



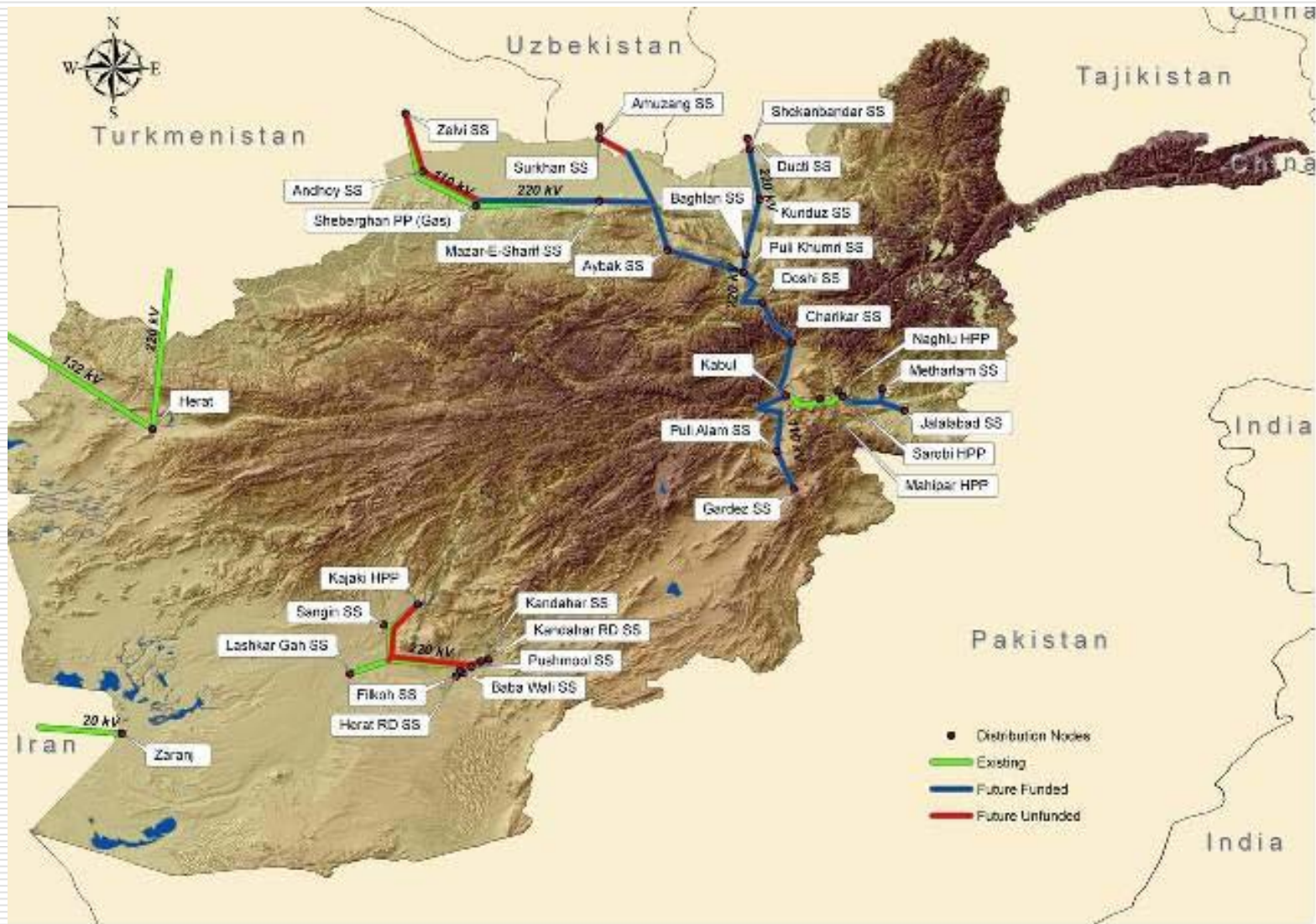
A Quantitative Assessment of the Implementation of Strategy in the Electric Power Sector in Afghanistan

**Afghanistan Energy Assistance Program (AEAP)
Advanced Engineering Associates, Inc. (AEAI)**

Introduction and Context of the Presentation

- Quantitative Assessment of all Donor Programs and all GoA actions across the electric energy sector
- Afghanistan Energy Assistance Program (AEAP)
- One Key Component of USAID's Afghanistan Strategy

