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**Islamic Republic of Afghanistan  
Ministry of Energy & Water**

**Power Sector Strategy  
For  
The Afghanistan National Development Strategy  
(WITH FOCUS ON PRIORITIZATION)**

**DRAFT**

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**ABBREVIATIONS AND ACRONYMS**

<b>AC</b>	Afghanistan Compact
<b>ADB</b>	Asian Development Bank
<b>ADF</b>	Afghan Development Forum
<b>ANA</b>	Afghanistan National Army
<b>ANDS</b>	Afghanistan National Development Strategy
<b>ANP</b>	Afghanistan National Police
<b>CDCs</b>	Community Development Councils
<b>DABM</b>	Da Afghanistan Breshna Moassessa (The Afghan utility)
<b>ETS</b>	Eastern Transmission System
<b>FAO</b>	Food and Agriculture Organization
<b>GDP</b>	Gross Domestic Product
<b>GWh</b>	Gigawatt-hour
<b>GoA</b>	Government of Afghanistan
<b>GTZ</b>	Deutsch Gessellschaft fur Technische (German Agency for Assistance)
<b>ICE</b>	Inter-ministerial Commission on Energy
<b>ISAF</b>	International Security Assistance Force
<b>IPP</b>	Independent Power Producers
<b>KW</b>	Kilo-watt (Unit of electricity)
<b>MDG</b>	Millennium Development Goals
<b>MEW</b>	Ministry of Energy and Water
<b>MoE</b>	Ministry of Economy
<b>MoJ</b>	Ministry of Justice
<b>MoM</b>	Ministry of Mines
<b>MRRD</b>	Ministry of Rural Rehabilitation and Development
<b>MWH</b>	Mega-watt-hours.
<b>NEPA</b>	National Environmental Protection Agency
<b>NEPS</b>	North-east Power System
<b>NGOs</b>	Non-Government Organizations
<b>NRRDC</b>	New & Renewable Energy Research and Development Center
<b>NSP</b>	National Solidarity Program
<b>NTS</b>	Northern Transmission System
<b>O&amp;M</b>	Operation and Management
<b>PCBs</b>	Polychlorinated Biphenyls (Highly toxic chemical)
<b>PPA</b>	Power Purchase Agreement
<b>PPE</b>	Personal Protective Equipment (for worker safety)
<b>SEPS</b>	South-east Power System
<b>USAID</b>	US Agency for International Development
<b>WB</b>	World Bank
<b>WTS</b>	Western Transmission System

## EXECUTIVE SUMMARY

Energy is our economy's hope for growth. Electricity is the motor that powers our economic growth; its sustainable availability, at affordable prices, can improve our living standards, strengthen our society and promote economic growth. To achieve our vision, our power sector strategy lays out its context and constraints, key objectives and various programs as well as resource needs. The strategy, through its various programs, recognizes that only a diversified resource base, combined with sound implementation capacity, can sustainably deliver our power needs. Our strategic planning, therefore, lays emphasis on developing such a resource base, cost-effectively, and in an environmentally responsible manner. In addition, inclusion of various policy reforms and institutional restructuring will ensure accountability and effectiveness, while providing backbone to the strategy.

War, under-investments, lack of technical and management capacity and funds have decimated our power sector. The existing infrastructure is severely constraining our economic development. Power availability is crucial to achieving not only our development but also our reconstruction goals. Officially, the access to power is **around 7%** of the population<sup>1</sup> **and at 18.50 to 19.25 kWh** per capita, it is among the lowest in the world. *Annex 2 Figure 1: Afghanistan Electricity Coverage* highlights this aspect. Given the power infrastructure's dilapidated condition, our current efforts are focused on the urgent need to rehabilitate the dilapidated, war-damaged power infrastructure, starting with our three major urban centers, Kabul, Kandahar and Herat, the economic hubs of our country. Such efforts, mostly donor funded, for these areas include: repairing and/or replacing turbines at Naghlu, Mahipar and Sarobi hydropower plants,<sup>2</sup> and the North-west Thermal (diesel) power plant.<sup>3</sup>

To expeditiously meet serious power shortfalls, we have also added 16-20 MW through installation of 25 diesel generators, which includes 15 generators for Kabul. In addition, private sector, through diesel generation, is also providing an estimated 93 MW. Kabul's current total available power supply, estimated at 205 MW, seriously falls short of the estimated requirements of 310 MW, necessitating programmed load shedding and regular outages at severe economic losses.

Across the country, substantial reconstruction and expansion of transmission and distribution systems, based on modern least-cost design concepts, and other power interventions that add generation capacity, are also being implemented. For instance, **a 220 kV transmission line from Termez via Pul-i-Khumri, our important industrial city, to Kabul is being installed.** Another program is installing a single circuit 110 kV line from Naghlu to Jalalabad, in addition to constructing a 110/20 kV substation at Jalalabad. Currently, the existing substations and low voltage distribution networks including of Kabul are totally inadequate, and given the lack of funding and other constraints, only a limited number of programs are rehabilitating these in order to improve their capacity.

Other important interventions that are underway to improve power supply capacity, including through increased generation, are: (i) North-east Power System (NEPS), which will link the Northern and Eastern systems including connecting Kabul to Pul-e-Khumri, with ties to Tajikistan, Uzbekistan and Turkmenistan, will enhance power supply through increasing low-cost power imports. Power imports, in absence of low-cost, assured power supply alternatives, are considered cost-effective for the short- and medium terms. In addition, NEPS will also increase our existing power generating capacity by adding 105 MW of thermal generation, based on indigenous natural gas at Sheberghan,<sup>4</sup> (ii) North Transmission System (NTS) which is a part of NEPS, is constructing

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<sup>1</sup> Historically, Afghanistan never had power coverage of more than 22 percent of its population.

<sup>2</sup> Total installed capacity; 188 MW; Naghlu Dam, 100 MW, Mahipar Dam, 66 MW, and Sarobi, Dam, 22 MW per MEW

<sup>3</sup> Total installed capacity, 46 MW

<sup>4</sup> The plant needs funding estimated at \$24 million/gas well to move **beyond the completed feasibility study**, as per Mr. Rabbani, Director General, DABM (Personal Communication, April 17, 07)

220 kV transmission lines from (i) Nahri Shahi (Mazar-e-Sharif suburb) to Surkhan Daria in Uzbekistan, and to Pul-e-Khumri and beyond. NTS includes a planned line to connect Nahri Shahi to Shberghan Zenew in Turkmenistan, (iii) The Eastern Transmission System (ETS), which is rehabilitating and strengthening Kabul's existing 110 kV transmission lines to Mahipar, Naghlu and Sarobi, and is also strengthening the Distribution system. .

For our country's West and South-east, two systems are noteworthy. These are: (i) The Western Transmission System (WTS), which is strengthening (a) the existing 110 kV line that connects Herat to Mary in Turkmenistan and (b) the 132 kV line that connects Herat to Taiband. Improvements to each line will also help increase low-cost power imports and. (ii) The South East Power System (SEPS) which will enhance the transmission efficiency and utilization of Kajaki hydropower in the south, specifically to Helmand and Kandahar provinces. To achieve these objectives, 110 kV power lines, connecting Kandahar to Lashkar Gah and Dural Junction are being installed and will also strengthen existing transmission lines from Dural Junction to Kajakai are also being strengthened. Other activities are helping to improve power supply to secondary cities and towns.

At present, our total installed capacity is **estimated at 769 MW**, of which 464 MW is the operating capacity<sup>5</sup>. Included is 96 MW of imports, against an **installed capacity of 220 MW**. It is estimated that with the completion of the above four key systems—NEPS, ETS, WTS, and SEPS—collectively, they will **add 680 MW of capacity**. **By middle of 2010**, NEPS is projected to supply 4 million MWH to Kabul, exceeding its projected demand of 1,320,423 MWH.<sup>6</sup> The completion of NEPS, around 2009, therefore will significantly strengthen power imports, valuable for their low-costs and potentially assured supply.

The above, combined with other interventions, are **estimated to add 850 MW** to the existing installed capacity of installed capacity of 769 MW.<sup>7</sup> At the same time, private sector is estimated to add another 250 MW, enhancing the **total installed capacity to 1019 MW by 2012**. The increased capacity is considered adequate to supply most of the urban and many industrial needs. It will also cover limited rural and small town electrification. By 2022, as a result of the on-going and planned interventions including potentially increasing private sector role, the rural coverage is **estimated to increase to 65% of the total rural population**. We recognize that providing rural electrification is a daunting challenge and there are no easy fixes.

Our strategy's objectives also call for increasing the number of new connections. We believe that the above interventions will also enable us to add **approximately 730,000 new connections by 2010**. This would increase access ratio in urban areas from currently estimated **27% to 77% by 2010**, and country-wide by the same date, from **current 6-10 % to almost 25%**. By 2015, the urban access ratio is **estimated to be almost 90 percent**, and an overall access ratio of **33 percent**. Our plans include installation of diesel generators in various cities for which the need exists and no alternatives to electricity are available. In the long run, we intend to replace most diesel generation with other less costly and environmentally sound alternatives.

