power demand by 2015, and 10% by 2020.

Institutional development was a factor discussed in the policy document, with the Sustainable Energy Development Agency (SEDA) being introduced as a future player, the organisation was subsequently formed but under a slightly different name, SREDA. The responsibilities of the agency were to broadly provide coordination of sustainable energy planning, promote awareness, demonstrate new technologies, support private sector development, enable systematic development of renewable energy projects through audits, develop financing mechanisms, collect data, and implement policies for mitigation of environmental issues.

Before the agency was formed the power division of the MPEMR would be responsible for the development of renewable energy technology development and program implementation.

The concept of electricity generated from renewable energy projects – both in the public and private sphere – being purchased by power utility companies was outlined, as long as it was below 5MW. In a similar vein the policy of allowing renewable energy producing organisations to use existing transmission lines was floated, depending on capacity and the payment of a wheeling charge.

Investment and fiscal incentives were outlined by initially expanding the energy financing facility so that is was capable of accessing public, private, donor, carbon trading (CDM), and carbon funds for investment. A 15% VAT exemption was initiated specifically for renewable energy equipment, and raw materials. Renewable energy investors were to be exempt from corporate income tax for a period of five years, to be extended periodically following an impact assessment. An incentive tariff was outlined at a figure of 10% higher than the highest purchase price of electricity from private generators.

2.4 THE SIXTH FIVE YEAR PLAN (2011-2015)

The energy development chapter in the 6th FYP highlights in its title an overall objective of supporting higher growth and employment. The effect and the frequency of power and gas outages is noted to threaten citizen and welfare development prospects, to an estimated GDP cost exceeding 0.5% per year. The availability of domestic primary fuel supplies are becoming so scarce that it is forcing severe measures to be taken including shutting down fertiliser factories, rationing gas supplies for household and transport use, and keeping idle power units. The fact that every 1% of GDP growth is estimated to lead to a growth of 1.4% in electricity demand in a typical developing country is of note. For a growth rate of 5-6% (as it was at the time the 6th FYP was written), this implies a need for close to 7-8% growth in electricity. The expansion of the rural electricity grid was also noted, as was the fact that it was still amongst the lowest in the developing world, being a serious constraint to non-farm sector growth. Against this demand pattern no substantial low-cost and reliable power generation capacity has been added since 2002.

This power crisis forced the government to enter into contractual agreements for high-cost, temporary solutions, such as rental power and small Independent Power Plants (IPPs), much of these using diesel or liquid fuel-based sources. The fiscal pressure from these agreements is noted as budgetary transfers were routinely made to the power sector in order to enable it to stay current on payment to power suppliers. One of the longer-term strategies laid out is to develop low-cost sustainable power generation, transmission and distribution mechanisms as an alternative.

The issue of dependence on natural gas for power generation was highlighted with the figure of 89.22% of power coming from gas fired generators. With the country confronting the simultaneous shortage of gas and electricity, the need for developing the use of other sources to generate low-cost base load energy was outlined, such as coal, liquid fuels, or a renewable source such as hydropower. The long-term nature of each of these was noted as being a severe issue due to the critical nature of the shortages.

The key issues outlined in the policy document are defined below:

- Inadequacy of electricity supply compared to demand.
- Outdated generation, transmission, and distribution systems of electricity.
- Lack of rationalisation of energy power prices.
- Large dependence on a single resource for electricity generation (gas).
- Development of other sources such as liquid gas refining and storage, and coal exploration.
- Inefficient transmission lines.
- Minimal participation or private sector in electricity generation.
- Limited use of renewable energy sources.
- Use of PPP model to plug the resource gap.
- Lack of public awareness.

The strategy for the energy chapter of the document was focussed on the energy supply 'crisis' Bangladesh was going through, in supporting the country's continued economic growth.

The key strategies in the document sought to address the key issues listed, they are outlined below:

- Increase in power generation to reduce the demand-supply gap through public-private partnerships and through power imports from neighbours.
- Energy savings through demand side management (shop closing times, staggering holidays in industries and shopping complexes, replacing lighting with CFL and reducing air-conditioning load).
- Diversification of fuel uses on electricity generation.
- Use of dual fuel in electricity generation where possible.
- Facilitate cost reduction in importing power plant machinery.
- Reform the energy to reduce cost and improve service delivery.
- Implement price adjustment of electricity, gas and liquid fuel to make them compatible with international prices.
- Intensification of exploration activities for finding new oil, gas and coal fields.
- Development of coal mining, policy, and extraction plan.
- Increased imports of LNG to supplement the national gas reserves.
- Installation of nuclear power generation.
- Installation of solar panels in public and private buildings.
- Increase use of renewable energy by 5% of electricity demands within the plan period.
- The development of public awareness through publicity in electronic and print media.

In regards to energy efficiency, little is discussed in the policy document regarding existing issues or key strategies. The CFL distribution programme was highlighted and was expected to save 200-350MW of electricity per month. However, the founding of SEDA (SREDA) was outlined as the future source of renewable energy and energy efficiency developments.

The proper pricing of primary fuel and electricity was covered in depth in the policy document as a measure to conserve energy as well as to generate resources for future investments. Proper energy pricing was also highlighted as a critical factor to attract foreign and domestic private investment, the setting of prices was outlined as a key element of the 6th year plan energy strategy, with the per unit production cost of electricity expected to rise by 50-60% in the proceeding 2-3 years due to the development and installation of high cost liquid fuel-based generation plants. The prediction that the price tariff would drop off after 2014 due to the introduction of coal-based power plants was outlined.

Of note, a detailed section was included on institutional reforms in the power sector, and the requirement for continued and sustained reforms. Alongside the development of reforms to

organisations undertaking the operation of power generation and transmission, the following was highlighted as requiring change;

- Resource mobilisation, planning and implementation of least cost power expansion programs.
- Efficiency of billing and collection processes.
- Sector corporate governance.

This was to be achieved through the following objectives:

- Establishment of transparent corporate governance and a regulatory regime to provide performance-based incentives to sector entities.
- Attracting investments from the private sector to increase the generation capacity of the country and maintain an adequate and reliable power supply.
- Changing the prevailing culture of electricity pilferage and non-payment of electricity bills in collusion with utility employees.
- Establishing a performance driven and accountable corporate culture – a drastic change from the existing practices of the power industry.
- Addressing overall financial non-viability of the sector despite improvement in control over losses and bill collection, significant increases in power tariffs are needed to ensure that all sector entities achieve financial viability.

Regarding renewable energy in the plan, the use of biomass, solar power and wind was discussed as being in use, especially in areas without an existing gas supply. In addition, hydro-electricity, electricity generation using municipal waste and bio-gas production were also outlined as being in place.

In brief the plan covered: the formation of SREDA; the preparation of the Energy Conservation Act; the standardisation of energy saving electronic machineries; the installation of SHS's by IDCOL; four solar power plants (10-15MW); the BPDB has established an offshore wind power plant in Cox's Bazar on Kutubdia Island which produces up to 1-2MW of power; the setting up of solar panel factories by IDCOL, the use of solar panels to be made mandatory in three years; and the import of solar panels to be made duty-free.

2.5 GOB - PERSPECTIVE PLAN OF BANGLADESH 2010-2021: MAKING VISION 2021 A REALITY – 2012

In the perspective plan, chapter 8, which outlines Bangladesh's energy strategy, is of particular interest. It states that even though Bangladesh has a far lower Kilogram of Oil Equivalent (KGOE) than most other Asian countries, due to its recent rapid and greater economic growth there is already a serious energy crisis, and one which will only increase with the predicted increase in demand. It cites the 6th 5YP, as the current comprehensive strategy document and reasserted the need for diversification of fuels for generating electricity, and electricity trading as future developments. An interesting point to note is that the Plan states that the supply side options will be balanced with policies for demand management that conserve energy and discourage inefficient use of electricity.

Regarding the current electricity situation, the Plan highlights that this is not a new crisis, but a neglected one. The demand for power is increasing, but generation is not. With one area – the small private sector run power plants – being a development. The access to foreign funds for power sector reform was also highlighted.

Key Strategies:

- Diversify primary fuels such as gas, coal, and liquid fuels.

- Provision for dual fuel within power plants.
- Increase of power generation through the use of renewable sources.
- Implement nuclear based power generation.
- Finance power generation through public-private partnerships.
- Increase in sector efficiency.
- Price adjustment to ensure a balance between budget solvency and affordability for consumers.

Highlighted key constraints:

- Absence of adequate public and private investment in power generation.
- Absence of cost reflective tariffs.
- Absence of primary fuel supply chain.

Key objectives:

- Ensure power security.
- Make the power sector financially viable for economic growth.
- Increase sector efficiency.
- Introduce corporate culture to power sector entities.
- Improve reliability of the electricity supply.
- Economize use of natural gas, coal, and oil as the primary fuels for electricity generation.
- Ensure a reasonable affordable price for electricity by pursuing low cost options.

The plan also discusses the use of energy efficiency as currently existing in the form of energy saving bulbs, but surprisingly no other mention of means or approaches to energy efficiency. There is also the admission that energy conservation has become a critical issue for environmental and economic reasons, but until very recently no serious efforts had been made to take up and implement conservation programmes.

2.6 THE NATIONAL SUSTAINABLE DEVELOPMENT STRATEGY 2013

Based upon the long-term work on the 6th Five Year Plan (FYP) the National Sustainable Development Strategy (NSDS) was designed to meet the formidable environmental challenges that Bangladesh faces on the way to development. These challenges arise when the country's development efforts are made without proper recognition of consequential environmental impacts. Apart from domestic demands, the NSDS fulfils Bangladesh's commitment to the international community to formulate and implement a sustainable development strategy addressing environmental issues.

Regrading energy security the strategy defines the lack of coverage and quality of energy supply in being a key barrier to development of both industry and the agricultural sector. Accountability, transparency, and modernisation in the management of the power and gas sector need to be ensured. Illegal electricity connections have to be severed and system loss has to be minimised.

The document also aligned Bangladesh policy with that of the concept of the 'green economy' in achieving sustainable development in its three dimensions – economic, social, and environmental. Also covered was the Bangladesh Bank's undertaking of a green banking initiative which encouraged banks to finance green activities or projects such as renewable energy, green buildings, green products and materials, solid waste management, water management, and clean transportation.

Policy implementation was stated to require the import of capital machinery, technology and materials which are relatively costly. Therefore, raising production cost and potentially making products less competitive (globally), and cost of living higher. In this context the fact that Bangladesh

can ask development partners to promote access to and development transfer, and diffusion of environmentally sound technologies on favourable terms, was mentioned.

2.7 BANGLADESH'S INTENDED NATIONALLY DETERMINED CONTRIBUTIONS 2015

The policy document states that Bangladesh is adopting a two-fold strategy against climate change. The first and main focus is on increasing the resilience to the impacts of climate change, which are presently severely hampering the livelihoods of the population and are continuing to do so. Main issues include extreme temperatures, erratic rainfall, floods, drought, tropical cyclones, rising sea levels, tidal surges, salinity intrusion, and ocean acidification.

The second focus is the working towards achieving lower carbon emissions, in line with resilient development. The Intended Nationally Determined Contributions (INDC) therefore aims to put forth mitigation actions that Bangladesh can take to mitigate its growing emissions and play its part in efforts to limit global temperature rise to below 2^{o}.