Focus of AEAP/AEAI: NETS and SETS



Afghanistan: Shared Strategic Vision

- Evolve from a poverty-stricken, unstable, insecure and fragmented post-conflict nation, into a systemically self-sustaining, stable, secure and fully-integrated nation, internally and externally
- USAID's Afghanistan Strategy is coincident with, and complementary to the Government of Afghanistan's strategic vision and priority objectives
- Sector Strategy Integration

Afghanistan's Goals

- Established in
 - National Development Framework (NDF) – 2002
 - Securing Afghanistan's Future – 2004
 - National Priorities Program – 2005
 - National Development Strategy – 2005
 - Afghan Compact - 2006



London Conference on Afghanistan January 31, 2006

Afghan Compact – Largest Donors

London Conference on Afghanistan Financial Commitments (in millions)

	Current Year Commitments	Future Commitments to the Afghanistan National Development Strategy
	1384 March 2005- March 2006	From 1385 From March 2006
United States	3,053	4,000
World Bank	263	1,200
Asian Development Bank	244	1,000
United Kingdom	284	885
Germany	74	480
Japan/JICA	31	450
European Community	132	268
Spain	12	182
India	126	181
Netherlands	53	179
Saudi Arabia	22	153
Pakistan	105	150

Afghanistan's National Development Strategy

- Align Priorities and Programs of all Cooperating Partners with needs determined by Afghanistan
- End State:
 - Basic social and economic conditions needed for long-term sustainable economic and socio-political growth, stability, and security

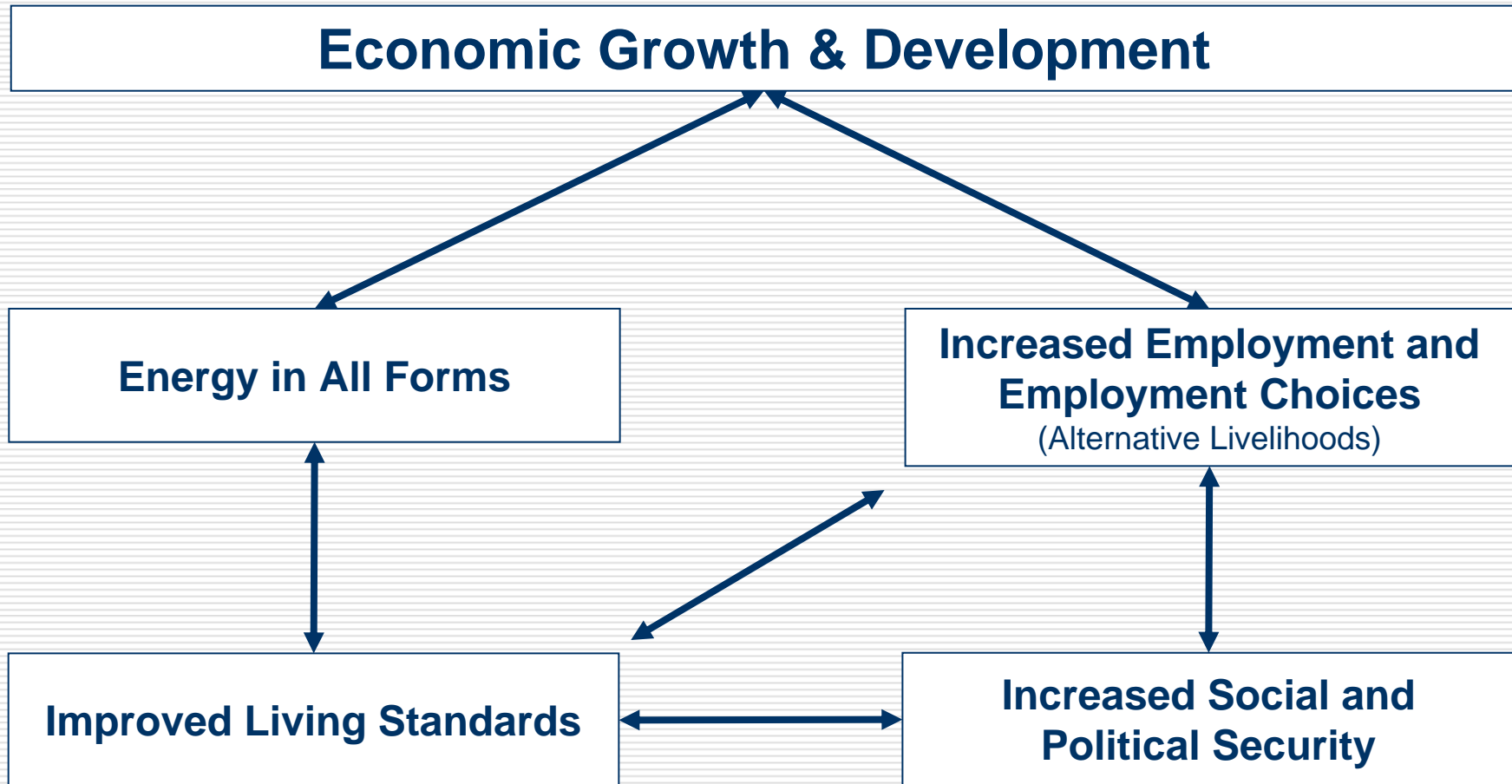
USAID Strategic Objective: Economic Growth