In addition to improving the physical infrastructure, our strategy also recognizes that weak implementation capacity is the *single largest constraint* to achieving our above goals. We, therefore have programs, current and planned, to strengthen institutional capacity (in particular at DABM and MEW), and also increasingly incorporate commercial elements to our power sector in order to assure its solvency and long-term sustainability. Our main utility, DABM, under on-going regulatory reforms, is targeted to evolve into an autonomous, commercially-oriented, and

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<sup>5</sup> Data compiled from MEW, DABM, NSP, and AEAI's close out reports (as per Jack Whippen), April 12, 2007; Operating capacity is lower due to unexpected maintenance, seasonality of water flows, damaged infrastructure, limits on fuel availability etc.

<sup>6</sup> MEW Strategy, September 30, 2006

<sup>7</sup> Operating capacity is however, 464 MW, which is enhanced by imports (2006) of 96 MW and also by private sector generated power.

financially viable enterprise to enable it to provide reliable and affordable electric service to all Afghans in an environmentally sound manner. Given the existence of several thousand private (diesel or petrol) power generators, Afghan consumers are aware of the real electricity costs and are willing (and in many cases), able to pay for a reliable supply of acceptable quality

To provide sound financial footings to the DABM, our strategy embarks upon an ambitious program of tariff and other reforms. For instance, **it proposes to establish** an Energy Regulatory Commission, an independent body responsible for establishing power tariffs in accordance with our country's regulatory and legislative mandates. These programs, along with other complementary measures, such as additional diesel generation, as indicated earlier, if successfully implemented, can provide power to over 65% percent of our households and 90% of non-residential establishments in major urban areas and over 25% of households in rural areas. In addition, the tariff increases, improving implementation capacity, the regulatory policy and other reforms will assure over **75% of cost recovery** from our grid-connected power customers by 2010. These targets, we believe, will also bring perceptible improvements in people's lives; equitable enough to significantly reduce poverty levels.

Beyond 2015, our plans call for increased diversification of the power resource base through increasing the use of indigenous natural gas, coal, and oil,<sup>8</sup> greater low-cost power imports, and use of solar and renewables, the later primarily for decentralized rural electrification, where technically viable and cost-effective; a number of such systems however, may need potentially long-term) subsidies. Notwithstanding such constraints, we recognize that rural power availability, will also improve linkage between rural, urban and regional economies. This, in turn, potentially will increase and diversify production of tradable goods, and foster complementarities between public and private investments, potentially helping, over the long-term, competitiveness of the Afghan economy.

Our policies will promote regulatory predictability to help stabilize and enhance private investments, potentially leading to privatization of most Afghan power supply over the longer term, 2018 or beyond. During the interim, we will provide lifeline rates for the needy, the poor, and others<sup>9</sup>, as necessary, for their upliftment and empowerment. Our ultimate goal is to make Afghanistan self-reliant in electricity, an energy (and a power trader), and hopefully, a net power exporter, somewhere beyond 2022. The Government's commitment is strong, unambiguous, and resolute towards making all our goals a reality.

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<sup>8</sup> Gas/oil-fired power plants are more expensive to operate than coal-fired power plants. However, gas or oil plants can be easily started, in 30 minutes or less to meet peak power demands. A hydropower plant, on the other hand, is the fastest to respond to increasing power demands, reaching full power in 2-3 minutes. These plants can provide both base load and peak load demand for power at a relatively low cost, but are limited by the amount of water available.

<sup>9</sup> For example, returnees, disabled, widows, etc.

## 1.0 Introduction

Power is fundamental to our economic development. For example, our entrepreneurs need electricity for their businesses. Our children need light to extend their day for learning, and our farmers need electric power to add value to their produce. Increasing access to affordable electricity, while improving our current living standards, also sows the seeds of our future prosperity. In short, energy is our top economic development priority and our economy's hope.

*Our power strategy is based on clearly articulated goals and objectives. In our current context, it lays out strategies to achieve our objectives through priority program, including their proposed sequencing and potential costing, to achieve the goal of providing sustainable power supply, at affordable prices, and in an environmentally responsible manner, for economic growth and to improve living standards.*

## 2.0 Context and Constraints

Our existing power supply infrastructure is extensively damaged and fragmented. Its four main isolated grids are clustered around areas of Kabul in the east, Mazar-e-Sharif in the north, Herat in the West, and Kandahar in the south. The decades of war-damage, combined the poor maintenance, lack of funds, technical and management capacity, and outright neglect has left the system in shambles. It is estimated that only about 70% of our transmission and distribution systems survived the prolonged conflicts. The generation capacity suffered similar fate, and since demand outstrips supply, there are extensive load shedding and programmed outages. Rural areas remain practically unconnected to the grid or other affordable, sustainable power supply options. Hydropower, the major indigenous source, both for urban and rural areas, remains badly under-utilized.<sup>10</sup>

The dilapidated power sector assets need urgent and extensive rehabilitation and refurbishment in order to operate reliably. A number of systems, even though currently functioning, are on the verge of obsolescence. *Annex 2 Figure 2: Darunta, Jalalabad Control System*, exemplifies the outdated nature of the equipment. Likewise, the sector's institutional capacity, currently in disarray, **needs skilled** manpower, financial resources and organizational structure to meet the economy's power needs on a sustainable basis. The DABM, the national utility, urgently needs commercial re-orientation for its sustenance and solvency, and also to attract private sector investments.

In view of the urgent need to improve power supply, since 1381 (2002), we have implemented a number of interventions to improve the physical infrastructure as well as our institutional framework to build much-needed implementation capacity and also to improve financial performance of the sector. Notwithstanding improvements to date, the actual delivery of low-cost power since 1381 (2002), unfortunately has not increased sufficiently. We, currently have less power supply<sup>11</sup> as compared to 1978. *Table 1: Sources of Electricity Supply* below is indicative of this situation.

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<sup>10</sup> According to Power System Master Plan for Afghanistan, the theoretical hydroelectric potential is believed to be 25,000 MW; for the near term, the capacity is estimated at 800 MW. Current installed capacity is 304 MW and operating capacity is 183 MW, as per AEAI a current USAID contractor.

<sup>11</sup> Excluding imports

**Table 1: Sources of Electricity Supply, Operating Capacity (MW)<sup>12</sup>**

Year	Hydro	Thermal	Imported	Micro-Hydro	Total (MW)
<b>Before 1978</b> (1357)	258.72	137.18	0	0	<b>395.9</b>
<b>2002</b> (1381)	140.56	15.79	86.7	0	<b>243.05</b>
<b>Today</b> (2007) (1386)	183.35	87.50	96.0	14.84	<b>463.99</b>

Current power coverage is estimated to be **over 70% in** urban areas,<sup>13</sup> and includes privately-owned diesel-power generators diesel power. The diesel generators produce electricity at high-cost to both the firms and the country's foreign exchange holdings, thereby impairing competitiveness, while other business languish because of non availability of affordable power supply. The cost of such basic services as hospital care, and consumer goods and services go up.

A synoptic view of the current situation along with some key activities is provided below:

## **2.1 Generation of electricity**

Of the total installed generation capacity as of 2006, hydropower, historically, Afghanistan most promising resource, generates over 55% of this total. The rest primarily comes from thermal sources, primarily diesel, and to a limited extent, coal and natural gas. Power generation facilities however, suffered extensive war damage, have poor design quality, continue to suffer from poor management and neglect, lack of spare parts, and inadequate control systems, and require significant rehabilitation and/or upgrading. *Annex 2 Figure 3: Kabul East Thermal Power Plant* exemplifies the extent and nature of the damage. A number of current and/or planned efforts across the country aim to rehabilitate our generation system. Included are: (i) the rehabilitation of existing hydropower plants (HPPs) such as Naghlu, Mahipar (34 MW; second largest plant in our country), and Sarobi, (ii) Emergency repairs and diesel fuel procurement such as for the NW Kabul thermal plant (44 MW), (iii) Expansion/New generations plants including Sheberghan Gas-fired Project (105 MW) and Baghdara (360 MW)<sup>14</sup>, and Kajakai (100 MW) hydropower development.

In addition, some power generation activities are also directed to provide off-grid supply. Included are: micro-hydro and solar-based power systems, potentially, collectively adding about 21 MW. Also, to meet winter and emergency needs for Kabul (and Kandahar), in 2005/06, we installed 25 diesel-generators. Rural power supply however, continues to rely mostly on micro hydro plants (MHP's), limited diesel (mostly privately owned), and batteries, and is estimated to cover less **than 7% of** the rural population.<sup>15</sup> Most power generation efforts are funded by donors with, in few cases, limited cost-sharing by the Government. However, in general, various efforts are constrained by the lack of funds, inadequate technical and management capacity, and/or security-related issues.

## **2.2 Transmission**

The war-damaged transmission system, in spite of on-going improvements, continues to stay fragmented and disconnected (to the national grid). Supporting infrastructure, including metering of power supplied is highly inadequate. It is important to note that an adequate and sound transmission system is crucial to achieving the objectives of NEPS, SEPS and our other power sector programs as

<sup>12</sup> Source: DABM, Ministry of Energy and Water, February, 2007. .

<sup>13</sup> The often quoted access figure of 6% applies only to those who have access to one of the public power grids serving major urban centers. See: *Lack of Access to Power (Energy)* World Bank (November 2006).It is important to note that percent urban access also depends on the population number used. The number however, varies significantly from source to source.

<sup>14</sup> Indicated capacity of 360 MW includes phase I.

<sup>15</sup> There is no reliable estimates of rural electricity coverage; some anecdotal evidence, including personal conversation (April 16, 2007) with Mr. Ghulam Rabbani, Director General, DABM, indicates such coverage from all sources as over 70%

well as to reduce power losses. *Annex 2 Figure 4: NEPS: Existing, under Construction and Planned Transmission System* shows various NEPS transmission lines.