The INDC[12] states that it includes both conditional and unconditional emissions reduction goals, for the power transport, and industry sectors, alongside further mitigation actions in other sectors. Bangladesh intends to implement its conditional emissions reduction goal subject to appropriate international support in the form of finance, investment, technology development and transfer and capacity building. The INDC of Bangladesh consists of the following elements:

Mitigation contribution defined:

- An unconditional contribution to reduce GHG emissions by 5% from Business As Usual (BAU) levels by 2030 in the power, transport, and industry sectors based upon existing resources.
- A conditional 15% reduction in GHG emissions from BAU levels by 2030 in the power, transport, and industry sectors subject to appropriate international support in the form of finance, investment, technology development and transfer, and capacity building.
- A number of further mitigation actions in other sectors which it intends to achieve subject to the provision of additional international resources.

Under a BAU scenario the specified sectors are expected to represent 69% of total GHG emissions by 2030. This is an increase from 64Mt$C0_2$e in 2011 to 234 Mt$C0_2$e in 2030. Quantified, in the unconditional contribution this accounts for a reduction of 12Mt$C0_2$e by 2030, and in the conditional contribution 36Mt$C0_2$e. Figure 2.1 below shows the predicted emissions increase, and contribution trajectories.

[12] This builds on the 'Bangladesh Climate Change Strategy and Action Plan' (BCCSAP), 'Renewable Energy Policy 2008', the 'Energy Efficiency and Conservation Master Plan' (EEC Master Plan), the 'National Adaption plan', the 'National Sustainable Development Strategy', the 'Perspective Plan' (Vision 2021), the 'National Disaster Management Plan', the 'Disaster Management act' , and the 6th and 7th 'Five Year' Plans.

Figure 2.1: GHG Emissions for Power, Transport and Energy Demand in the Industry to 2030

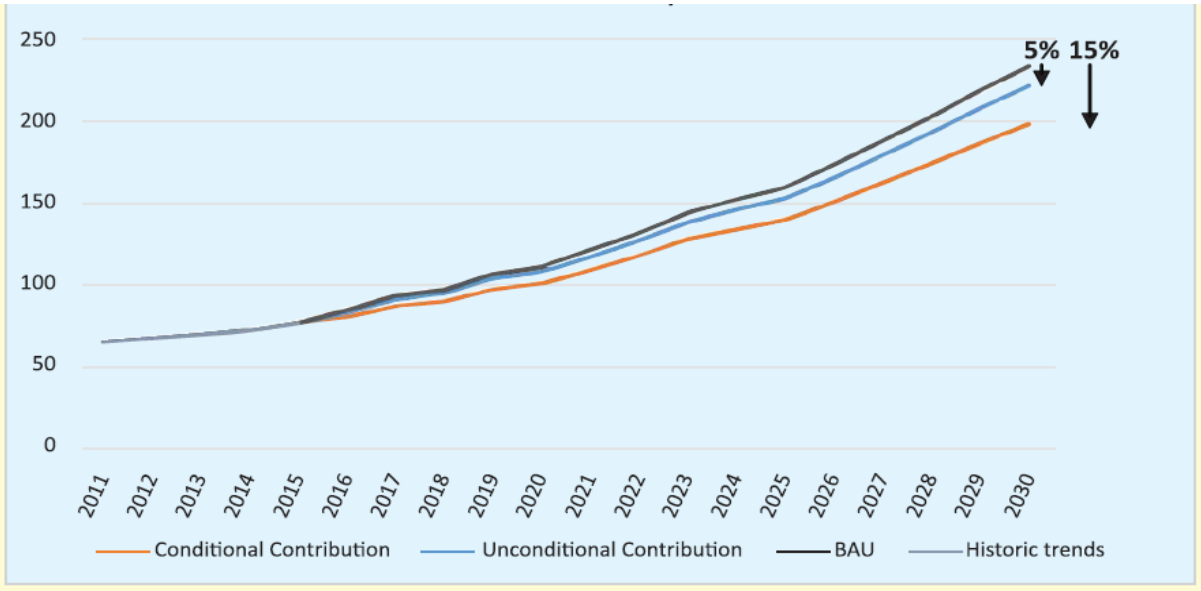


Table 2.2: Nationally Determined Contributions

Sector	Base Year (2011) ($MtC0_2e$)	BAU Scenario 2030 ($MtC0_2e$)	BAU change from 2011 to 2030	Unconditional contribution scenario 2030 ($MtC0_2e$)	Change Vs BAU	Conditional contribution scenario 2030 ($MtC0_2e$)	Change Vs BAU
Power	21	91	336%	86	-5%	75	-18%
Transport	17	37	118%	33	-9%	28	-24%
Industry	26	106	300%	102	-4%	95	-10%
Total	64	234	264%	222	-5%	198	-15%

2.8 THE SEVENTH FIVE YEAR PLAN (2015-2020)

The 7th FYP usefully for this paper has a sub-section exclusively designated for green growth strategy, under the environment and climate change chapter. In addition there are a number of other relevant points raised. The continued expansion of GDP in Bangladesh is the core theme that runs through this Plan.

Within the power and primary energy sector the area described by the Plan as having the most impressive performance was the expansion of the installed grid-based power generation and captive power capacity to 13,540MW in the financial year (FY) 2015. Grid based generation alone was 11,532MW. The populations access to electricity increased from 48% in 2010 to 72% in FY2017. The other main highlighted target indicator was per capita electricity generation which increased from 220KWH to 371KWH. Additionally, 500MW of power was added to the national grid based upon a purchase agreement with India.

The expansion of petroleum storage was outlined, with the increase by 268,00 metric tonnes through the implementation of four major projects with the objective of strengthening energy security.

Key energy points;

- Installed generation capacity of electricity to be increased to 23,000MW by 2020.
- Ensure a greater energy mix for energy security.
- Electricity coverage to 96 percent with uninterrupted supply to industries.
- Reduce generation supply side system loss from 13% to 9%.
- Completion of the following nigh priority mega projects; LNG terminal project, Rooppur nuclear power plant, Rampal coal power plant, Maturbari coal power plant.

Regarding the 23,000MW increase in electricity generation the figure is expected to be shared 40:60 by public and private sector. A key point highlighted was that the target is to provide electricity to almost all of the population with special emphasis on reliable power to productive sectors. As previously stated, the energy mix will be key to ensuring security of supply. Most of the new generation coming from coal-based power plants, with state of the art technology that minimises environmental impact and ensures high efficiency, and imported LNG. The accelerated exploration of hydrocarbons in the offshore and deep-sea areas would also be an area of growth.

Industrial gas users and captive generators had been also targeted to increase efficiency through cogeneration/tri-generation. Regional cooperation will also be pursued, with a particular focus on harnessing hydropower.

With regards to energy efficiency and renewable energy, the plan looks back to the priority given to the implementation of renewable energy, energy efficiency and energy conversation programmes in the 6th 5YP. A focal discussion point of the 7th 5YP is the targets set out in 2008 renewable energy policy (covered above), which envisioned 5% of total generation by 2015 and 10% by 2020. The recently established SREDA was also introduced and given a status of 'soon to be operational.'

Fiscal incentives were covered, with a target of renewable energy project developers and investors, with dedicated funding support being extended through government financial institutions like Bangladesh bank and IDCOL, as well as certain unnamed commercial banks. The extension of fiscal exemptions on certain renewable energy products was also highlighted, with; solar panels; solar panel manufacturing accessories; LED lights; solar operated lights; and wind power plants being used as examples. A special fund was claimed to be established to finance renewable based power plans, with some 4 billion BDT being allocated in FY2015.

The progress of solar energy – especially SHSs – was outlined in the plan with progress from the 6th FYP. The cost of the electricity was discussed as being high (compared to the grid), however it allowed electricity in areas that the grid is unlikely to reach. The progress of roof top solar was also outlined, and mini-grids and grid connected MW-scale solar PV plants being explored. A USAID project's discovery of 180MW of wind potential was covered.

Table 2.3: Renewable Energy Progress

Programme	Achievement
Solar Home System	150MW
Solar Irrigation	1MW
Roof Top Solar (Government Buildings)	14MW
Wind Energy	2MW

Biomass based electricity	1MW
Biogas based electricity	5MW
Total	173MW

Renewable energy progress during the sixth-year plan phase

The Energy Conversation and Energy Efficiency Programme was briefly discussed in the plan, with the statement that the government accorded it high priority during the 6th FYP. With the 'Energy Efficiency and Conversation Map' and 'Energy Efficiency Action Plan' being prepared, and the disclosure of the 'Energy Efficiency and Conversation Master plan' with support from the Government of Japan to be soon underway.

The fact that the Government put priority on the development of the power sector during the 6th FYP was disclosed. With success achieved in terms of installed capacity and associated supply of power, however the progress of diversifying and increasing the supply of primary fuel was very limited. An important point was made that the 7th FYP was looking to build upon the success of, but also address the implementation gaps if the 6th FYP. An example was made of not increasing generation at any cost, but the importance of long term competitiveness, and fiscal security being important for more efficient and lower cost generation. One big challenge that was highlighted was how the growing needs of primary fuel will be met in the next 10-20 years.

It is important to highlight the Plan's demand side management (DSM) objectives. The key point that the Plan defines in DSM is a proper pricing policy, in the terms of being an extremely cost-effective way of curtailing peak demand. The example of a DSM programme being used to better manage air-conditioning and other loads, the cost savings in terms of investment in new capacity would be much higher than the cost of implementing the DSM. The paper outlines a number of energy efficiency options that are shown in the below table.

Table 2.4: Energy Efficiency Options

Energy/ peak reduction potential per year		
Item	Energy (GWh)	Peak (MW)
Lights	253	116
Reflectors	400	183
Fans	140	32
Cooling	175	33
VSD motors	540	77
Total	1,508	440

The plan goes on to state that in recognition of the importance of energy conservation, the sustainable component of SREDA is entrusted with three main pillars (i) an energy management programme; (ii) an energy efficiency labelling programme; and (iii) an energy efficiency building programme. It also

states that SREDA will be empowered to offer financial incentive schemes for promoting the programmes within a range of 1,000MW during the 7th FYP.

In detail the energy management programme includes two main features, firstly a certification mechanism for energy managers and energy auditors, and secondly the designation of large energy consumers in industry and building sectors. Within the second category it was planned that that would have obligations to nominate energy managers, to implement management for energy saving, to prepare and submit annual energy reports and improvement plans to SREDA and implement periodical energy audits.

In detail the energy efficiency labelling programme intended to promote the sales of high efficiency products in the national market. These products would primarily be home appliances, such as air-conditioners, fridges, freezers, fans, and lighting. Due to the lack of widespread uniform testing facilities the programme would initially start on a voluntary basis, where manufacturers and importers can join the programme if they have in house laboratories or they can outsource to 3rd party laboratories.

The energy efficiency labelling programme is planned to run in tandem with the planned 'new national building code' and 'energy efficiency building guidelines'. The under-development 'green building code'. The long-term plan was defined as being the 'green building code' which was to be a voluntary programme to be used as a guideline for the design and construction of upper-grade energy efficiency, conservation, and low environment impact buildings.