- Security
- Economic & Social Stability
 - Rebuilding Infrastructure
- Reform
 - Market Economy
 - Governing Institutions
 - Transparency of Process
 - Public Service Financing
- Capacity Building – Institutions and Infrastructure to Support Development Essential to the Endurance of Stability and Reform
 - Physical
 - Social
 - Political
 - Economic

AEAP and USAID Objectives

- Energy Services
 - Improve: Access, Reliability, Stability, Affordability
- Short-term (1-3 years) to Intermediate (3-5 years)
 - Emergency Programs: “Keep the Lights On”
 - Add Capacity, Lower the Cost of Service
 - Physical
 - Human
 - Financial
 - Directed towards reduced subsidies and increased Energy Security
- “Energy Security” - Definition: economic growth unconstrained by energy shortages; easier access at affordable price

USAID's Strategic Objectives: Linkages

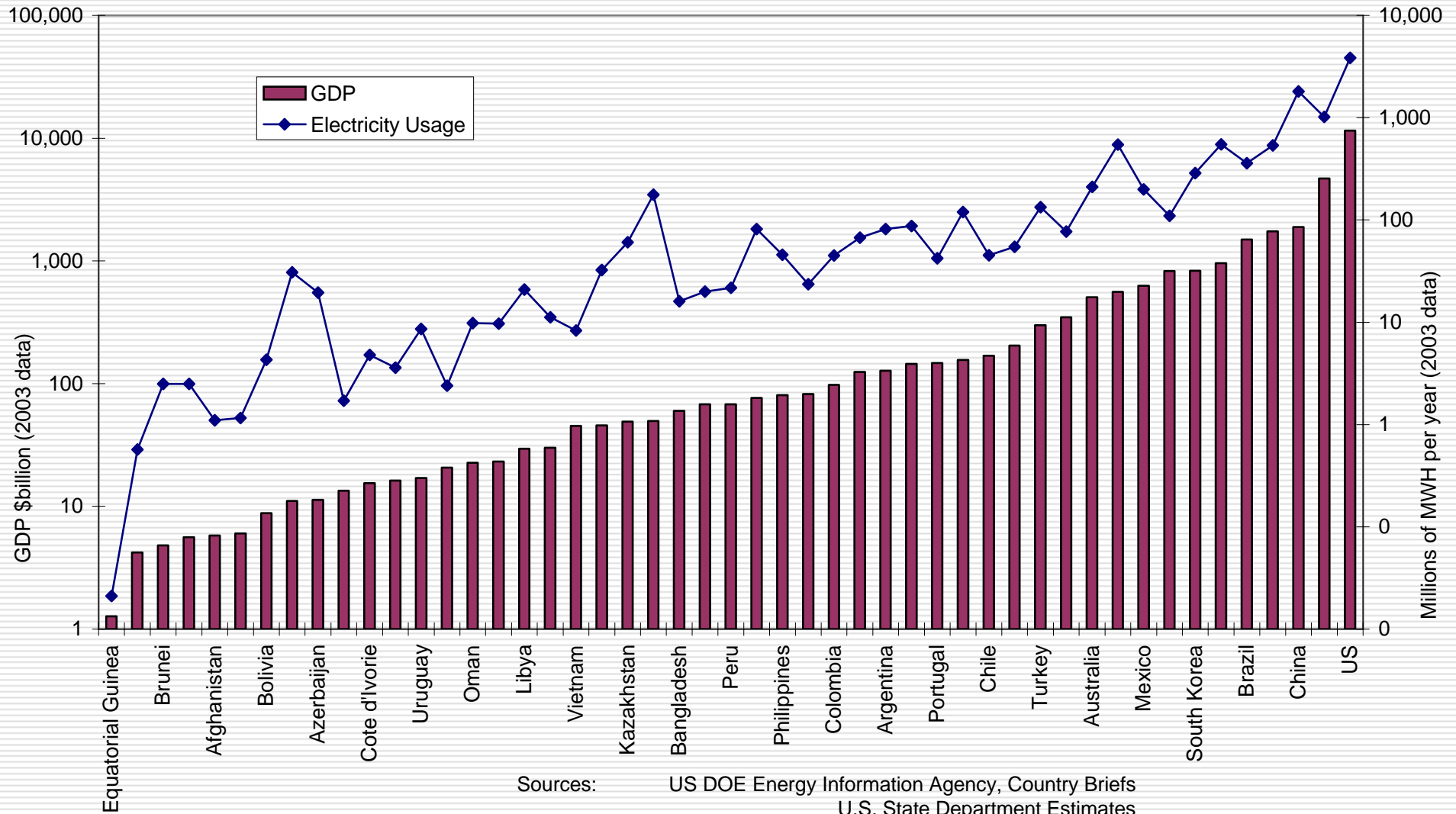


Afghanistan Electricity Use is Relatively Very Low

<u>Country</u>	<u>GDP \$ billions</u>	<u>Power Demand billion KWh</u>
Equatorial Guinea	1.3	0.02
Congo	4.2	0.57
Brunei	4.8	2.50
Paraguay	5.6	2.50
Afghanistan	5.8	1.10
Gabon	6.0	1.16
Bolivia	8.8	4.30
North Korea	11.1	30.80
Azerbaijan	11.3	19.50
Angola	13.4	1.71
Cote d'Ivoire	15.5	4.80