Several activities, since 1381 (2002), have been underway or are waiting implementation. The important ones include: (i) Pul-e-Khumri-Chimtala transmission line installation to connect Kabul at **220KV**, (ii) Hairatan--Mazar-e-Sharif-Pul-i-Khumri Power Grid (iii) Prioritized improvements directed at system's operation and maintenance and control. Initial efforts focused on stabilizing the system, cost effective and operationally, to the extent possible. Rehabilitation and strengthening of the transmission system will also help import low-cost power and also connect the existing seven disconnected transmission lines. *Annex 2 Figure 5: Afghanistan's Existing, under Construction and Planned Transmission System* shows various transmission-related activities across the country.

### **2.3 Distribution of electricity to consumers**

Distribution is the least developed part of the Afghan power system. Its existing condition significantly limits the availability of power supply. We recognize that as power supply continues to increase, the existing local and regional distribution networks, without timely and significant improvement, will emerge as serious constraints to effective power delivery to the end-users. Such is currently the case in Mazar-e-Sharif, where, in spite of (adequate) power supply, the inadequate capacity of the distribution system limits effective power delivery..

Our priority focus therefore has been the rehabilitation and expansion of the distribution system for our major urban centers, in particular our three key economic hubs: Kabul, Kandahar and Herat. Existing distribution networks in Kabul, for instance, are unable to handle more than 150 MW, against a potential need twice this amount. Some key projects to upgrade the distribution networks, along with estimated cost for each, are: (i) Improving Kabul City Networks (\$65 M), Mazar-e-Sharif (\$31 M) projects, and (iii) improvements in towns such as Charikar, Doshi, Khulm, Gulbahar and Aybak, located along the Northern Transmission System (NTS) which is part of North-east Power System (NEPS). The major constraint on improving distribution is funding.

We recognize that connecting each new customer to the system is expensive, costs \$1,000 in distribution costs alone. For Kabul alone, total distribution costs are estimated at \$310 M. Weak distribution systems can lead to power wastage of up to 75%. Since most funding to date has gone to rehabilitate and upgrade generation systems, funds for distribution system improvements, we believe, need high priority. *Annex 2 Figure 6: Priority Proposed Transmission Lines* shows various proposed transmission lines as well as funding sources.

### **2.4 Rural Energy Availability and Use**

Access to electricity in rural areas is very limited; some estimates put it **at ?? of the** total Afghan population. Linking rural people to energy is crucial, complicated, expensive and continues to remain unresolved. Power supply can improve the lot of rural population as a whole, incalculably. It can significantly help to alleviate poverty.

Sources of power, except for those villages in the close proximity of the grid, are micro-hydropower, private diesel generation, candles, batteries, solar lanterns, and hurricane lamps for light, and biomass for cooking. Poor households or communities typically rely on diverse sources of energy, using one fuel for heating, another for cooking or lighting, another for agriculture or productive activities.

The result is that often, the real (per unit) costs of these alternative energy sources are high relative to those of electricity or gas delivered through networks; such networks provide energy access such as for lighting, cooking, refrigeration, and power for communication and motive force, most cheaply

and conveniently, and with least local pollution. However, substantial barriers<sup>16</sup> often exist in providing access to modern fuels by rural communities.

The critical issue in rural electrification is not the technology but what kinds of policies and programs will be most cost-effective in lowering the barriers. A sound institutional framework is also needed. However, both of these are currently missing in Afghanistan. There exists no clear institutional framework or policy for rural electrification and a *de facto* split of responsibilities exist among various ministries. Moreover, coordination with donors is poor at best. There is a need to develop a robust enabling environment such as through articulation of a Rural Electrification Policy that encourages community buy-in, and emphasizes the role of Community Development Councils (CDC's), and also the private sector in advancing rural electrification.

The above approach will recognize the Government's limitations to meaningfully intervene, given the extent of the need—estimated to be over 85-94% of the total energy needs—of the Afghan rural population, which is often thinly spread including over mountainous and over difficult-to-access terrains. Notwithstanding these difficulties, it is important to note that providing rural electrification is important to alleviate Afghan poverty, and also bring rural economic development as a strategic intervention against the opium economy. Obviously, there is a need to promote income-generating opportunities<sup>17</sup>, which are virtually non-existent at this time.<sup>18</sup>

Under a World Bank-funded program called the National Solidarity Program (NSP), which is working with local Community Development Councils (CDC's), over 500 micro-hydro projects have been built since 2003. CDC's participation has included operations and maintenance (O&M) and implementing viable systems of cost-recovery, in turn providing sustainability. As experience is generated, this model will be reviewed for potential replication and wider use.

For small towns and cities, the current efforts to provide and/or strengthen power availability include: (i) the Qalat Electrification project, which established 4,300 new connections, among other improvements, and the Aybak Distribution Project, (ii) Microhydro project in various parts of the country and (iii) limited wind energy projects (such as in Herat, with over 120 days of potentially strong winds) and an estimated 200 small biogas digesters in Kandahar. The Ministry of Rural Rehabilitation and Development is focusing attention in these areas.

## **2.5 Cost Recovery, Institutional Reforms and Capacity Building**

We believe that full cost recovery through proper (such as market) pricing is the backbone of financial sustainability. However, DABM's current tariff regimes do not even recover costs,<sup>19</sup> distort market prices, and create significant gaps between power supply costs and revenues on a system-wide aggregate level. In addition, DABM's billed revenues, which are based on a customer providing its power meter readings, in many cases go unbilled or uncollected. Ironically-speaking, non-payment of power bills for example, up to two years by some key government institutes also exists. The entire system suffers from numerous serious shortfalls—power tariffs are often based on political rather than economic criteria—including . The cash-strapped Government fills the gap through subsidies, averaging US \$56 million/year.<sup>20</sup> It is of relevance to note that donors frown on subsidies, unless they are targeted and short-lived.

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<sup>16</sup> Included are: low population densities, low demand, high grid-connection cost/household, high upfront capital costs for non-grid power and others.

<sup>17</sup> Such as small retail shops, weaving and knitting operation, water pumping etc.

<sup>18</sup> A number of developing countries have successfully provided rural electrification covering over 85% of the population. Included are: Thailand and Bangladesh, via grid power, and Kenya via Solar Home Systems, all of which is under private sector.

<sup>19</sup> At present, according to the World Bank, DABM's per kWh revenues are US 5.1 cents against its power generation cost of US cents 12.3, as of 2005.

<sup>20</sup> Based on anecdotal evidence, the indicated amount is an underestimate. Several costs such as fuel are not included and covered by MEW.

To date, some operational and management improvements in DABM have been made. Included are: tariff increases in some areas, completion of the DABM's inventory, establishment of a loss reduction unit, and staff training in billing and collections. The utility is waiting for the approval of by-laws authorizing its liquidation. This will enable it to expeditiously move towards its planned **'corporatization'**.

Our on-going efforts are aimed at : (i) Putting DABM' functioning on commercial basis, and as an autonomous body, reporting to the Ministry of Energy and Water (MEW), (ii) Preparation and enactment of power sector specific decree, (iii) Implementing pricing reforms, metering and billing and procedures, (iv) Computerizing DABM's accounts and billing and collection systems, (iv) tariff reforms (gradually leading to full cost recovery) for Kabul and Herat, followed by other cities, and (v) Building MEW's capacity, in particular, to improve its operations and ability to encourage private sector participation, and to effectively negotiate power imports.

In the area of institutional strengthening, to-date, the efforts of donors and the Government have been weak or non-existent, given the urgent need to rehabilitate the physical infrastructure. The power system continues to be managed by semi-skilled staff, who lack knowledge of state-of-the-art systems, work with limited spare parts, and within an unsafe environmental including safety conditions. Low salaries have kept the morale down. Such systemic deficiencies are multi-dimensional—technical level, managerial, financial, and legal and others—and need timely rectification through adequate measures. Our strategy proposes measures to achieve these objectives.

The legal and investment framework is a key element of the investment climate. However, in our country, there are several constraints to a favorable environment. Included are: (i) lengthy and costly company registration, (ii) difficult access and high costs of financing, and (iii) outdated and weak legal provisions—poor commercial laws and administrative impediments included.

Implementation capacity is very weak in our country. The staff is poor trained, lacks state-of-the-art knowledge, majority in close to retirement, and given poor management and poor salary structure is not motivated. Compounding the situation is lack of spare parts and other resources, preventing better operation of the sector.

It is important to note that many Afghans, like many developing-country citizens, have shown a demonstrated "willingness to pay"<sup>22</sup> for reliable power supply of acceptable quality and affordable prices.

## **2.6 Cross-cutting Issues**

There are several cross-cutting issues that exist with power supply. Given the urgency to rehabilitate physical infrastructure, these issues have been overlooked. The implementation of our strategy, while bringing attention to these issues, will also have a direct, mostly positive bearing on cross-cutting issues—environment, counter narcotics, anti-corruption, gender and regional cooperation—in addition to capacity building.

For instance, the strategy recognizes that the use of diesel fuel and other fossil fuels for power generation and biomass use such as in rural areas, has adverse environmental effects. To mitigate, the strategy proposes to develop applicable environmental management and other plans, and strengthen

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<sup>22</sup> Examples are: Nigeria, Cambodia, India, Thailand and others, according to several studies. In Cambodia, for example, some consumers pay up to 90 US cents/kWh.

regulatory requirements and their enforcement. For example, our plans will ensure the use of Personal Protective Equipment (PPE's), and include public education and awareness campaigns, among other activities to help minimize adverse environmental and health consequences.