There is an important final word included in the policy paper, stating that although some of the options have already started in full scale, full implementation requires clear incentive mechanisms. A range of incentives has been proposed including preferential taxation, subsidy and low-interest financing. Concerted efforts will be needed to make SREDA fully functional with a clear mandate to implement the Government's power conservation strategy.

2.9 SREDA ENERGY EFFICIENCY AND CONSERVATION MASTERPLAN UP TO 2030

SREDA laid down three energy efficiency and conservation programmes to be targeted at large energy consuming entities and equipment in the industrial, residential, and commercial sectors. These are detailed in the following Table 2.5.

Table 2.5: Energy Efficiency and Conservation Programmes

Programme	Target
Energy Management Program	Large Industrial Energy Consumers
Energy Efficiency Labelling Program	Residential Customers
Energy Efficiency Buildings Program	Selected Buildings

With the adoption of these three programmes the Masterplan predicts between 2015 and 2030 a total of 5.3Mtoe/year of energy savings, totalling 100Billion BDT/year could be achieved. In addition, the masterplan sets out the following programmes:

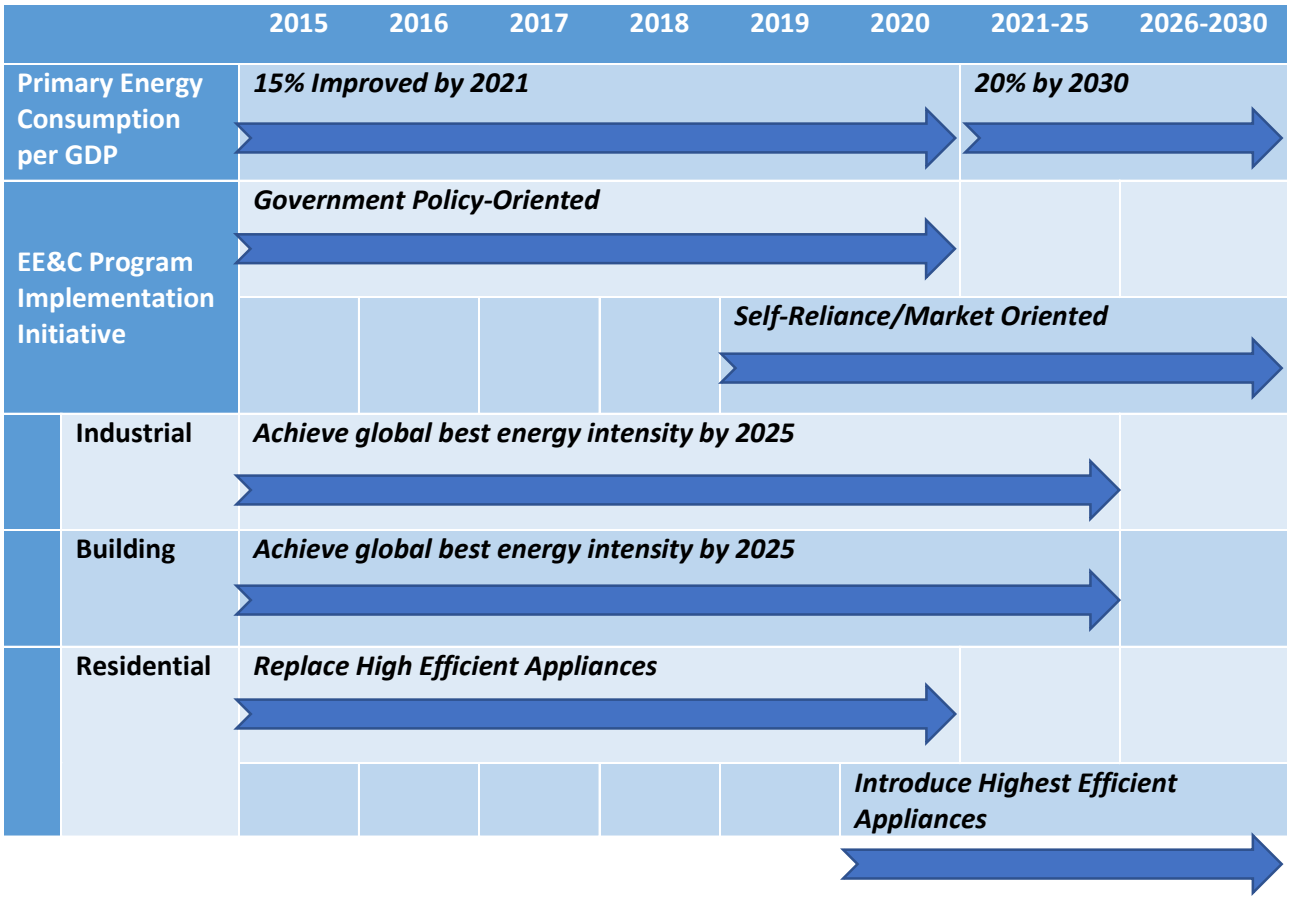
Table 2.6: Energy Programmes

Programme	Target
Energy Efficiency and Conservation Finance Programme	Private Companies
Government Initiatives (ISO:14001)	Government
Energy Consumption Data Collection	Government
Global Warming Countermeasure	All

These programmes have been designed to provide energy efficiency awareness amongst power end users and boost investment in EE products. With carefully designed low interest loans, subsidies and preferential tax to financially incentivise end users to buy into EE appliances and equipment.

Another key point highlighted is the requirement for periodical monitoring and data collection of indicators on the energy consumption in various sectors, through a web-based portal. This is outlined as being a key factor to the success of energy efficiency and conservation implementation and enabling the appropriate PDCA cycle of the policies in entirety. The chart below outlines the timescale of the masterplan's actions.

Figure 2.2: PSMP Action Timescale



2.10 THE POWER SECTOR MASTER PLAN (PSMP) 2016 (VISION 2041)

The PSMP is a document that aimed to assist the Bangladesh Government in formulating an extensive energy and power development plan up to the year 2041. It highlights the country's desire to become a high-income country by 2041, so the quantity and quality of the power infrastructure must also reflect that status. Due to the upcoming depletion of domestic gas the Plan highlights the issues of sustainable development harmonising with economic optimisation, improvement of power quality for the developing high-tech industries and the operation and maintenance of power plants to be all addressed holistically. It should be noted that the current form of the paper is not set in stone and further development is likely to take place.

The factor of energy subsidies was also highlighted as being a tough challenge due to the concern that a drastic increase of fuel and energy prices may trigger another negative effect on the national economy. A meticulous analysis is required to find the best route to attaining the balance of energy sustainability and economic growth.

The 2016 version of the PSMP covers why that the energy development predicted in the 2010 PSMP is not on track. It cited various assumptions about expected sources of base load energy having changed, and the vast increase of oil based rental power plants, and the lack of control over their power production. This has created a very unstable production network with no real central control to dictate country wide production schedules.

The plan lays out five key goals of the vision 2041:

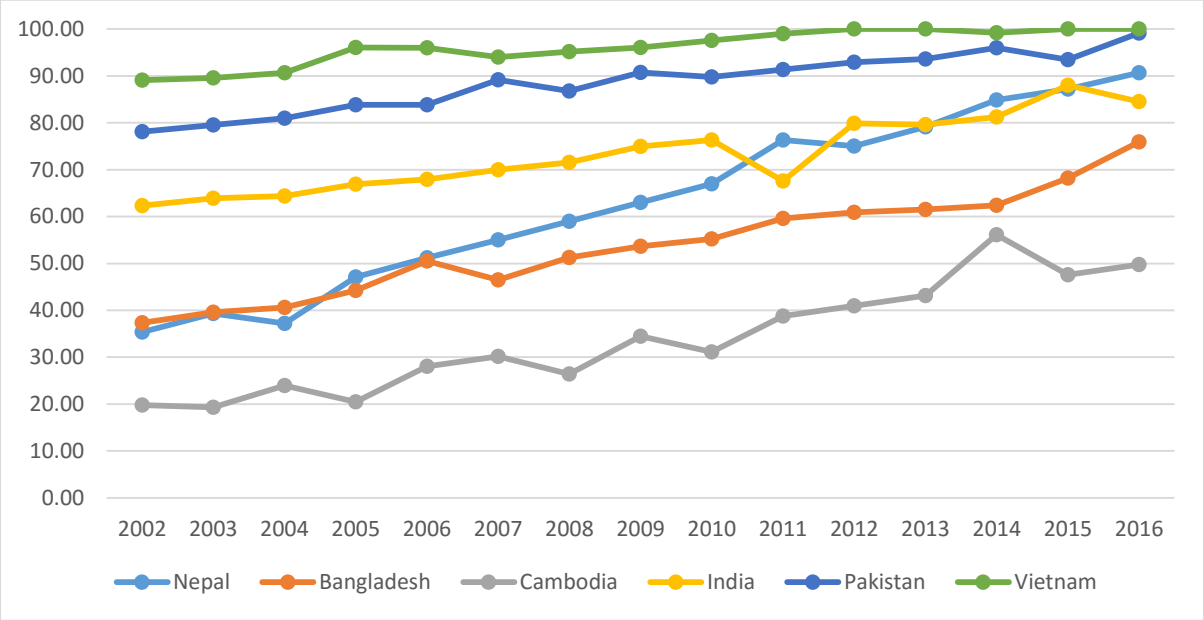
- Enhancement of imported energy infrastructure and its flexible operation.
- Efficient Development and utilisation of domestic natural resources (gas and coal).
- Construction of a robust, high-quality power network.
- Maximisation of green energy and promotion of its introduction.
- Improvement of human resources and mechanisms related to the stable supply of energy.

2.11 COMPARATIVE STUDY OF OTHER COUNTRIES POLICY AND PROGRESS

South Asia and Southeast Asia have both experienced strong growth and rising energy demands leading to a need for energy efficiency amongst these countries. The political will for energy efficiency policies has risen resulting in most countries developing their own national energy efficiency policies. Energy efficiency is seen as the quickest way to meet rising energy demands. Contrary to popular belief amongst policy makers that the inclusion of energy efficiency interventions could hamper economic growth, it has instead been shown that energy efficiency in fact improves total productivity. According to a study by Geller et al. in 2006 countries within the OECD would have used 49% more energy in 1998 without energy efficiency interventions.

Within South Asia and Southeast Asia, supply-side losses pose a serious problem. This includes power plants with decreased efficiency and losses in the transmission and electricity delivery systems. On the demand side, better energy conservation and management are needed. Wide spread awareness is necessary in achieving this. Though these countries are still in the developing stages, many like Bangladesh have yet to reach 100% access to electricity for its population. Countries such as Vietnam and Pakistan have done so. The graph below shows the growth in access to electricity in Bangladesh, Nepal, Cambodia, India, Pakistan and Vietnam.

Figure 2.3: Percentage of Total Population Access to Electricity



In spite of being developing economies, they have all invested in producing renewable energy. The following graph shows what percentage of renewable energy makes up the total electricity production in Bangladesh, Cambodia, India and Nepal. From the graph Nepal is almost 100% reliable on renewable energy. Bangladesh remains at the bottom of the with barely 1.5% share of renewables making up total energy production. The government hopes to raise this figure to 15% by 2030 with several new projects in the pipelines.