Yemen	16.3	3.60
Uruguay	17.0	8.60
Sudan	20.7	2.40
Oman	22.7	9.80
Qatar	23.2	9.70
Libya	29.5	20.90
Ecuador	30.0	11.20

Sources: US DOE Energy Information Agency, Country Briefs
U.S. State Department Estimates
AEAI Power Sector Collected Statistics

Electricity and GDP are 90% Correlated (\$1,000 GDP ~ 300 kWh power use)



Sources: US DOE Energy Information Agency, Country Briefs
U.S. State Department Estimates
AEAI Power Sector Collected Statistics

Benefit of AEAP Programs

COST BENEFIT ANALYSIS OF PROVIDING ELECTRICITY

		<u>NW Kabul</u>	<u>Kandahar</u>	<u>Sheberghan</u>
Net MW Capacity		44.00	14.00	100.00
Months Operation		12.0	12.0	12.0
Availability		<u>60%</u>	<u>85%</u>	<u>85%</u>
Energy Produced or Purchas	MWh	231,264	104,244	744,600
<u>Fuel (If Any)</u>				
Diesel Price Cents/Litre		63	63	
Litres/MWh		444.0	250.0	
Energy Produced or Purchased		231,264	104,244	
Fuel Expense (If Any)		64,689	16,418	
<u>Capital Recovery/Sinking Fund (annualized)</u>				
\$1,000 per KW over 20 years				5,000
kWh per \$1000 of GDP		300	300	300
MWh per \$1000 of GDP		0.3	0.3	0.3
Annual GDP Benefit (predicted)		770,880	347,480	2,482,000
Annual USAID Cost (\$millions, annualized)		64,689	16,418	5,000
Benefit:Cost		12:1	21:1	496:1