A highly important environmental issue is related to the use and working with *old* transformers, capacitors and other electrical equipment.. Such transformers, very likely, contain Polychlorinated Biphenyls (PCB's), proven to be highly toxic, potentially carcinogenic, and environmentally persistent; their use is banned in most countries. Our strategy will provide worker education and training, and also require use of Personal Protective Equipment (PPE) during rehabilitation, retrofitting and other similar work. . Over the longer haul, it is recommended that all such transformers be replaced and the disposal of older ones be done following international disposal standards. The private sector will be required to abide by the prevailing environmental laws. Regular monitoring and regulatory enforcement will help assure compliance.

At present, women (along with children), are the major suppliers of rural energy. We believe the two groups will directly and greatly benefit from the above measures. Likewise, with assured and increasing power supply, the remaining cross-cutting issues will also be positively impacted. The strategy and its plans require creation of income-generating opportunities especially in rural areas, by providing alternative livelihoods and family-supporting jobs, such as in poppy growing areas to lure people away from the illegal activity. An effective program of “value chain” investments can also help by stimulating rural economic activities.

Regional cooperation will be enhanced by projects such as NEPS and the government's priority to seek imports from our neighbors—electricity trade offers some “win-win” solutions—will strengthen regional trade. Furthermore, the increasing privatization requires rule-of-law, increased transparency and high accountability, thereby indirectly strengthening anti-corruption measures. The proposed capacity building measures, essential for our power systems' long-term sustainability will favorably impact this cross-cutting issue.

## **2.7 Constraints**

In developing our strategy, we are sensitive to the prevailing constraints and for our strategy's effectiveness, the urgent need to mitigate them. For instance, the security situation may inhibit increasing hydropower capacity, a current situation in Kajakai, or preventing timely rehabilitation or building of new transmission lines due to need of de-mining in the area. Some donors, according to MEW withdrew security-related funding due to prevailing insecurity, putting improvements on hold, thereby adversely impacting power supply targets, while creating a socially destabilizing situation.

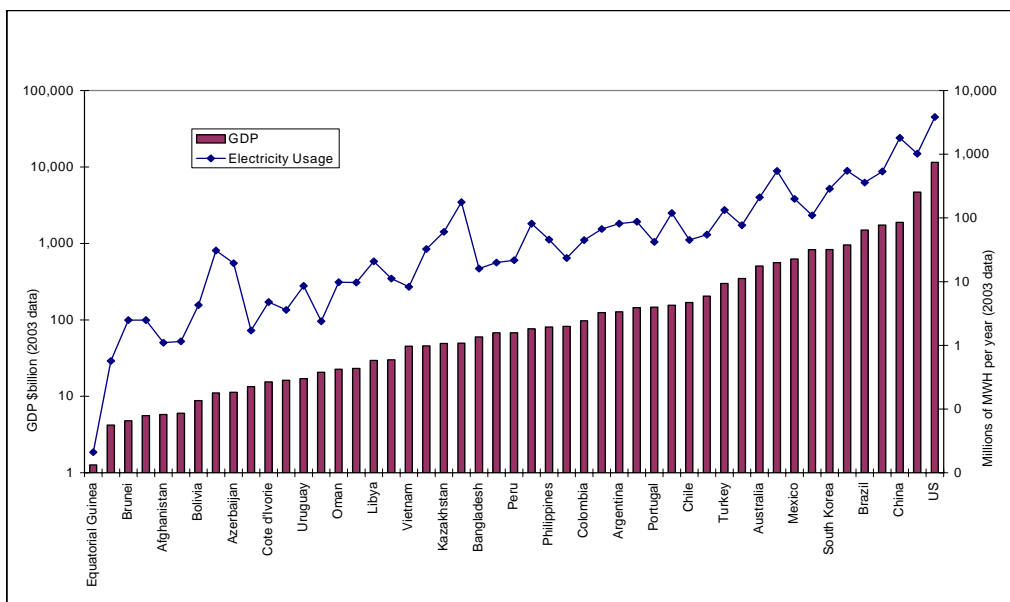
Another important constraint to achieving Afghan Compact benchmarks which are based on numerical values (percentages), is the lack of knowledge on important data for Afghanistan. For example, information on such important parameters as: (i) total number of urban households, (ii) total number of non-residential establishments, and (iii) total number of rural households, as well as total cost of power import, generation, transmission, distribution, operation, maintenance, and administration for the entire country is not available. Given this lack of data, accurate calculations for various percentages and monitoring the results of the program's interventions can become difficult. Our strategy has incorporated activities to overcome most of these constraints. Notwithstanding this, we will conduct a study to determine the exact nature of various constraints. It will help develop and implement targeted strategies.

## **3.0 Overall Goal and Desired Outcomes**

*Our overall goal is to provide sustainable power supply, at affordable prices, and in an environmentally sound manner, for economic growth, and to improve living standards.*

As is widely recognized, the benefits of electricity availability are immediate, positive and multi-dimensional. For example, a direct correlation<sup>23</sup> between electric power production and GDP growth exists, as highlighted by *Figure 3-1: Electricity Usage and GDP Growth*. Also, economic growth, in addition to helping alleviate poverty, is also profoundly important for our political stability; our citizens must see tangible improvements in their lives.

**Figure 3-1: Electricity Usage and GDP Growth**



Our strategy, therefore, is outcome oriented. Our aim is to deliver sufficient electric power to meet the needs of the economic growth rate of 9% per annum,<sup>25</sup> which in turn, we believe, will help lower poverty by 3% a year.<sup>26</sup> By 2013 (1392), the proposed power supply and economic growth, we believe, will enable over 90% of Afghans in its three major urban areas to pay and access affordable power. In villages and small towns, we estimate that over 50% of Afghans should have access to power including for light rural industries by 2010. We believe that given major economic and power-related on-going and proposed interventions, by 2020, a meaningful impact on all of our Millennium Development Goals (MDG) will also occur, helping eliminate *extreme* poverty, while protecting our environment for future generations.

We realize that the anticipated power and economic growth will create increased infrastructure, requiring financial, manpower and other resources for operation and management. Working with other ministries and donors, we are confident that the Government will provide resources to implement measures to meet these goals in a timely manner. Our strategy is based on these expectations.

<sup>23</sup> According to the World Bank, the ratio of GDP growth to electrical production is approximately US \$1,000 per 300 kW of electricity.

<sup>25</sup> This has been the Government’s growth goal for the economy since 1383 (2004) (See: Securing Afghanistan’s Future), and is estimated to be sufficient growth to build a legal economy while abolishing the trade without causing devastating poverty.

<sup>26</sup> Afghanistan Compact benchmarks

## 4.0 Objectives

As indicated above, the major objective of our programs and their intended outcomes is to meet the energy benchmarks of the Afghan Compact. These are listed as follows: (i) By the end of 1389 (20 March 2010), electricity will reach at least 65% of households in major urban areas, (ii) By the end of 2010, electricity will reach at least 90% of non-residential establishments in major urban areas, (iii) By the end of 2010 at least 25% of households in rural areas will have electricity access. (iv) By the end of 2010, at least 75% of the costs will be recovered from users connected to the national power grid, and (v) A strategy for the development and the use of renewable energies will be developed by the end of 2007.

To achieve the above benchmarks, our strategy seeks to achieve the following objectives.

### **4.1 Increase the Operating Capacity in Afghanistan from 464 MW 850 MW by 2011**

We believe that by increasing the operating capacity and by implementing enabling options such as improved distribution system and regulatory reforms, both on-going and planned, we will be able to provide power to at least 65% of the households in major urban areas by 2010.

Currently, approximate installed capacity for power in Afghanistan **is 464 MW**<sup>27</sup>. Total operating capacity, however is estimated to be less than 448 MW. This is due to the technical losses, inadequate and also poor quality (diesel) fuel supply, poor upkeep and maintenance, and decreased water flows in autumn and winters. With some system improvements, we estimate that the current power availability has the potential to reach 285 MW in urban areas, and 80 MW in rural areas by 2020.

### **4.2 Increase power distribution Capacity in Kabul to 500 MW by 2010**

Improved power distribution is essential to effective delivery of the increased power availability. Given significant population growth in Kabul in recent years,<sup>28</sup> original estimates for power demand in Kabul turned out to be low.<sup>29</sup> Power demand in Kabul is estimated to exceed 500 MW by 2013. Current available supply, including from recently installed 25 diesel generators, is estimated to be around 205 MW, which is reduced to 140 MW during autumn and winter due to decreased water supply for hydropower. This amount is augmented by 95 MW through distributed (private) diesel generators<sup>30</sup>. Given the significant shortfalls, outages and load shedding is heavy, and programmed. In addition, the low voltage—as low as 150 volts instead of (esired) 220 volts—results in potentially significant damage to appliances. .

### **4.3 Increase Power Distribution to Other Major Urban Centers by 100 MW by 2010:**

<sup>27</sup> See CELT Overview, January 2007; USAID Afghan Energy Infrastructure Center.

<sup>28</sup> Kabul's Population has grown by more than 1.7 million since the late 1970s, and since 1381 (2002), there has also been a significant influx of refugees and migrants from rural areas looking for work opportunities and relative security. It's clear that the Master Plan (1383 (2004)) significantly underestimated Kabul's power needs.