Figure 2.4: Renewable Electricity % Share in Total Electricity Share

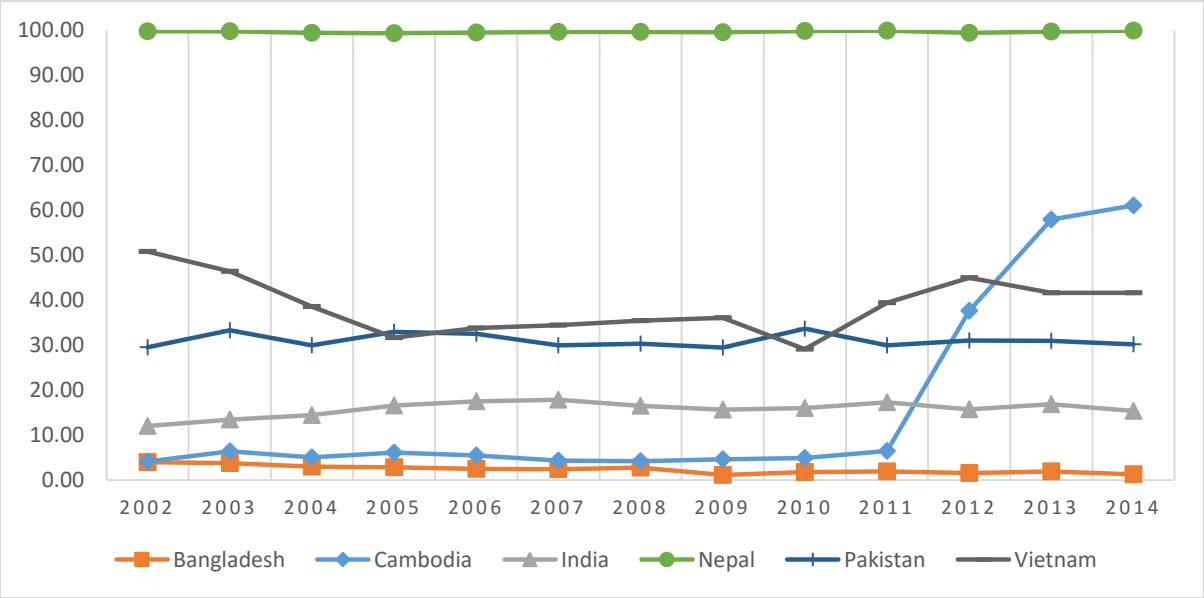


Table 2.7 Comparative Study of Energy Policy, Efficiency and Auditing in Bangladesh and its Peers

Country	Energy Policy	Energy Efficiency	Energy Auditing
Bangladesh	National Energy Policy (amended in 2004) • Formulated in 1996 to address Millennium Development Goals Amended in 2004. • Government Vision: to provide affordable and reliable power to all by 2020	Energy Efficiency and Conservation Master Plan up to 2030 • Increase public and private investments in renewable energy • Increase the percentage of renewable energy supply in total power output	Energy Audit Regulations for the Government of Bangladesh 2016 • Bangladesh has recently finalised its energy audit regulations and will begin the implementation phase by auditing 113 industries that they have chosen as designated energy consumers, i.e. their energy consumption is above the threshold.
Pakistan	National Power Policy 2013 • Designed to aggressively sale up power generation to meet the needs of the country	National Energy Efficiency and Conservation Act 2015 • Addresses both auditing and efficiency. • Authority is given to the Board formed to oversee the implementation of the ACT. • Allows the Board sovereign authority to approve energy efficiency standards and ensure their enforcement and compliance.	National Energy Efficiency and Conservation Act 2015 • The Board has the authority to order energy audits by accredited or designated energy auditors on any building, facility, or industry to address energy conservation issues.
Nepal	National Energy Strategy of Nepal 2013 • Designed to address the challenges and the utilisation of energy resources in a sustainable manner	Nepal Energy Efficiency Programme • Programme aims to reduce the supply gap • Decrease dependency on fossil fuels • Reduce carbon emissions • Seen as key to achieving energy security	Office of Energy Services established in the Department of Industry in 1995 • Detailed energy efficiency audits in some industries and hotels • Energy efficiency study on boilers • Awareness program in energy efficiency • Training for energy auditors • At present energy audits are not mandatory in Nepal
Vietnam	Vietnam National Energy Development Strategy to 2020	Under the National Energy Efficiency Programme: National Goals on Energy Efficiency Improvement	GIZ is supporting Vietnam in the development of a guidebook for energy audits

Country	Energy Policy	Energy Efficiency	Energy Auditing
	with an outlook to 2050 • To ensure national energy security • Supply high quality energy for socio-economic development • Use domestic resources reasonably and efficiently • Diversify energy investments and business models • Develop a competitive energy market • Promote new and renewable energy resources	• Reduce national energy consumption • Application of energy management systems within all industries • Introduction of high energy efficiency equipment • Raise awareness on energy savings • Optimizing transport	
Cambodia	Electricity Law of the Kingdom of Cambodia 2001 • Governs the electric power supply and services throughout the Kingdom • protection of the rights of consumers to receive reliable and adequate power supply services at reasonable cost • Create favourable conditions for investments • Promote private ownership of power providing services	Development of a National Energy Efficiency Policy Strategy and Action Plan • Rural electrification • Biomass • Energy efficient building codes • Energy efficient labelling	Development of a National Energy Efficiency Policy Strategy and Action Plan • Energy audits will be conducted under this action plan
India	National Energy Policy (NEP) 2040 • Draft stage defines energy	Energy Conservation Act 2001 • Empowered the Government to regulate	Energy Conservation Act 2001 (amended 2010) • Amended version included a provision for energy audits

Country	Energy Policy	Energy Efficiency	Energy Auditing
	strategy up to 2040 • Aims for uninterrupted power to 100% of the country	energy efficiency and energy conservation • Requires large energy consumers to maintain energy consumption norms • New buildings must adhere to Energy Conservation Building Code • All appliances must meet energy performance standards and display energy consumption labels • Created the Bureau of Energy Efficiency (BEE) to implement the provisions of the Act	• Government has assigned energy-intensive industries and other larger consumers as Designated Consumers, for which specific regulations are adopted on energy efficiency • 700 companies from nine energy-intensive sectors have been identified as Designated Consumers, including 7 sectors in industry • Companies in these sectors with an energy use over a certain threshold are subject to ECA regulation • It is mandatory for all designated energy consumers to have energy audits carried out by an accredited energy auditor, to designate or appoint an energy manager and to report annually on energy consumption

3. ENERGY AUDITING POLICY REVIEW

3.1 INTRODUCTION AND OUTLINE OF THE DEVELOPMENT OF THE ENERGY AUDITING FRAMEWORK

Energy efficiency is key to ensuring a safe, reliable, affordable, and sustainable energy system for the future. It is the one energy resource that every country possesses in abundance and is the quickest and least costly way of addressing energy security, environmental, and economic challenges[13].

As the importance of environmental issues within society has risen over the past decade, the value of effective environmental management has also become more recognised within commerce and business as a key tool in amongst other things developing a streamlined energy efficiency methodology. Notable for Bangladesh, environmental auditing in recent years has transformed to include global warming, resource depletion, recycling and transportation issues as key factors within its mechanisms. The background to the energy auditing framework was born out of the SREDA energy masterplan, and the institution itself. From the masterplan SREDA defines itself as being established in 2012 by the Bangladesh Parliament as a national nodal organisation for promoting demand-side energy efficiency and conservation in the country[14].

Energy audits first gained popularity in the United Stated during the 1973 oil crisis when several Arab states put an embargo on oil exports. Energy audits were a way to deal with the hike in prices. They subsequently helped managed and conserve energy and increase energy efficiency. The changes which began at that time stopped the incremental demand for energy which would have occurred otherwise. Taking into account the increased prosperity of the Nation the energy consumption would have doubled. These changes have had positive impacts on building, transportation and industrial sectors.

Energy auditing should be based on the following guidelines: a) be based on up-to-date, measured, traceable operational data on energy consumption and (for electricity) load profiles; b) comprise a detailed review of the energy consumption profile of buildings or groups of buildings, industrial operations or installations, including transportation; c) build, whenever possible, on life-cycle cost analysis (LCCA) instead of Simple Payback Periods (SPP) in order to take account of long-term savings, residual values of long-term investments and discount rates; d) be proportionate, and sufficiently representative to permit the drawing of a reliable picture of overall energy performance and the reliable identification of the most significant opportunities for improvement. Energy audits shall allow detailed and validated calculations for the proposed measures so as to provide clear information on potential savings. The data used in energy audits shall be storable for historical analysis and tracking performance.[15]

An energy audit is performed to accomplish an effective energy management program designed to improve the energy efficiency and reduce energy operating costs. The audit takes a detailed look at how a facility uses energy, what it pays for that energy, and recommends changes in operating practices or energy consuming equipment that will cost effectively save money on energy bills. Energy audits are often referred to as an energy survey or an energy analysis, so that it is not confused with a financial audit. Overall it is a positive experience with significant benefits to the energy consumer.

[13] https://www.iea.org/topics/energyefficiency/
[14] Energy Efficiency and Conservation Master Plan up to 2030. SREDA 2015
[15] EU, minimum requirements for energy audits 2015

An Energy Audit (EA) is an inspection survey and analysis of energy flows, for energy conservation in a building, process, or system to reduce the amount of energy input into the system without negatively affecting the outputs. In commercial and industrial real estate, an energy audit is the first step in identifying the opportunities to reduce energy expense and carbon footprints[16]. In the industrial segment of energy efficiency, energy auditing acts as a well-defined tool for assessing energy saving opportunities. Industrial sectors rely heavily upon energy resources to provide power and steam to convert raw materials into usable products. The way in which energy is harnessed within industrial processes is a key factor for technical professionals in moving towards sustainability. Energy auditing is one of the most comprehensive methods of achieving energy savings in industry so that wasteful consumption of energy will be minimised[17]. Alongside the savings, an EA is widely considered as one of the most cost-effective ways to improve energy efficiency. The term 'low hanging fruit' fits nicely here, as in the most cost effective easiest to access measure in reducing demand on the climate, grid and economy.

A leading body in the field, the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) outline the four levels of analysis which are generally accepted.

Table 3.1: ASHRAE Four Levels of Analysis

Level	Analysis	Detail	Output
1	Benchmarking Analysis	Preliminary whole building energy use analysis based using historic utility costs and comparison of similar buildings through a benchmarking paradigm.	Rudimentary audit (Will however illuminate through benchmarking whether further analysis is required).
2	Walkthrough Audit	Initial on the ground analysis, using visual verification, study of installed equipment, operating data, utility costs and benchmarking.	Identifies low cost improvements, and a list of conversation measures.
3	Detailed/General Energy Audit	Using data from a pre-audit, this audit consists of an energy use survey, detailed analysis of the facility, a quantitative evaluation of ECOs/ECMs selected, often involving advanced on site-measurements and sophisticated computer modelling.	Detailed analysis of improvements of all levels of an organisation.
4	Investment Grade Audit	As the detailed audit but with the additional focus on financial concerns and return on investments, by rating energy and non-energy investments on a set of financial criteria. Often involving a complete engineering study.	An in-depth analysis of an organisation using financial criteria to measure factors against each other.