US State Department – USAID Strategic Plan



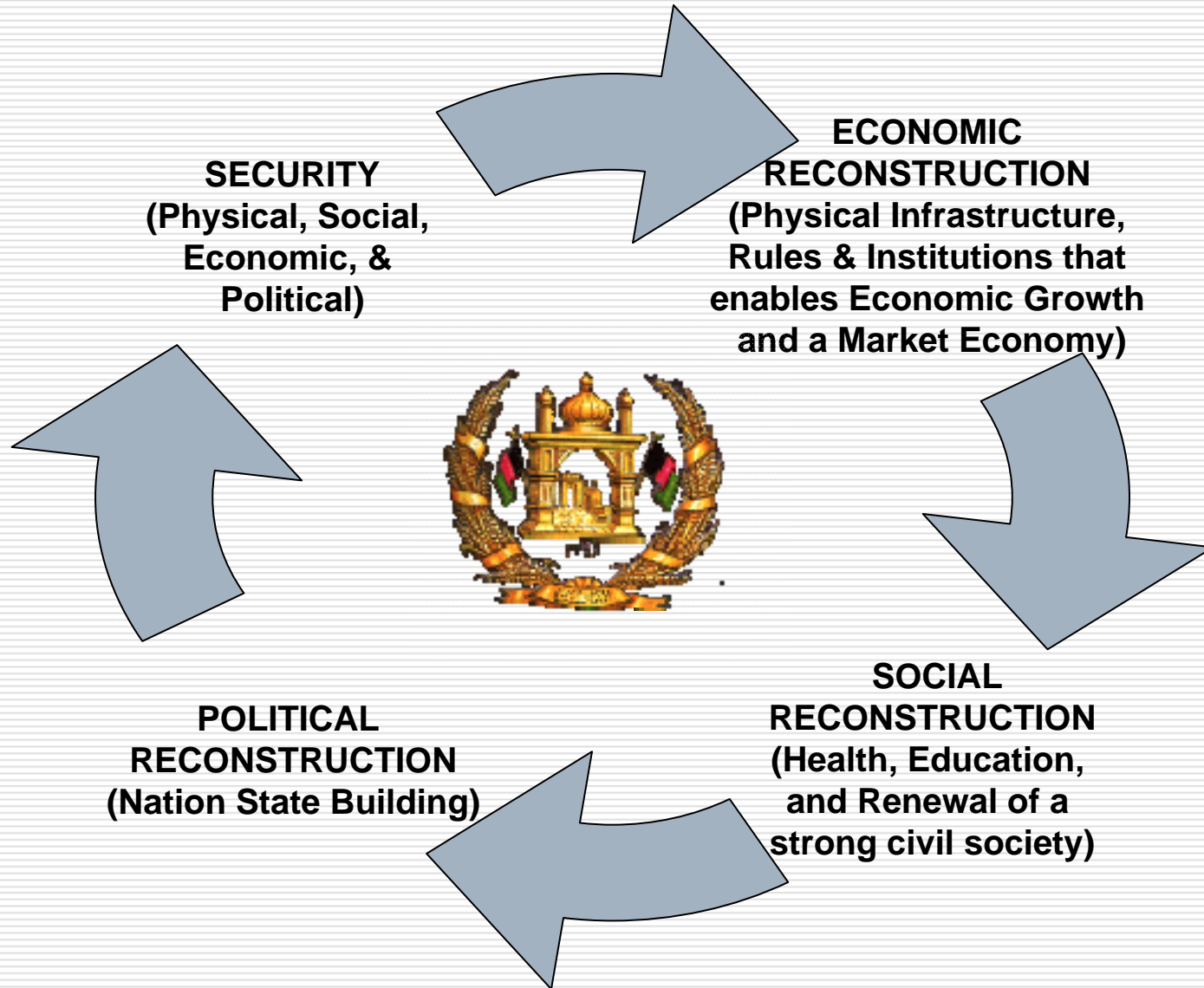
SECURITY
(Physical, Social,
Economic, &
Political)

**ECONOMIC
RECONSTRUCTION**
(Physical Infrastructure,
Rules & Institutions that
enables Economic Growth
and a Market Economy)