<sup>29</sup> Adapted from NorPlan/NorConsult Master Plan and World Bank reports; Norplan/NorConsult, foer 2007, had projected a total demand of 185-200 MW for Kabul, significantly under-estimating (highly unexpected) population increase.

<sup>30</sup> Generator set sizes varies from: (i) very small, 300 -500 W (cost \$100), (ii) small sets, 2-6 kW, petrol-based, cost \$700-\$1,980, (iii) Used Truck Engine/Diesel, 50 kW, often rented, cost varies, and (iv) Medium and large-sizes, diesel -based, 100 -1,500 kW, cost \$250/kW

This objective, along with the above two, we believe will provide electricity for at least 90% of non-residential establishments in major urban areas. Any power generation shortfalls, if experienced, will be met through addition of diesel generators. Electricity needs in many areas in Afghanistan are increasing due to the growing economy as well as population. For instance, Kandahar and Helmand, two key urban centers that currently need a total of over 40 MW is estimated to go up to 100 MW or more by 1392 (2013).

Likewise, power demand in Herat, is estimated to reach from current 30 MW to 100 MW by 2013. In the North, for example, in the Balkh province, current electricity demand of about 75 MW is expected to go to a high of 160 MW by 2013; in the Ghorri Region the demand of about 40 MW is estimated to go to almost 100 MW by 1392 (2013). While it is important that both the current and estimated future demands are met, a major existing constraint, even where power supply is adequate (such as in Herat), is the highly inadequate distribution system. to meet power supply needs. Including are the weak city networks. Our strategy aims to provide improved and adequate distribution networks to meet current and future demands. .

#### ***4.4 Provide 100 MW to Electrify 25 Small Towns and 800 Representative Rural Households By 2013***

Many of our small cities and towns have poor or no grid-power. In the rural areas, overall coverage is less **than 7%** of our total population. Household tariff charges, in covered areas are mostly based on the number of light bulbs in use. Given the very low coverage, in spite of potential demand, there is virtually no productive use of electricity especially in our rural communities. It is estimated by MRRD that , there are over 38,000 villages in Afghanistan; their collective demand can be estimated to be quite high.

We recognize that electrifying rural areas offer daunting challenges. This is due to: dispersed populations, often difficult terrain; high initial capital and operating costs of power systems, poor load profiles (evenings only) and competing priorities. Remote areas present additional difficulties. Furthermore, developing country experience shows that rural electrification often requires subsidies.

#### ***4.5 Strengthen Relevant Institutional Capacity at MEW, MRRD and Ministry of Mines (MM) by 2015***

While some institutional reform is underway, a lot more needs to be done, with resolve and commitment, to develop sustainable supply of electricity to a level, where the private sector—given its infinite financial resources and management capacity—is increasingly managing most aspects of our power sector. This will assure long-term sustainability. Included in these objectives is: (i) the need to conduct energy needs surveys, both for urban and rural areas to develop a reliable baseline data for effective planning (ii) to further improve regulatory regimes to increase private sector investment and operation, (iii) to significantly enhance technical and management capacity of relevant entities including through improved work environment, (iv) reform tariff regimes with an aim to bring sound financial footings for the utility and also encourage energy conservation, and (v) through working stakeholders to identify elements where policy improvements can be made to achieve sustainable power supply.

### **5.0 Linking our Objectives to the Programs**

To achieve our objectives, as listed under Section 4.0, we are implementing a range of, short-, medium-, and long-term power interventions called our Programs. These well-thought out programs balance our needs and our resources, incorporate applicable cost considerations, and needed technical and management capacity measures. It is however important to note that only a combination of measures—energy resources combined with adequate planning that also incorporate mitigation measures for the known constraints, offers the best hope to develop a sustainable power supply to meet our objectives. Projected outputs, based on an effective implementation of our programs, are listed below.

### **5.1 Increase the Operating Capacity in Afghanistan from 464 MW to 850 MW by 2012**

Key programs that will contribute to achieving the Compact benchmark to provide power to at least 65% of the urban households are: (i) The North-east Power System (NEPS), including the Northern Transmission System, which will construct a number of 220 kV transmission lines in the northern part.

NEPS is targeted for completion by or before 2009. Key activities that will contribute to the above objective are: (i) the completion of transmission line from Tajikistan to Mazar-e-Sharif, (ii) Upgrading of the existing 22 kV substations including city networks in key cities, (iii) Establishing the National Load and Dispatch Center, as planned, (iv) Installing and operating the 105 MW Sheberghan, Thermal Gas plant (v) Completion of the transmission line from Uzbekistan to Pul-i-Khumri, and (v) Construction of Khan Abad Hydro power plant (10.5 MW installed capacity), and improving city networks in Kunduz province. While some of these activities are already underway, their timely completion is essential to achieving the Compact benchmark. .

The second important system contributing to the benchmark is the Eastern Transmission System (ETS). Within the ETS system, the existing 110 kV such as from Kabul East to Sarobi, via Mahipar, need upgrading to 220 kV, to help match with the anticipated needs. At the same time, planned construction of 220 kV transmission line to Shakar Darreh and points north, need to be completed. In addition, the Western Transmission System that currently uses 132 kV lines from Mary, via Herat to Taiband also needs upgrading within the Afghan sector to help achieve the 850 MW output. These systems, individually and collectively, will add power supply and also rehabilitation, upgrading including through improvements of the existing 6kV city networks, will contribute to meeting above goals. Some details for the above systems are provided under Section 5.0: Programs.

### **5.2 Increase Power Distribution Capacity in Kabul by 250 MW by 2012**

To meet power needs relatively quickly, given the urgency of demand especially for our three major cities, the country's economic hubs, Kabul, Kandahar and Herat, we (i) will expedite rehabilitation of the NW Kabul Thermal Plant (45 MW) (ii) have added (emergency) diesel power by installing 25 new generators. In addition, the government recently approved plans to install additional 100 MW of diesel power (at a budget of \$90 M) anticipated to be in operation by mid 2008, (ii) are improving distribution systems such as by constructing two circuit transmission line (**110 kV**) from Naghlo-Kabul Sub stations, (iv) will rehabilitate various units at Mahipar, Naghlu and Sarobi hydropower plants. We plan to complete these activities by the end of 2009. Longer term, 2014 and beyond, we will also explore the possibility of further increasing (low-cost) power imports from our neighbors.

In addition, to further add power generation capacity, we have plans to develop feasibility studies for hydropower plants at Baghdara (280 MW), Kajaki 2, and Surubi 2 (180 MW), and also to add thermal power generation, based on indigenous gas resources, at Sheberghan (**105 MW**). This capacity will also contribute to Kabul power supply beyond 2012. Also, during the next couple of years, we will develop a feasibility study to explore the possibility of installing coal-fired power plant within the

NEPS area of coverage. Existing information indicates that we have potentially abundant coal resources. However, current coal utilization is limited, primarily for heating and cooking; we plan to use coal for power generation including in the mining areas..

### **5.3 Increase Power Distribution to Other Major Urban Centers by 100 MW by 2014**

Adequate distribution network capacity is highly important to supplying power. Efforts to meet the projected targets include: a number of on-going and proposed transmission and distribution improvements, across the country, to minimize transmission and other losses.

To meet our specific objectives, we will: (i) Upgrade city networks from 6 kV to 20 kV, the latest system and also install digital meters to prevent power thefts, and (ii) Based on a feasibility study, construct 2, 220 kV transmission lines connecting Herat, Kandahar and Kabul. In addition, we will improve their substations on line routes and power networks, (ii) explore the feasibility of extending 110 kV transmission line from Kandahar to Qalat (adding substations, as needed) and also extend 110 kV transmission line from Kajaki to Uruzgan (adding substations, as needed), (iii) revive diesel generation to expeditiously add to power supply, and (iv) expedite extension of power transmission line from Heart to Farah province, and upgrading of distribution networks. These and supporting activities such as improved management will enable us to meet the above objectives.

### **5.4 Deliver 100 MW to Electrify 25 Small Towns and 800 Rural Villages By 2013**

Providing power to the rural areas is important given the high percentage of the population (over 78% of the total) living in these areas and the need to create income-generating opportunities to help alleviate rural poverty. Our programs to achieve the above objectives include grid power, where it is technically and economically feasible, use of micro-hydropower and decentralized stand-alone systems, including those based on renewable energy. For the later, by the end of 2007, we will also develop a strategy for development and use of renewable energy<sup>32</sup> in rural areas.

Currently, the Ministry of Energy and Water (MEW) has the lead responsibility for rural electrification. MEW is supported by the Ministry of Rural Rehabilitation and Development (MRRD). In addition, some key organization such as the National Solidarity Program, and NGOS Agha Khan Foundation, the International Assistance Mission (IAM), and others are also contributing towards rural electrification, primarily through micro-hydropower plants. However, the overall coverage continues to remain low, as is the private sector participation.

Over time, we propose to move from meeting basic lighting needs to facilitating income-generating opportunities such as through rural enterprises and village-level light industry. Given the lack of financial and technical resources, we believe, we will have to tailor investments both to levels of demand and to situation-specific capacity.