[16] https://en.wikipedia.org/wiki/Energy_audit
[17] A methodology for the energy scan of SMEs. Cagno, E Trucco, P Trianni, A Sala 2010

The development of the energy audit regulations in Bangladesh for SREDA was completed by GIZ acting as the implementing agency, under funding from DFID's Providing Clean Energy to the Rural Poor of Bangladesh Programme. This programme has been and continues funding other capacity development of SREDA including policy and regulation development towards the promotion of energy efficiency in Bangladesh.

The functions of SREDA in relation to the proposed energy audit framework are listed below:

I. To assist the Government in making and implementation of energy efficient building code;

II. To make regulation for qualification and competency of energy manager and energy auditors and selection of accredited energy auditor firm;

III. To coordinate the implementation activities of energy efficiency and conservation in government, semi-government and autonomous bodies and create commercial market for sustainable energy in private sector through demonstration;

IV. To assist Government in making necessary laws, rules, regulations for sustainable energy development;

V. To take necessary measures to declare designated consumers of different energy consumers and category of consumers;

VI. To encourage commercialization of renewable energy and energy efficiency activities in private sector through implementation of pilot project;

VII. To assist the Government to formulate, update and implementation of policies made under this Act, including revision of renewable energy policy.

In the early stage project documents demand side efficiency was highlighted as an important measure in reducing energy consumption at industrial, commercial and other sectors while ensuring at least the same level of service. The study was to be subdivided into five components:

Table 3.2: Energy Auditing Components and Details

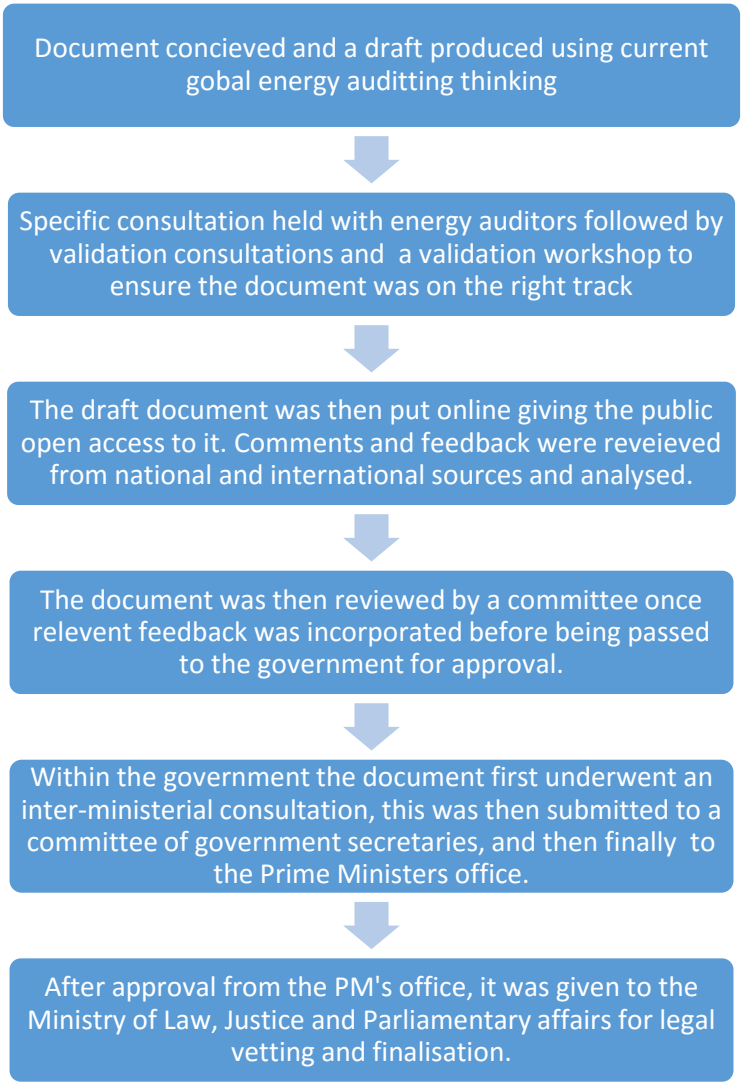
Component	Component Detail
1. Energy auditor qualification certification	Study existing EA certification in comparable countries, propose minimum qualification and experience required for energy auditors, development of curriculum, selection of training institutions, determine the responsibilities of energy auditors.
2. Provision of energy auditing industries	Two broad categories in which industries will be classified, Mandatory and Voluntary. Propose achievable timelines for EA to be voluntary and then mandatory, preparation of energy audit reporting standard for industries, propose phase wide reduction targets, recommendation of incentives and penalty mechanisms.
3. Large energy consumers- accreditation and appointment of energy managers	Set the criteria for consumer classification, set the criteria and responsibilities for the energy manager, set when consumers appoint energy managers and their reporting format.
4. Monitoring and verification	Recommend monitoring and verification, and reporting templates for industries.

5. Framework condition for energy services company limited (ESCO)	Desk review of ESCOs in comparable countries, framework for ESCO operations in Bangladesh, Accreditation procedure and experience for ESCOs, ESCO responsibilities.

A key factor in the early stages of the framework is the designated consumers and the sectors selected for initial auditing. According to SREDA this was decided on by using the Environment Conservation Rules (ECR 1997), and stakeholder consultation from the industrial, residential, commercial, governmental, utility, and academic sectors.

Shown in figure 3.1 is the process that was followed to ensure ongoing content quality control for the document to reach is current state. This information was supplied by SREDA.

Figure 3.1: Energy Auditing Framework Formulation Process.



At the second phase shown in Figure 3.2 above, there was a validation workshop held with a selection of stakeholders in August 2016. The full transcript will not be included but drawn from it are the following interesting points. The names and positions of the stakeholders have been redacted for data protection reasons. Also included are the responses of the representatives of SREDA and the GIZ consultants tasked with designing and writing the framework.

Table 3.3: Questions from the Consultation

Question	Response (if answered directly)
The two years' experience required for candidates to sit the energy auditor exam is not sufficient and should be increased to four years	A separate consultation will be undertaken for qualifying for the exams, and exam procedure.
The exam which was set at two hours long, should be increased to four hours as is the international standard	As above
A point of concern was raised about SREDA becoming an accreditation institute due to conflicts of interest.	SREDA will only mange certification processes but not the accreditation
It was questioned whether the designated consumers were selected based upon energy consumption in TOE or specific energy consumption	Criteria for selection of the DCs are according to the EE and C masterplan 2030
Would monitoring and verification be completed by the same person	Monitoring and verification will be undertaken by a different person / entity.
A point of concern over there being no provision for extension of energy auditing deadlines.	Not answered directly
Does the framework deviate from the Energy efficiency and conservation masterplan	Not answered directly
Can utility providers provide funding for EE projects for end users.	Not answered directly
The fine of 100,000 BDT seems too high	Not answered directly

The main theme questions from the stakeholders can be seen to be regarding the quality of the auditors, the auditing reporting process and ensuring that the process is fair. The overwhelming proportion of questions asked were positive in nature, rather than critically negative.

3.2 THE ENERGY AUDIT REGULATIONS 2016 DOCUMENT CRITICAL ASSESSMENT

The final version of the Energy Audit Regulations 2016 is dated 6 October 2016 and is currently being finalised and vetted by the Ministry of Law, Justice and parliamentary affairs. In chapter 1 (ii) it is stated that the regulations shall come into force on the date of their publication in the official gazette.

In the document there are a number of technical terms used that are important to firstly clearly define.

- Accredited energy firm: An organisation that is enlisted by SREDA that has under it a number of accredited energy auditors.
- Authority: Refers to SREDA
- Designated Consumer: Is an organisation that has been selected by SREDA to be the target of the initial phase of energy audits.

- Energy Manager: The certified energy auditor appointed by the designated consumer for performing the energy management activities within the organisation.

The policy document is broken down into these main sub headings which will be analysed in turn, these are shown in the table below.

Table 3.4: Sub-sections under the Auditing Framework

Framework Sub-Section	Detail
Certification of energy manager and energy auditor	The skills and qualifications that will define who can become and energy auditor
Accreditation of energy auditor	The mechanism for accrediting and managing the auditors
Responsibility and submission of report by designated consumers	The responsibility that the designated consumers have regarding the process
Manner of energy auditing	Process of reporting and construction of the audit
Monitoring, Evaluation and Reporting to the Government	Form in which continued reporting to the Government will take

For each sub-section the key points of interest and any stand out positives or negatives will be highlighted. Due to the depth of some of the sections, the critique of the whole sub-section will not be discussed in this paper.

3.3 CERTIFICATION OF ENERGY MANAGER AND ENERGY AUDITOR

There are effectively two levels of auditor outlined in the framework. The initial level is the Certified Energy Auditor (CEA). A person can be designated a CEA if (i) he/she has passed the examination of energy auditing certificate (EEAC), and (ii) if he/she has been issued a certificate to that effect. The defined role of the CEA is to conduct energy audit activities in small and medium level energy intensive organisations, as well as this a CEA is eligible to be appointed as the energy manager within the designated consumers.

4.2 Defines that it shall be the Accredited energy auditor (defined below) who should be allowed to conduct the mandatory provision of energy auditing within designated consumers - unless regulation 26 is used – which basically states that under special circumstances the authority may relax the enforcement of regulation 16 and allow CEA conduct the EA on designated consumers.

There is no explanation what the special circumstances would be, or a limit to the amount this may happen which is of a minor concern. However, having a flexibility in rare circumstances is an effective and common regulatory mechanism.

Regulation 5 defines the eligibility for taking the Examination of Energy Auditing (EEA) with a limited educational qualification in Engineering – with a variety of engineering disciplines – and a minimum amount of work experience. 5.2 allows the flexibility of these minimum requirements if the authority deems it necessary. Once again this is a sensible addition, although an expansion of the circumstances under which this would be necessary would have been prudent.

The examination is to be conducted in English, which is of critical importance to stay in line and connect to global EA methodology.

Regulation 12 states that the certification will be valid for a period of 5 years at which point it will be renewed.

3.4 ACCREDITATION OF ENERGY AUDITOR

As outlined above there are two levels of Energy Auditor, the second level being Accredited Energy Auditor (AEA). The entry point for this tier is that the person is (i) a CEA, and (ii) has experience of conducting five energy audits in the last three years.

Regulation 20 outlines the terms under which the AEA can operate, and notably 20.5 states that a listed AEA firm can intake students as apprentices up to a maximum of 5 per auditor which has the dual purpose of working as qualification on entry to becoming a CEA. The discussed potential removal of the AEA above puts this into question, and removes the important tiering or responsibility, and self-regulating experience-based accreditation, which is a large step backwards if enacted.

Regulations 21-25 define management of the list of accredited EAs. The general theme is weighted in ensuring good professional conduct and complying with the regulations, and if found to be inadequate to be immediately removed. The seriousness of the enforcement is a positive factor.

3.5 RESPONSIBILITY AND SUBMISSION OF REPORT BY DESIGNATED CONSUMERS

The obligations of the designated consumer as laid out in the framework are outlined below:

i. To appoint an energy manager for their organisation from amongst the CEAs.
ii. Comply with energy consumption norms as set by the authority.
iii. Undertake energy audits with the timespan as defined in the framework.
iv. Provide necessary documents to the accredited EA.
v. Ensure reporting to the authority in the timespan as defined in the framework.
vi. Submit reporting of the EA during the undertaking of the audit.
vii. Permit the auditor or representatives of the authority to enter the premises and cooperate fully with the energy auditing processes.