As a start, for the short to medium-term, we will concentrate our own and donor-aligned resources on (representative) larger villages and small towns serving as growth points. Our criteria for investments, based on sound planning, will include: equitable geographic distribution, existing poverty levels, political considerations, and the need to provide livelihood alternatives such as family-supporting jobs to replace existing or potential poppy cultivation. The data and information generated under the proposed energy needs survey, as indicated earlier, will provide important insight into devising and implementing various energy options for the poor. As progress is made, we will (selectively) open up

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<sup>32</sup> Currently, Empower Consultants Limited, a New Zealand firm ([www.mpwr.co.nz](http://www.mpwr.co.nz)) is working on renewable energy use for rural Afghan areas. Also, National Renewable Energy Laboratory, Golden, Colorado, USA has mapped a number of Afghan areas in terms of their wind potential. This work could be useful for our needs.

rural energy markets. We believe that low-income rural households represent a huge market for energy services.

Poor consume a mix of energy sources that is suboptimal from economic, financial, health, and environmental perspectives.

In developing our specific programs for rural areas, our strategy will be to find (and develop) appropriate technological and institutional innovations that lower the costs of obtaining and using energy services, and tailoring these services to the requirements of low-income households and communities. This is where the energy needs and survey data will be most useful. The information will act as a starting point for improving access.<sup>33</sup>

### ***5.5 Strengthen Relevant Institutional Capacity at MEW, MRRD, and MoM by 2015***

While physical improvements to our power structure are underway, simultaneously we will initiate and/or strengthen the existing activities aimed at building institutional and implementation capacity across relevant power sector ministries. Such efforts may include technical training of technicians and engineers in power sector infrastructure maintenance; management courses and training in procurement, billing and collection and other areas. It is also important all training needs, their costs, venues etc., are carefully defined and prioritized to optimize impacts. Related to capacity building needs is merit promoting, competitive selection and incentives for superior performance. It is suggested that until adequate domestic capacity gets built, qualified staff on contractual basis, for varying periods, as needed, may be procured such as from Iran, India and other countries.

Of urgency, also is to expeditiously move ‘corporatization’ of DABM in order to put it on commercial track. Currently, some activities such as (i) inventorying of DABM’s assets, (ii) training to selected DABM staff in procurement, billing and collection, and others have been completed. Other activities such as: (i) approval of bye-laws to authorize DABM’s liquidation (and conversion to a new entity, as planned), capacity building through training, quality recruitment and others are needed. We will work with other ministries, including the Inter Ministerial Commission on Energy (ICE) to develop plans and seek funding to implement such activities, considered crucial to the success of our strategy.

Of equal importance is the need to develop regulatory mechanisms to lower risks such as to Independent Power Producers, helping them to effectively participate in power supply and management. In this regard, recently ARC, an Afghan/US company with Turkish technical backing has proposed a 100 MW IPP scheme for which payment guarantees are to be found. Also, along the way, Power Purchase Agreements (PPAs) are also being finalized with our neighbors. In the area of capacity building, 25 technicians were sent to Iran to improve their skills in thermal power generation, (ii) proposing pre-paid metering systems under privatized DABM.

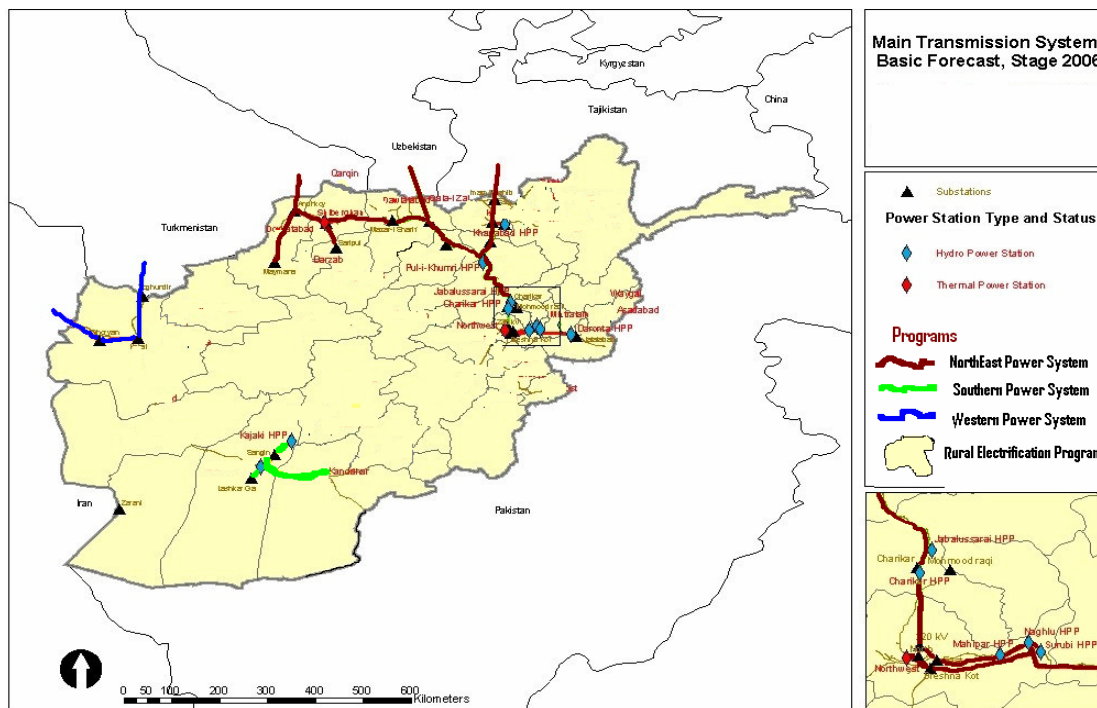
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<sup>33</sup> Poor households and communities typically rely on diverse sources of energy, using one fuel for heating, another for agriculture or other productive activities. Often, the real (per unit) cost of these alternative energy sources are high relative to those of electricity or gas delivered through networks to wealthier households. Also, the non-monetary costs (of collecting and transporting) as well as environmental and health costs are high for the poor.

## 6.0 Programs

In order to achieve our objectives, several activities, some on-going, and others planned or under planning, are being implemented. Of particular relevance includes the following which our strategy will depend upon to meet its objectives. We refer to them as our Programs. The key ones are: (1) the North East Power System (2) the South East Power System; (3) the Western Power System; and (4) Rural Electrification Program. A synoptic view of these programs is provided below

**Figure 6-1: Main Transmission System, Basic Forecast, Stage 2006**



### **Program One: the North East Power System (NEPS)**

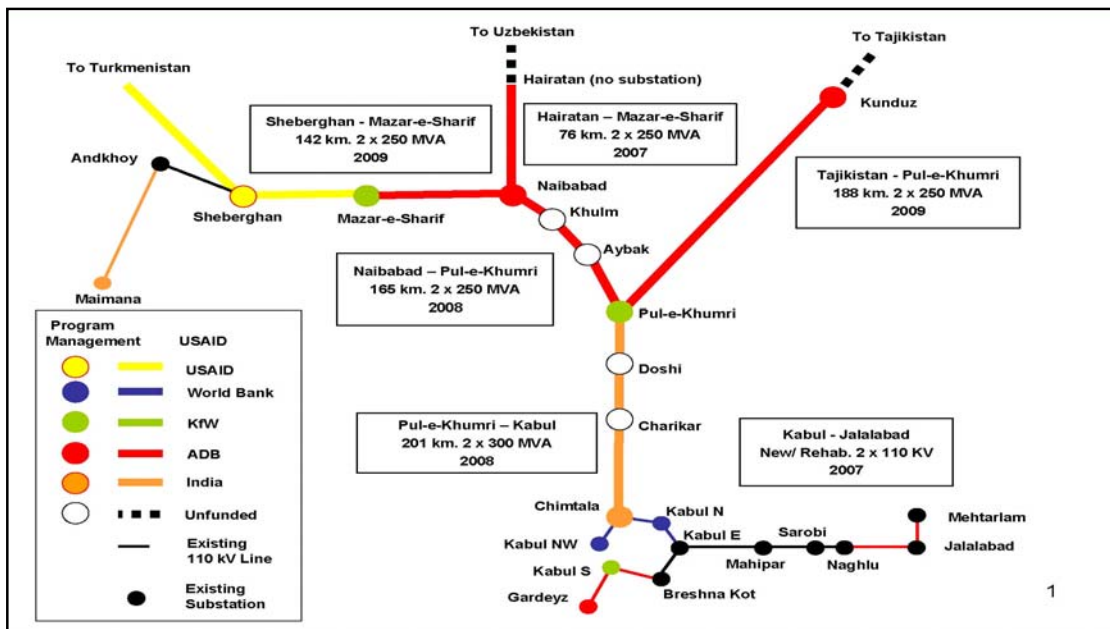
NEPS, our flagship program, consists of generation, transmission and distribution. It also includes domestically generated (100 MW) thermal (based on indigenous natural gas)<sup>34</sup> and power imports. NEPS's *primary* objective is to serve urban centers in Kabul, Nangarhar, Parwan, Balkh, Jawzjan, Kunduz and Baghlan. On a priority basis, the transmission lines to transmit imported power from Uzbekistan, Turkmenistan, and Tajikistan to major urban centers in the North and East, in particular Kabul are being completed. The completion will help meet the existing shortfall on quicker basis.