All of the global standard bases are covered by the framework regulations; however, the wording is a little unclear in this section. It is critical when developing a positive relationship with the private sector especially at this early stage to be very clear with what is expected and required.

Regulations 28-31 define the time scale of activities including; the submission of a baseline report; the completion of the first audit; the interval between subsequent audits; the compliance report; and the yearly progress report. Each of these are within a reasonable but not ambitious timespan in regards to global EA best practice.

3.6 MONITORING, EVALUATION AND REPORTING TO THE GOVERNMENT

The framework states that the authority is obligated to prepare a National Annual Report on Energy Conservation and which be submitted to the government. In addition, the authority shall compile and analyse the reports submitted by the AEA's and prepare an analytical report based upon these. Included in the report; a summary of data on energy consumption and conservation activities in each sector; the status of major energy conservation programmes implemented by the Authority; and the status on implementation of government programmes.

Regarding the designated consumers 36.4 states that the authority shall monitor the implementation status of the energy saving options as recommended by the EA. 36.5 states that the authority will take steps for designated consumers to facilitate them to implement the recommendations included in the audit report.

For other groups 36.5 defines that the authority shall arrange workshops, seminars, coordination, meetings with consumers, and initiate mechanisms to incentivise energy saving through energy auditing.

Regulation 36.6 outlines the development of a web-based acquisition system within SREDA with the purpose of accessing energy data quickly in a centralised format. This is widely seen as being a critical step within Bangladesh, and through conversations had with parties for the research for this paper it is understood to be an area which is essential to EE progression. Consistent, quality, verifiable data in this field is an issue, and without a better system of collection this will remain so, hampering development of effective EE mechanisms. The importance of quality data cannot be understated in this field as the complexities of energy mechanisms and their systems are significant.

Although this sub-section covers the rudimentary steps in data collection, a more advanced and tailored outline of how the authority was going to; analyse the data; ensure that the auditors were compliant; set targets and for the number of completed audits; present the data to parties other than the government would have been useful.

3.7 RECENT UPDATE TO THE ENERGY AUDITING FRAMEWORK

During the writing of this paper there has been a number of changes to the energy auditing framework than those outlined in the above synthesis by the Bangladesh Ministry of Law, Justice and Parliamentary Affairs (MINLAW). The information has been passed to our team by a member of SREDA so we are going to take it as written. As does frequently occur this might not be the final version, but at this time of writing this is the most up to date information we have. Below are the three key amendments:

- Designated certified energy auditors no longer exist, nor do certified energy auditors. Anyone having completed the exams will be referred to simply as an ‘energy auditor’.
- The Energy manager requirement for all companies is no longer a mandatory clause. It is just a recommendation. The Energy Auditor Regulations (EAR) still outlines what the job entails, but it will no longer be compulsory.
- The provision of a fine for failure to comply and submit an energy audit has been removed. This maybe added on later once the project begins.

The first point effectively removes the skill barrier required for selecting which auditor can undertake the more complicated audits for the larger organisations. This is likely to remove safeguards for ensuring correct compliance and producing quality audits in the long run.

The second point removes what would have been an effective tool for ensuring the audit process had had a lifecycle with safeguards after the initial report was produced. Now there would be reports produced at certain points over the following years, but in between there are no safeguards to ensure that organisations are correctly collecting data and are benefitting from the gathered information.

The third point softens the effect of the programme as a whole, as without a penalty for non-compliance there will be a number of organisations who will not participate. This is an issue as organisations who are not aware of the benefits of energy efficiency, or who are aware of their present inefficiency but for whatever reason do not want to remedy will be given an easy route to not engage.

The motivations for organisations to engage with the EAR framework are critical to its success, and having a financial penalty is a key way of ensuring this.

3.8 SPECIFIC OUTLINE OF THE BARRIERS OF THE EXISTING AND FUTURE DEVELOPMENT OF THE ENERGY AUDITING FRAMEWORK

At the time of this papers writing, the EAR framework has been approved by the government and is at the final stage of the process, the publishing at the BG press. Therefore, the framework is expected to be fully operational if not being implemented in real terms by the autumn of 2018.

As outlined in the framework critique above there have been a number of important amendments made by MINLAW which have notably softened the impact of and the reach of the framework. Of particular concern is the removal of the tiering of the energy auditors, opening up issues of report qualities. With a tiered system the more complex larger companies would have been only undertaken by the more experienced auditors, and although this might still be the case, the way is open to less experienced auditors working on them. The integrity of the entire framework is obviously at stake if sub-par reports are produced providing inaccurate organisation analysis which is planned to be used for EE recommendations and benchmarking amongst others.

The downgrading of the requirement to have an energy manager to it simply being a recommendation, and the removal of fines for not undertaking energy audits are both problematic as they remove the ongoing compliance and the ability to punish non-compliance using a familiar device. The amendments by MINLAW show that they are not convinced that the positive EE outcomes of the programme are not convincing enough to give SREDA the fairly limited powers that they requested. There is essentially little reason for organisations who do not see the benefits of the framework to participate. This has to be said, is not the case for many, as has been shown there is a lot of interest in the development of EE and some if only a little, in emissions reduction. However, with the current level of understanding in Bangladesh in this field, the easiest and quickest way of encouraging EE and sustainable energy development is through the use of financial penalties.

Regarding the compulsory energy manager this effects the realistic potential of future EE development. As rather than having a constant guiding presence from the commencement of the first audit, now there will only be a period within the required energy audit every 5 years. This may not prove to hinder the potential of EE for some organisations, but it undoubtedly raises barriers to progress for others.

It is difficult to know the motivations of MINLAW in the amendments they have made, but it does feel as though there may be a lack of understanding regarding the benefits of EE. From a perspective of global energy audit best practice and experience, softening the framework's tone and removing some of its most pressing incentives are not a positive early step. The initial stages will be critical in ensuring that firstly the framework gains a good reputation and secondly that it has the authority behind it to start the change required for EE to be successful. The resistance to allowing this from the government, as you can decipher from the framework amendments, is troubling but understandable due to the shift from traditional thought that EE frequently demands.

Another factor that has been experienced by the authors and was bought up in our KIIs is access to the DC's organisations initially, and then subsequently the wider sectors. There is a high level of opacity when it comes to data from private companies in Bangladesh. There is a surprisingly small amount of quality verifiable corporate data on organisations, due to this very issue. It is understood to be a very significant barrier in the success of the programme as transparency is crucial, as a high level of trust being built up between SREDA and the consumer is key. This is even more pressing now

that the necessity to have energy managers has been removed, as in that case the designated person would have been already working for and trusted by the organisation. It should be pointed out, that there will be a number of organisations who will be keen to open up their doors to the framework, who have already invested in EE or green energy, it is the other end of the spectrum that is a concern. It is a known scenario in Bangladesh for organisations to prefer to pay fines or bribes rather than to comply with legislation, or simply holding up the process with full knowledge that the stretched legal system would take years to deal with them at which point they soak up the fine. The issue of enforcement of the first batch is critical in laying down a benchmark of how non-compliance will be dealt with. Once again, the recent amendments do not help in this regard.

Although Bangladesh has some very good educational centres of excellence in the fields of renewable energy and sustainability, the EAR is operating at a sophisticated level, which requires a level of tailoring for the country it is designed for. It is certainly not a one size fits all scenario, so you cannot simply copy and paste from one country to another as they are only effective if targeted at the right consumers, especially initially. The human resource level in Bangladesh needs to be raised to help develop EE within the country. Currently there is not enough national knowledge and experience as it is a new field at the national level. This will of course develop over time, but there needs to be a shared learning across the private sector, government and educational institutions to help facilitate this as efficiently as possible.

4. EXISTING BARRIERS TO THE IMPLEMENTATION AND ENFORCEMENT OF ENERGY POLICY AND LOGICAL NEXT STEPS

4.1 ANALYSIS OF THE BARRIERS DISCOVERED THROUGH KII INTERVIEWS AND THE DISSEMINATION EVENT

4.1.1 ANALYSIS AND IDENTIFICATION OF SPECIFIC BARRIERS TO THE DEVELOPMENT OF CERTAIN INDIVIDUAL OR BRANCHES OF ENERGY POLICY RELEVANT TO THIS STUDY

The EE scenario in Bangladesh has been analysed fairly extensively previously. Effective implementation is the challenge. Implementation has been weak due to a combination of challenges.

Political Economy challenges

- The biggest challenge remains a complex and non-uniform present scenario of subsidised and cross subsidised energy pricing.
- Preference of energy usage still relying heavily on the use of gas where in fact the future is not looking good for the continued heavy industrial use, to the imminent shortages so a change of energy use built within an objective country wide system is required with the diversification of energy sources to be an absolute for certain industries.
- The idea that energy efficiency / green growth will lead to an economic slowdown needs to be revaluated. If anything, the culling of short-termism that is the scourge of the modern world, into one of a more holistic approach of understanding that the countries energy scenario is critically affected by the global one.
- Lack of enforcement mechanisms or very weak mechanisms open to corruption in the motivation to comply with any policy. Also probably the key barrier for future progression.

Gaps in knowledge

- The neglect of developing not only technical and commercial mechanisms but human resources also. The support of grass roots education and support of the already excellent ICAAD and ULAB CSD for example.
- The lack of a coherent strategy that progressively builds on lessons learnt from initiatives undertaken in Bangladesh has been a key constraint. There are recent examples where new policies and frameworks have been developed disregarding previous work in the energy auditing. GoB, through agencies such as SREDA, must emphasise continuity and institutional memory.
- Traditional methods in certain plant, and industries not allowing better/ cleaner/ more efficient development. For example, in an ADB study[18] the ship breaking yards in the Chittagong region were reselling old diesel and heavy fuel oil engines which were frequently 15-20 years old, from a time when such machinery was a fraction as efficient as todays. Industries using these engines – in particular it was found jute mills – were purchasing the second-hand engines at cheap prices without any regard to their efficiency with only the short term in mind. Without even taking into account the expected rise in energy prices the very nature of these machines is environmentally damaging and unsustainable in an energy-scarce future.

[1818] Bangladesh Industrial energy efficiency program 2014 ADB

- The severe lack of data collection and sharing for a multitude of purposes way beyond the basic understanding of a clear true picture of energy use within Bangladesh.
- High cost from the background process of legal, technical and human resources in the transition process from the old ways to the new.

Access to green finance

- The major issues with access to green finance nationally are; a lack of awareness among relevant stakeholders; it's inaccessibility by all sectors of the industry; the products and services which are listed by Bangladesh Bank limiting choice; and that there is a limit on the amount borrowed through green finance.
- Global access is a more complex issue, but Bangladesh's position as one of the world's most climate prone countries puts it high up the list in theory at least, for access to funds. The development of domestic EE will open up the opportunities and the only rudimentary developments are its biggest constraint.

4.1.2 DISSEMINATION FEEDBACK

The initial findings from the research were presented at a round-table discussion at SREDA in the first week of October, 2018, in the presence of key figures in the government, EE, energy and educational sectors represented. The key points brought to the table by the stakeholders are outlined in the table below.