However, to enhance power supply on a country-wide basis, with a key aim to reduce our long-term dependence on imported power, our strategy includes generation of power based on indigenous resources such as natural gas. In addition to the natural gas-based 100 MW power generation indicated above, we are also rehabilitating our Hydropower plants (HPPs) in Pul-i-Chumri and Khanabad in the North, and Naghlu, Surobi and Mahipar in the east. The generated power will feed through the NEPS. For the long-term, 15 years and beyond, we propose to establish new hydro power plants in Baghdara and a second plant in Saurobi; pre-feasibility studies for these hydro plants have

<sup>34</sup> Estimated gas reserves available as of 2006: 1197.17 billion, current demand including for the 100 MW power plant is estimated at 21.09 billion ft<sup>3</sup>; Expected life of gas reserves, 56 years. Plant operational target date: late 2008

been completed. In addition, a transmission line will also be extended from Kabul to Logar and Gardez

**Figure 6-1: NEPS Transmission Lines and Contributing Donors** show the status of various activities



The effectiveness of NEPS however, depends on (1) strengthening Power Purchase Agreements (PPA's) with our neighbors to assure guaranteed supplies at agreed upon costs and quality<sup>35</sup> (2) accurate metering of the imported power and (3) garnering sufficient funds from donors including through loans, for physical completion of the entire NEPS. Of equal relevance are: (i) rehabilitating and/or upgrading substations and distribution networks for towns under NEPS main transmission lines (estimated cost, US \$120 M), Kabul distribution grid reconstruction and extension (estimated cost, US \$ 250-300 M), establishment of a Dispatch and Control Center (US \$25 M), and installation of reactive power equipment and implementing capacity building and other measures.

### **Program Two: South-east Power System (SEPS)**

SEPS aim is to serve urban centers in Helmand and Kandahar). It will enhance power supply to Kandahar and Helmand by rehabilitating two turbines, and by extending a third turbine at Kajakai. In addition to enhancing power supply, another key aim is to gradually reduce our reliance upon diesel fuel generated power. Furthermore, we will attempt to advance the proposed time-frame for the feasibility study to expand hydro power production in Kajaki through a second dam. Graphically, *Annex 2 Figure 7: SEPS Existing and Planned Activities* show various transmission lines under this Program.

However, security is a particular concern especially in the South-east including Kajakai-dam area. In the event it becomes a serious threat or an actuality, our Government, as an alternate power supply source will explore the feasibility of installing, small-scale power systems such as decentralized systems, mini-grids and others, in areas where security becomes a threat.

<sup>35</sup> Currently, PPAs are skeletal and include no terms concerning technical quality, quality of service, or metering. In addition, MOU with Tajikistan has not been finalized.

### ***Program Three: Eastern Transmission System***

This system's objective is to provide transmission lines from Kabul region (Naghlu) to Jalalabad and to Mehtarlam, the capital of Laghman Province. Planned lines will be of 110 kV. *Annex 2 Figure 8: ETS – Existing, under Construction and Planned Transmission Systems* graphically reveals various activities under the program. Hydropower and diesel are the main sources of power generation.

### ***Program Four: Western Urban Energy Program***

Under this program, we will primarily serve *urban centers in Herat and Bagdhis*. Currently, under the Program, two transmission lines import electricity from Iran and Turkmenistan to Herat, where power supply is not a concern, except that it is imported power. While our short-term efforts focus on improving the distribution and cost recovery systems, over the long-term, we will look at cost-effective domestic sources of power generation for the West including Herat, either from coal deposits at Sabzak or connecting to the NEPS from Balkh or use of solar, in particular wind turbines for Herat, with over 120 windy days offers the potential to cost-effectively provide power. We will conduct a detailed feasibility study. *Annex 2 Figure 9: Western Transmission System (WTS): Existing and under Construction Systems* highlights key aspects of the program.

### ***Program Five: Rural Electrification Program***

Under this Program, we propose to provide power to rural areas including small towns and cities. The Government will establish a specialized entity such as a Rural Electrification Authority to assess various options, facilitate investment, set standards, and improve coordination across ministries, among other activities. The proposed authority will articulate a Rural Electrification Policy that: (1) clarifies the roles of various government agencies in rural electrification, and determines the content of a rural energy survey and (2) lays out our plans for increasing private sector and rural cooperative engagement in the beginning, to help with localized small power operations, billing and collection and safety standards.<sup>36</sup>

Upon establishment of the Authority, we will (i) assess the feasibility of providing grid-power to key rural areas (such as for larger and/or growing villages) near the vicinity of existing transmission lines, (ii) encourage, by providing enabling environment, such as micro-finance loans through existing Community Development Councils (CDC's), and (iii) expediting on-going works such as under NEPS to add and/or provide power to smaller towns and cities such as Aybak and Qalat; some residents are threatening to damage existing lines, if power is not provided to them.

We will also strengthen the distribution and other systems, as needed. We believe, that the proposed linkage, as indicated earlier, with the Community Development Councils (CDCs) potentially offers good opportunities to meet the above objective. CDC's bring good experience, in particular, with micro-hydropower power plants as well as the knowledge of local resources and culture, and to effectively mobilize the community will assure project's buy-in, in turn helping sustainability of implemented interventions. CDC's have been successfully helping operate, maintain and collect (often full) payments for power provided. We believe all such interventions, devised, as necessary, will help us meet our above objectives. We realize that there are no quick fixes to providing electricity to rural areas. We will work with full resolve while exploring and optimizing available options.

The Compact benchmark calls for providing rural electrification to at least 25% of the rural households by 2010. We intend to achieve this by: (i) strengthening the existing micro-hydropower and diesel generation, both private and public, (ii) connecting areas that are or will be in close

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<sup>36</sup> Private sector supply to poor rural villages is succeeding in Cambodia and rural cooperatives have been successfully implemented throughout Bangladesh rural communities and other venues in South Asia.

proximity to the grid, including transmission lines under NEPS, SEPS etc., (iii) explore near-term alternate power sources such as solar lanterns, and selectively, wind power, and (iv) establishing a Rural Electrification Policy. Beyond 2010, and over the longer term, 2015 and beyond, we will look at other solar energy options, both grid- and non-grid.

## 7.0 Preliminary Prioritization, Costing, and Sequencing of Program Activities

The following lists key items that need attention on a high priority (suggested completion by end of 2008) and others categorized as near, mid and long-term needs.

### A. Urgent Priority: Targeted Completion Date: End of 1386 (2007) – 1388 (2008)

#### 1. North East Power System (NEPS)

S#	Project/Objectives	Budget (US \$)	Current Status
1	Reactive power compensation for Pulikhumri and Kabul	5.0 M	Under consideration.
2	Local Dispatching system	30.0 M	Feasibility study has completed
3	Sub Stations (Mazar, Pulikhumri (21MEuro for both), Kabul, Chrikar-20M , Aybak-14M, Khulm-14M, Doshi)	29 M 48 M	Some ongoing, need to be expedited
4	Rehabilitation/Expansion of Power Distribution Networks in Kabul.	275 M	Some activities currently underway
5	Complete Transmission Line: Uzbekistan-Pulikhumri	40.7 M	Parts completed; some sections need funding.
6	Complete transmission line from Tajikistan to Pulikhumri, including Sub Stations	46 M	Parts completed; some sections need funding.
7	Complete transmission line from Sheberghan to Turkmenistan border.		Line currently unfunded; need donor support.
8	Engineering/design study & construction of 220 kV transmission line: Pul-i-Khumri to Kabul	Not Available	Development of a feasibility study being considered.
9	Complete the transmission line from Naghlu to Jalalabad	68 M	Need technical assistance and funding.

#### 2. Non-NEPS/Representative Others

1	Rehabilitation of the NW Kabul Thermal Plant		On-going; need to be expedited.
2	Diesel fuel supplies for Kabul NW Plant beyond 2007 and repair of small diesel generators, Kandahr, Lashkargha, Qalat	121 M/Year	Uncertainty of continued USAID assistance; need urgent attention.

### B. High Priority: 1385 (2008) – 1390 (2012)

S#	Project/Objectives	Budget (US \$)	Current Status
1	Rehabilitation, Surveying and Construction of new Micro-hydro power plants.	Open	Some action underway, under NSP
2	Conceptualize and complete nationwide energy needs survey; Finalize rural Electrification Strategy, working with NSP/MRRD.	3-5 M	No action at present; need attention, given the importance of data and information availability
3	Feasibility study for Baghdara HPP	1.5 M	Need funds/feasibility study

S#	Project/Objectives	Budget (US \$)	Current Status
4	Construction of 3 Micro HP in Jurm, Chata, Sangab, Badakhshan province.	N/A	Primarily for productive uses of power; create job opportunities
5	Complete Darunta HPP Rehabilitation	35 M	Need funds.
6	Complete Naghlu HPP Rehabilitation	35 M	Some work underway.
7	Complete Mahipar HPP Rehabilitation	N/A	Some work underway; funds needed.
8	Complete Kajaki HPP Rehabilitation	27 M	Security and funding issues.
9	Complete Pulikhumri-2 Rehabilitation	N/A	Some work underway; Need funds.
10	Complete Sarobi Rehabilitation	N/A	Some work underway.