Energy efficiency should be considered a fuel
The lack of technical expertise in the sector is a critical issue
Industrial management need to be educated about the benefits of energy auditing
Market distortion needs to be carefully monitored and mitigated against
'Better' economic development needs to be encouraged and strived towards
The need for data gathering, data management and dissemination in Bangladesh is critical
SREDA should guide the market mechanism to avoid distortion
Cross border energy agreements need to be strategically and well negotiated as will be key in the future energy mix
The summer and winter variants in energy usage need to be worked into future planning
Sector wise benchmarking well be a useful next step, but only after enough data is gathered and analysed
Rural Bangladesh cannot be neglected, as 70% of the population lives in this increasingly energy intense area
The current skills gap in energy auditing needs to be bridged quickly within Bangladesh

The key themes were capacity building, data collection and management, strategic and considered government led intervention, and promotion of EE. Bangladesh policy was widely assessed as moving in the right direction, but the implementation in this field was seen as lacking. The feeling of positivity regarding the possibilities was present in much of the feedback, balanced with a healthy amount of scepticism.

4.2 ENERGY EFFICIENCY IMPACT ON INDUSTRIAL ENERGY USAGE

The case for energy efficiency in the Bangladesh industrial sector is clear, coming from either a perspective of continued economic growth or environmental concern. The deficit of energy in the grid needs to be bridged, and the national energy mix has a severe need to be regulated and controlled to

prevent future constraints. The effect of energy efficiency measures has been concisely documented in Bangladesh by several agencies as well as SREDA in their masterplan.

Below using the data from ADBs report[19] you can see the predicted savings potential for a cross section of industries, and the current comparison to global peers. Taking the textile industry, you can see that taking the international average of 275 Toe/million units, Bangladesh is 21% over that at 333. The savings potential relates to the modelled energy savings from the implementation of specific technological advance in the relevant industry, to come into line with global peers.

Table 4.1: Specific Energy Consumption for Bangladesh Against International Benchmarks

Industry	International		Bangladesh	
	High	Low	Existing	Saving Potential
Textile (Toe/million units)	300	250	333	25%
Leather (Toe/million sqft)	60	50-60	76	34%
Cold Rolling (Toe/Ton)	0.066	0.0382	0.159	76%
MS Rod (Toe/Ton)	0.088	0.046	0.091	49%
MS Ingot (Toe/Ton)	0.101	0.089	0.169	47%
Cement (Toe/Ton)	0.0004	0.00215	0.004	46%
Ceramic (Toe/Ton)	0.7	0.6	1.23	51%
Glass (Toe/Ton)	0.7	0.4	0.75	46%
Plastic (Toe/Ton)	0.16	0.1	0.18	44%
Paper (Toe/Ton)	0.3	0.26	0.32	19%
Sugar (Toe/Ton)	0.63	0.52	0.75	30%
Jute (Toe/Ton)	0.043	0.034	0.06	43%

There is clearly plenty of room for improvement in all of the listed industries, and although this may not have been as much as an issue during the time when energy was coming from cheap national gas, this gap is going to be a key benefit when the unit price increases as predicted.

The EAR framework can be a key mechanism to identify potential targets for savings and develop a clear idea of the level which Bangladeshi industry can realistic expect to achieve.

The ADB report targets six sectors and outlines the following specific improvements that can be implemented in the respective industry as outlined in the following figure.

[19] Final Report | TA 45916-01 BAN Industrial Energy Efficiency Finance Program,ADB

Table 4.2: Suggested Energy Reduction Targets for Bangladesh

Sector	Designated improvement
RMG	Exhaust Gas Boiler (EBG), Boiler Efficiency and Tuning, High-Efficiency Motors and Variable Frequency Drive (VFD)
Chemical	Heat Recovery Technology, Insulation Improvement, Boiler and Furnace combustion efficiency improvement.
Steel	Heat Recovery Technology, Furnace Insulation, Rod-making Automation.
Cement	High Efficiency Motor improvement, VFD
Ceramics and Glass	Heat Recovery Technology.
Agro-Industries	Smart Process Control, High Pressure Boiler and Steam Turbine (CHP)

As defined the recommendations are mostly 'end of pipe' improvements, in that they are able to be retro-fitted to the existing plant machinery. In a couple of cases more extensive overhaul is suggested, with for example high efficient motors to be fitted. A number of these improvements fall under the JICA Energy Efficiency and Conservation Promotion Financing Project which offers concessional loans for the purchase of specific high efficient replacement machinery. The list is all highly achievable, and with the predicted unit price increase look more attractive.

To break down one sector as an example, the steel sector has three recommended improvements. Heat recovery, where a portion of the exhaust gases will be utilized to pre-heat material before being melted down, therefore reducing amount of energy needed for the process. Furnace insulation, which means adding or maintaining the insulation around the furnace to prevent excessive heat loss reducing the amount of energy needed to keep the temperature at a constant. Rod making automation, where the material to be melted down is automated rather than manual insertion so that heat loss is greatly reduced from current levels. The predicted savings account to 20% from exhaust heat recovery, 5-10% for furnace insulation, and for automating the furnace 20-25%.

Although the figures can appear to be negative, in fact there is a lot to be hopeful here, the opportunity to substantially improve the efficiency of the specified industry before they have having a comparatively severe environmental impact is full of promise. The areas have been identified, the solution outlined, all is required is thoughtful implementation.

4.3 IMPLEMENTABLE POLICY REGULATIONS FOR SECTOR WISE BENCH-MARKING OF ENERGY EFFICIENCY AND ENERGY AUDIT STANDARDS

4.3.1 POLICY MAKING CONSIDERATIONS

In developing energy efficiency policy for the industrial sector, policy makers must adequately consider which interventions can best support the objectives and needs of diverse stakeholders within the sector. This requires identifying the nexus between the national objectives for energy efficiency

(in Bangladesh's case enhancing energy security and supporting economic growth) and the strategic objectives that drive investment decisions in industry (for example increasing production and developing new business opportunities). A multiple benefits approach supports this process by revealing the strategic value of energy efficiency opportunities in the business context[20].

The present barriers, such as access to capital and technical know-how, and risk aversion, prevent the uptake of EE. This gives governments a potentially catalytic role in communicating the benefits and encouraging stakeholders to engage in EE. This is where strategic energy policy can really shine and help solve some of Bangladesh's current energy demand issues.

4.4 CONCISE LIST OF ACHIEVABLE POLICY RECOMMENDATIONS

4.4.1 DEVELOPMENT AND CONTINUED REASSESSMENT OF THE EAR FRAMEWORK

The framework in its current form is a well thought out tailored piece of policy for the country. It could well be the catalyst for developing EE in Bangladesh, and with the backing of the equally capable SREDA could really bring some sophistication into the energy intense industrial realm in Bangladesh.

The EAR Framework is not a document that can stay in its current form, it will need to develop and flex with the developments of this fast-growing economy and the unstable regional and global energy market that it is being pushed into. The encouragement of the DC's initially, and then other consumers to undertake EE measures to reduce their energy usage will be key to its success. Whether this is done by the carrot or the stick approach in the form of tax breaks and fines for example will need to be assessed as each is trialled. For this to happen powers to enact these will need to be granted to the authority running the programme. The programme is going to need to grow to cover more consumers within the country, starting with the most energy intense and most amenable, moving onto to the more reluctant and Small and Medium Enterprises (SMEs) who individually have little impact but collectively make up significant markets. The next phase has to focus more on implementing EE measures rather than simply measuring and quantifying them, which is where the motivational power of the Government will become a key mechanism for change.

Key policy points:

- Timely reassessment of the current format of the EAR.
- Introduction of 'next level' policy to the framework, for example benchmarking.
- Focus on the implementation phase and expanding the list of targeted consumers.

4.4.2 DATA COLLECTION, MONITORING AND PUBLISHING IN A STRUCTURED EVEN-HANDED WAY

There is currently a database being designed and setup by SREDA to store and analyse the data collected in the energy audit process; the sophistication and public access to this are yet to be defined, however this is a well-used and effective tool in EE policy. The structured timely collection of reliable, quality data regarding energy usage and emissions has been a recurring topic of conversation in the KIIs for this paper, as well in other papers written on the topic. Poor access to data is not only an issue in the energy field within Bangladesh, there is a level of secrecy and a lack of trust especially within the private sector in sharing organisational data. The requirement to quantify and share data on companies has been widely seen as having multiple positive benefits. There is much to be said for the long-term benefits of introducing EE or 'greener' processes to organisational operation, however in the short-term investment is required, something that a lot of companies need encouragement to

[20] IEA Capturing the Multiple Benefits of Energy Efficiency. 2014

undertake. Initially having a clear idea about what is actually happening within the nation's industries is an essential first step; subsequently the database itself can be used to assess which sectors need the most support. It also identifies individual organisations that are operating outside of normal parameters. It is impossible to fairly incentivise or penalise sectors or individuals without having this initial understanding. Shareable quality data will also open up the nation to international co-operation whether it be in the form of cross border energy contracts or access to the GCFs, which if it could get itself in order Bangladesh would be high up the list to receive.

Key policy points:

- The design, maintenance and development of a global standard database.
- The publication of data accessible by all.
- The enforcement of transparent data collection policy.

4.4.3 THE DEVELOPMENT AND FACILITATION OF PRIVATE INVESTMENT IN ENERGY EFFICIENCY

The Government should endeavour to facilitate private investment in EE by supporting EE capacity building, standardised measurement, private lending, and technology research and deployment. Using the data collected from the outlined database, the Government then should set out to disseminate the information to the private sector to encourage their engagement. This is not a 'hard sell' as often EE measures are directly tied with increased productivity and cost saving, with the only barrier being lack of education or understanding. The most important steps are the development of training programmes to ensure that all sectors have access to the skilled labour force required to improve EE. Then the development and measurement of verification protocols to ensure consistency and overcome uncertainties and encourage the participation of the private sector. Tied in with this the collaboration with private financial institutions to develop public-private partnerships to reduce public spending.

Key policy points:

- Targeted dissemination of selected findings to key stakeholders.
- Development of training programmes for specific sectors to develop human resources.
- Establish defined verification protocols for confidence building and accountability.
- Collaboration with financial institutions to ensure barriers to participation are overcome.

4.4.4 ENCOURAGEMENT OF ENERGY EFFICIENCY HUMAN RESOURCE DEVELOPMENT

Alongside robust policy the necessity for human resources to evaluate, implement and monitor is an absolute. The requirement to look globally for people to work on EE measures will occur due to regional skill bases, however having a national workforce who are operating at the global base standard level of sophistication is key. Globally EE is a constantly evolving and fairly new mechanism especially when relating to policy on a national level and having a developed internal human resource paradigm has multiple benefits. The keen understanding of the country and factors outside of the EE field would be the initial benefit, along with development of a beneficial jobs market. The natural progression would be for the Bangladeshi EE specialists then working internationally bringing economic and cultural benefits and join the growing number of international specialists and organisations.

Key policy points:

- Targeted training for sectoral stakeholders.
- Collaboration with educational institutions to develop human resources.
- Establish a grant mechanism to encourage sectoral growth.

- Develop assistance for achieving ISO:50001 for stakeholders.

4.4.5 THE DEVELOPMENT OF ENFORCEMENT AND EVALUATION POLICIES AND MEASURES

Alongside the structured collection of data through a methodological internationally recognised mechanism, there also needs to be a structured system developed to be engaged in the case of non-compliance. It should be identified by being a fair and transparent process and should be reported on and made public. The entire mechanism needs to be designed to act as a constructive deterrent to non-compliance, and not as is sadly the case, a revenue generating venture. This is critical in a country such as Bangladesh where a level of corruption is entrenched. Instead the theme should be much the carbon credit and carbon trading concepts, with financial benefits being granted to compliance, and penalties to non-compliance balancing out to being equal.

Key policy points:

- Design and enforce a non-compliance framework for the EAR as an initial step.
- Ensure the framework is financial neutral to show accountability and build trust.
- Ensure constant M&E guaranteeing a fair system is an imperative.

4.4.6 THE TARGETED DEVELOPMENT OF ENERGY MANAGEMENT WITHIN SPECIFIC INDUSTRIES

Although the necessity to designate or employ an energy manager within the EAR framework was downgraded to an optional choice for DCs, the development of Energy Management Systems (EMSs) would be a very important policy step for a number of reasons. Initially an EMS ensures the timely collection of quality data and the establishing of functioning systems so this may continue. It will also facilitate the discovery of opportunities for EE or cross cutting planning, and the enforcement of policy. The key initial benefit and motivation however will be the better management of existing energy resources and energy using systems, allowing for no or low cost improvements to be implemented before any investment is required. The system as a whole does require an objective approach, but the benefits of understanding and controlling policy within a national energy system do require careful management, and the benefits of a well-run EMS are undeniable. Management systems such as the ISO:50001 would be an ideal fit and would allow the development of benchmarking.

Key policy points:

- Develop a public-private partnership based EMS in targeted energy intense sectors
- Ensure data is fed back into a central database
- Ensure that all EE opportunities are capitalised on and made public

4.4.7 THE DEVELOPMENT OF BENCHMARKING IN BOTH A SECTOR WISE AND CROSS CUTTING FORM

The impossibility of describing all possible situations that might be encountered during an audit means that it is necessary to find a way of describing what constitutes good, average and bad energy performance across a range of situations. The aim of benchmarking is to answer this question. Benchmarking mainly consists in comparing the measured consumption with reference consumption of other similar buildings or generated by simulation tools to identify excessive or unacceptable running costs. After the development of the EAR framework, which is targeting specific DCs the next stage will be to open up auditing to target other consumers. It is as this stage where benchmarking will become a very useful tool for pushing EE forward.

A standard process of benchmarking involves four stages. Firstly, the development of a database containing robust data with information of the energy performance of a number of buildings or industries. Secondly the gathering of data for the specific target for the benchmarking. Thirdly the

comparative analysis of the data collected from the second stage with the data held in the database. Finally, the fourth stage, the generation of feasible, and obtainable measures to improve, in this case the energy efficiency of the building or industry.

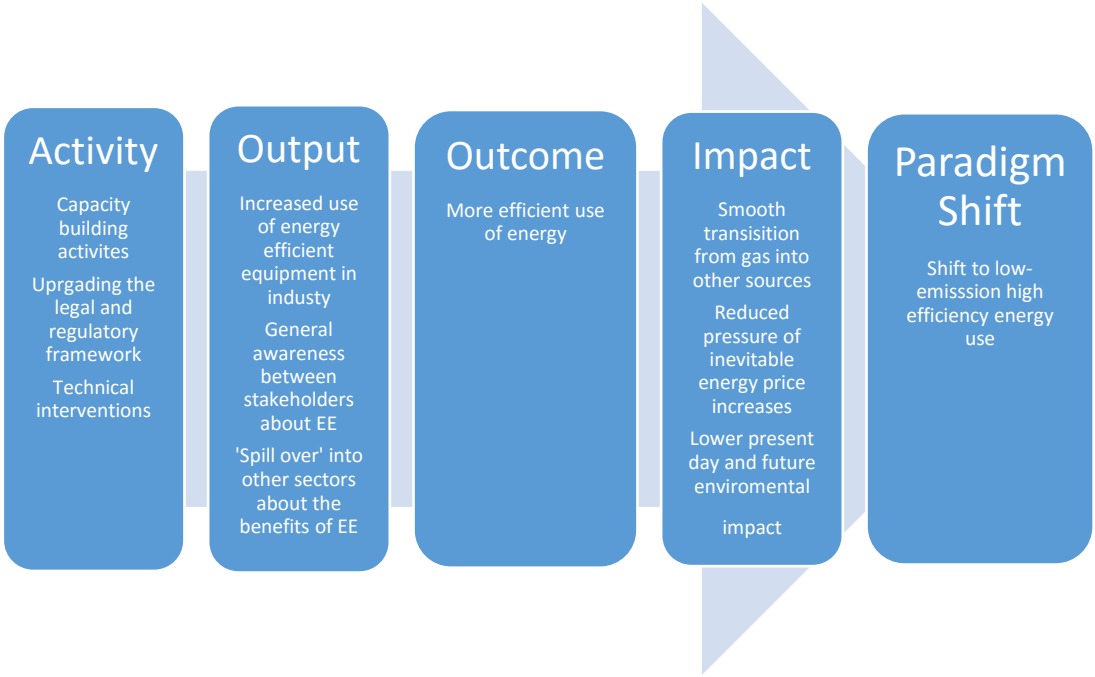
The key factor in the Bangladesh scenario currently is the database development phase. The availability of consistent, quality data in Bangladesh is a known issue, the meetings we undertook with many government agencies, donor agencies, NGOs and academic institutions reinforced this. Gathering data to populate a database with representative samples at a sufficient quality and depth is both time consuming and complex. Globally only countries with more advanced energy efficiency programs are seen to have developed frameworks to achieve this to an acceptable standard. An example of this is the US Energy Information Administration (EIA) database, or the UKs National Energy Efficiency Data-Framework (NEED). Although this is not a tool that could be generated in the short-term, it is without doubt a mid-term goal that Bangladesh should be worked towards, and the data collected with have multiple other uses outside of its primary purpose.

There is a specific form of database generation that we would like to highlight, namely parametric benchmarking. This is the application of building energy simulation to a variety of building types to a range of parameters. The advantage of this method is the possibility of covering a wide range of building energy consumption characteristics, with the selection of a variety of energy parameters. Therefore, giving a scenario that is complex, and un-uniform such as the various sectors of Bangladesh a tool for which to quantify and compare.

Part of this is building energy classification, which is any procedure in terms of energy use that allows the determination of the quality of the building in comparison with others. It is important to introduce the concepts of benchmarking, rating and labelling in the context of building energy classification.

The figure below shows the desired outcome of energy policy, and its implementation.

Figure 4.1: Desired Energy Policy Outcome and Impact



4.4.8 THE ROLE OF UTLITY COMPANIES IN EE PROGRAM DELIVERY

Another area of interest for Bangladesh is the interrelationship between the utility companies and policy makers in the delivery of EE programs. It is widely accepted that aligning the financial incentives of utility companies with cost effective EE programs is a proven strategy for successful delivery. At the basic level as previously outlined as being critical in any EE process is data collection, and the utility companies are an integral part of tracking progress. The collection of accurate data is key, and the access to this data is through the utility companies as they have the ability to monitor the entire network in detail.

For the utility companies, who after all are profit driven organisations, the financial implications of EE can be felt in three key ways (i) through recovery of the direct costs of the programs; (ii) through the impact on reduced utility earnings sales; and (iii) through the effects on shareholder value of energy efficiency spending versus investment in supply-side resources.

How these impacts are felt in isolation create incentives and disincentives for utility companies to pursue EE measures, and this is where the role of regulators and the government need to step in. In the case of state owned utility companies these have a lessened impact in the case of EE measures being pursued, however there is inevitable an amount of private investment so there will always be a role for regulation. In nearly every scenario a level of motivation is required to engage Utility companies in EE activities as there will be negative impacts in the organisation. Mechanisms such as program cost recovery, performance target incentives, shared savings inquisitives, rate of return adders, all either compensate or cushion the economic impact of EE measures.

The idea that Utility companies should be compensated for the successful delivery of EE programs is not universally accepted. There is the argument that if the state decrees that EE programs are to be pursued, then it is the obligation of the utility company as it is operating within that country to follow its lead. In the case of the standard model, where customers pay for EE through unit price increases, essentially the utility company is charging for something it should be doing anyway. Another more market led argument is that the role of the utility company is to deliver energy and providing financial

incentives on top of what can be earned by efficient management of the supply side of the business simply raises the cost of service to all customers and distorts management behaviour. In the Bangladesh scenario, the changing energy mix will determine how EE programs will be funded and who by. For example with the low unit cost of gas, it is currently realistic to expect the consumer to take on the majority of the financial burden, as they will realise the benefits. However if for example imported LPG gas becomes the prevalent source of energy the unit price will be substantially higher and the economic and political implications of a further increase in unit price will be problematic, in this case more creative solutions of funding may need to be sourced.

5. CONCLUSION

Bangladesh is at a key point in its economic growth, intrinsically tied to the drive to push the nation forwards is its energy needs. The move away from the nation's key energy source of domestic natural gas to other fuels raises some difficult questions, in particular the economic and potential environmental cost of joining the global energy market. The inevitably rising unit costs will have to be met by both the state and the consumer to the natural detriment of growth, so solutions to ease this burden are a necessity if growth is to continue to be at the required level. The 'low hanging fruit' scenario of EE needs to be extensively explored, and although it is seen as a short-term solution, the long-term possibilities will grow from this starting point. The end goal is a fully realised efficient energy system supporting the growth of the nation. There is a natural resistance to change, and within traditional energy policy this is no different. In a 2014 OECD working paper the effect of EE measures on economic productivity was discussed,

'A newly developed, cross-country composite proxy of environmental policy stringency (EPS) shows that stringency has been increasing across OECD countries over the past two decades. However, the tightening environmental policies have had little effect on the aggregate productivity, spurring primarily short-technologically advanced industries and firms have seen a small increase in productivity, possibly being the best position to adapt.'

'Finally, this project provides evidence on the anti-competitive bias of some aspects of environmental policies. The indicator of Burdens on the Economy due to Environmental Policies (BEEP) shows that barriers to energy and competition, and the consideration given to economic effects of environmental policies vary notably across countries, but this variation is not related to the stringency of policies. Hence, to support both economic and environmental outcomes, stringent economic policies can and should be implemented with minimum barriers to entry and competition.'[21]

The government needs to lead the way with the development of forward thinking, sustainable energy policy. It needs to join the other countries globally who are moving in this direction, and not those remaining 'sat on the fence' policy wise. Empirical evidence has shown that success in developing profitable EE business cases depends on the maturity of the market, and market segment, and the policies and measures hindering or helping EE service providers. Political decision makers and policymakers at the national level have a large responsibility in creating a supportive framework for this market development. As outlined in this paper the energy demand of Bangladesh is expected to double by 2020, and a significant amount of this can be covered by developing EE measures.

We have discussed the exciting new developments in the EAR framework, and the policy steps that would make EE integral to the energy usage for consumers and would bring the benefits of green growth into the economic success that Bangladesh has been enjoying. The opportunity right now, is to build a tailored energy system from the ground up so that when the inevitable development of Bangladesh reaches the next tier the opportunity of having a sophisticated energy setup is within easy reach.

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21 http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=ECO/WKP(2014)72&docLanguage=En

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