#### South East Power System (SEPS)

1	Rehabilitation of existing distribution systems in Kanadaha	N/A	Some action underway; need funds
2	Extension of 220 kV from Kajaki to Kandahar	N/A	Some action underway; need funds
3	Extension of city network from Kandahar to Lashkargha and other cities.	N/A	Being discussed; need funds
4	Extension of 110 kV lines from Kandahar to Zabul	N/A	Some action underway; need funds
5	Extension 110 kV line from Kajaki to Urzgan	N/A	Some action underway; need funds

#### C. Medium-term/Medium Priority 1390 (2012) – 1395 (2017)

S#	Project/Objectives	Budget (US \$)	Current Status
1	Construction of Baghdara HPP (360 MW)	600 M	Funding limitations/Seek donor assistance, and in-house funding.
2	Complete feasibility study for Surobi 2 HPP (180 MW)	3 M	Funding limitations/Seek donor assistance.
3	Operation and Maintenance NEPS transmission lines	5.0 M	Funds by donors being considered.
4	Feasibility study for HPP on Kunar (6 locations) and Kokcha River	5 M	Funding limitations/Seek donor assistance.
5	Complete development/commission of 105 MW power plant Sheberghan	150 M	Funding limitations/Seek donor assistance.
6	Upgrade all 110 KV transmission lines to 220 kV (Hirat Sub station)	5 M	Funding limitations/Seek donor assistance.
7	Construct/Rehabilitate Khanabad Hydropower plant (Installed capacity, 10.5 MW)	21 M	No action/need planning and funds

#### D. Long-term: 1395 (2017) and beyond/Priority

S#	Project/Objectives	Budget (US \$)	Current Status
1	Installation of Sarobi-2 HPP	N/A	Need planning and funds
2	Installation of Kajaki-2 HPP	N/A	Under Considerations and funds
3	Installation of Baghdara HPP	N/A	Need planning and funds
4	Installation of Kokcha HPP	N/A	No Actions at this time
5	Installation of Kunar River HPP	N/A	Needs funds
6	Installation of Ulam Bagh HPP (Urozgan)	N/A	Need planning and funds
7	Feasibility of generating coal-power	N/A	Need planning and funds

## 8.0 Priority Reforms

In addition to the technical and institutional strengthening, several priority reforms will be needed to establish a thriving, competitive, reliable and environmentally sound electricity sector. In this aspect key items are listed below:

### **8.1 Institutional Reform, Cost Recovery and Capacity Building Program**

The Government's aim is to establish a market-oriented institutional framework and capacity to develop and implement the Afghan power sector for the long term. Over time, we will modernize the curThe Government will: (i) expeditiously proceed to incorporate commercial elements into DABM in order to promote sustainability and quality of power supplies at affordable prices. DABM's 'corporatization' will also help minimize government's role in pricing and supplying power and also allow DABM to accept private capital; (ii) establish a Regulatory Body, as indicate earlier. The Energy Policy Department at MEW is currently working on this issue, (iii) as part of power sector management, over the mid-term establish a National Energy Conservation Program,<sup>37</sup> and (iv) implement complementary activities to achieve its targets.

Institutional reforms that lead to a full cost recovery, (over time, 3 years or more) are of prime importance for our power supply. In 2004/05, the average tariff collected by DABM was only five cents/kWh, compared to an average unit cost of power production of about 12/kWh. We can not afford to continuously subsidize the power sector; subsidies distort market pricing. Currently, power subsidies cost our government \$56 M/year, which is unsustainable and undesirable. A clear tariff policy leading to a full cost recover (with few exceptions such as for rural areas) is required. We will also look into implementing effective management systems such as for billing and collection.

Other proposals include: (i) Use of pre-paid, temper-proof meters, (ii) Full implementation of the 1385 tariff increases, (iii) Reduction technical losses, currently at 44%, (iv) Increased involvement of private sector in management of power. The privatization of the DABM is a major step towards cost recovery and long term sustainability of the power sector. The Compact target requires achievement of 75% cost recovery by the end of 2010. We propose to achieve this by implementing a number of the above items.

Empowering the capacity building will be one of our high priorities. Our activities towards capacity strengthening includes: (i) establish procurement capability at MEW and DABS, (particularly for conducting efficient, transparent and timely procurement) and at universities and selective rural and provincial areas, (ii) establish training programs to help the staff achieve state-of-the-art operational and management knowledge, and (iii) review existing payroll and compensation structure with the key objective to retain and also attract well-qualified staff. We will provide written job description to most employees and rules, including pay increases governing their employment. We will revise curriculums to reflect modern needs of power, including English language and computer training, among other measures.

### **8.2 Private Sector Power:**

Reforms that lead to transparency, fair competition, a functioning legal framework, and rule-of-law, among others can meaningfully bring private sector participation and (long-term) sustenance to the power supply. For the power sector, private sector can be mobilized through the use of: Independent Power Producers (IPP's), Management and Maintenance Contracts, Concessions, Build, Operate,

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<sup>37</sup> To economize for cost-savings, people in Kabul have started using fluorescent bulbs (also called white bulbs), 8,11 and 18 watts; these produce as much light as 60-100 watts (regular) bulbs. White bulbs also do not produce heat and have a longer life, 6 months or more. However, white bulbs are expensive; an 18 watts costs 120 Afs, as compared to 20 Afs for a regular 100 watt bulb.

Transfer (BOT) and Full Privatization of Assets, the highest extent of privatization. *As a start*, we will explore the feasibility of privatizing Works and Services of the DABM. Under this approach, the utility contracts out specific works such as rehabilitating and expanding distribution system and construction of new power plants. This approach is useful in situations, such as in Afghanistan, where there is no experience in privatizing power on a meaningful scale.

In the regulatory arena, our strategy includes: establishing enabling environment including commercial and power-sector specific contract laws such as for dispute resolution. Moreover, functioning courts can be an important enabler to attract private sector investments. We propose to create what we call a Minimum Infrastructure Platform (MIP)<sup>38</sup> for private sector led growth.

Given the on-going power infrastructure activities, including those planned, under proper regulatory environment and security conditions, over time, selectively, there is a good potential for the privatization of power. While some success of telecom privatization exists, a key difference is the public's perception that providing power is the government's responsibility, and also much higher costs of power infrastructure as compared to telecom. Nevertheless, such items as Concessions, Licenses can be looked into for potential use.

Some of the privatization areas we will look into are: (i) Equipment and human resource supply to power construction and rehabilitation projects, (ii) Owning and operating of small and medium sized stand-alone grids,<sup>39</sup> (iii) Management/maintenance contracts for regional power programs and major power plants, (iv) The installation and operation of alternative energy sources (solar and wind installations), potentially with subsidies in the short- and medium-terms, (v) For the longer term, through unbundling and divestiture of power generation plants which could operate as stand alone units that sell power to the grid, and (vi) over the longer term (2015 or beyond), subsidized development of coal fired power plants to support major industry such as mining.

Security remains an important issue including for private sector participation and operation. To reduce security-related risks, the Government is increasingly implementing corrective measures including increased security, creating employment opportunities and apprehending criminals.

Additional regulatory improvements are also underway to lower risks to the private sector. Also, we will educate the public to help accept privatization, as gradually phased in. We will work towards improving the regulatory framework to assure an investment's safety, such as, in terms of political risks and an acceptable rate of return. We are committed to encouraging and increasing private sector role in power.

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<sup>38</sup> Proposed MIP is a combination of elements including: (i) business environment; (ii) investment facilitation; (iii) human capital; (iv) financial services; (v) Power sector-specific laws including dispute resolution, and (vi) Physical and support infrastructure.

<sup>39</sup> The Omary Electric Company in Ghazni serves 8,500 customers with 24 hour electricity and only 42 staff (compared to DABM in Ghazni who serve 1,460 customers with 5 hours of supply from 29 staff).

**ANNEX 1:*****Policy Activity Matrix***

(Representative Items)

<i>S #</i>	<i>Specific objectives are to:</i>	<i>Responsible Institution(s)</i>	<i>Expected Result of Activities Completion</i>	<i>By (Date)</i>
1.	Complete DABM's Commercialization/approve Bye-laws to liquidate DABM	MOF/Cabinet & MoE	Will expedite DABM's	2007/08
2.	Provide training to electricity technicians/engineers/others.	DABM/MEW	Builds staff skills to state-of-the-art	2007-2010
3.	Finalize Power Purchase Agreements	DABM/MOF	Brings private sector participation	2008
4.	Assess the feasibility of installing pre-paid metering system	DABM/MEW	Contributes to increasing cost recovery	2008
5.	Establish Energy Regulatory Commission	MEW/Others	Help set up power tariffs	2008
6.	Capacity building for Environmental Management	NEPA	Environmental Regs./Enforcement	2008/09
7.	Strengthen approved Rural Electrification (RE) Interventions	MRRD/MEW/NRRDC	Help initiate National Rural Electrification program	
8.	Improve inter-agency communication and communication with donors	MEW, MOF	Better work coordination.	2007
9.	Improved GoA and Donors Communications	MEW/MoF	Potential of increased funding	2008
10.	Increased Capacity to Develop Budgets	MoF/MEW	Helps in Planning etc.	2008
11.	Public education and awareness campaign such as for tariff Increases and increased private sector participation	MEW/NEPA	Helps in accepting commercial rates for power, and their needs	2008
12.	Improve security	ANA, ANP, MoJ, ISAF	Keep activities going, and also to provide worker safety.	2007-2008

**ANNEX 2**

***Figure 1: Afghanistan Electricity Coverage***

***Figure 2: Darunta (Jalalabad) Control System***

***Figure 3: Kabul East Thermal Power Plant Damaged (Un-operational)***

***Figure 4: NEPS: Existing, Under Construction and Planned Transmission Systems***

***Figure 5: Afghanistan's Existing, Under Construction, and Planned Transmission Systems***

***Figure 6: Priority Proposed Transmission***

***Figure 7: SEPS: Existing and Planned Systems***

***Figure 8: ETS: Existing and Under Construction Systems***

***Figure 9: WTS: Existing and Under Construction Systems***