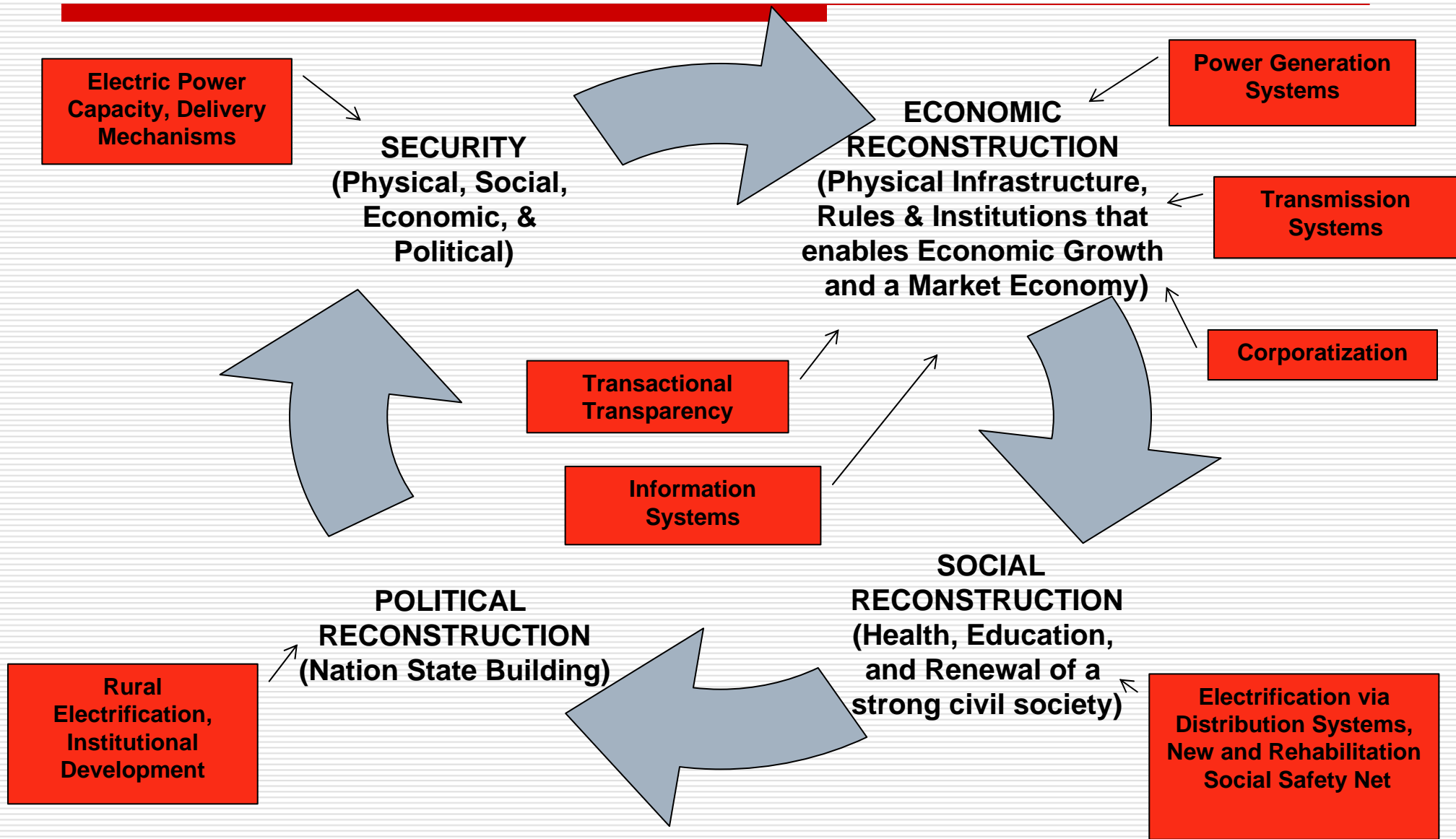


**POLITICAL
RECONSTRUCTION**
(Nation State Building)

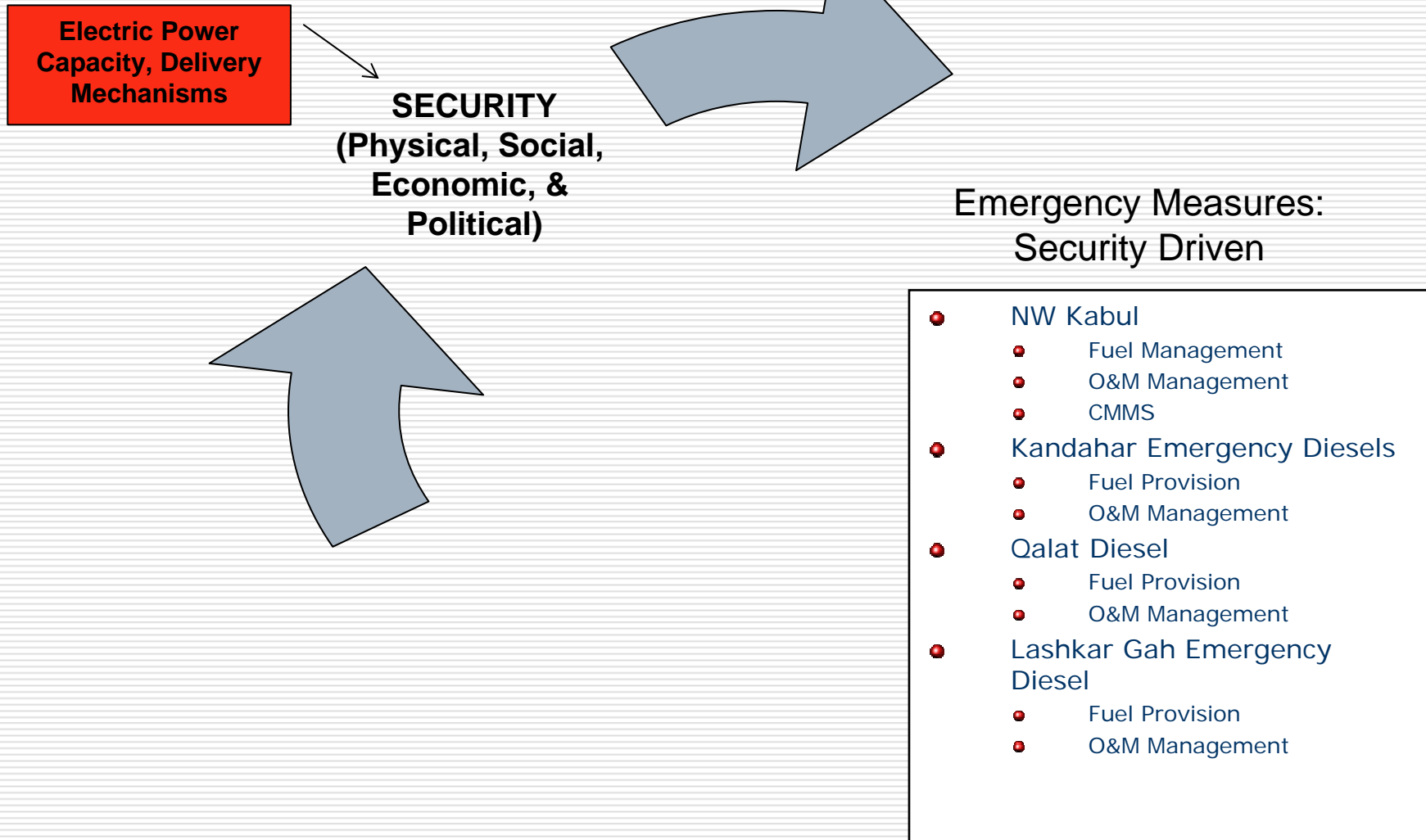
**SOCIAL
RECONSTRUCTION**
(Health, Education,
and Renewal of a
strong civil society)



AEAP Roles



AEAP Projects

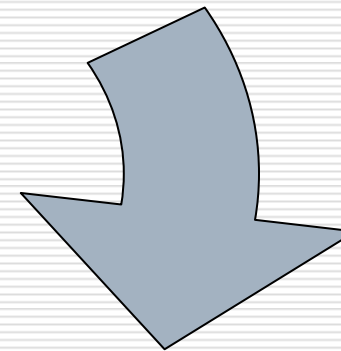
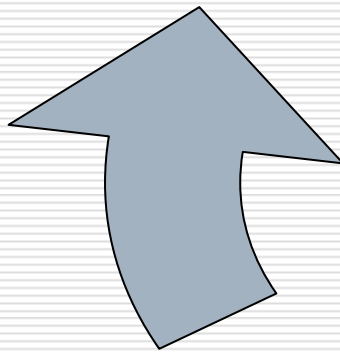


AEAP Projects

- DABM
 - Billing and Collections Pilot Program
 - Baseline of Needs
 - Institutional, capacity building/training
 - Minor reconstruction

- Rural Electric Association development (training REA, private sector participation)
 - Aybak
 - Tirin Kot
 - Qalat

- Electric Distribution (humanitarian, capacity building/training)
 - Aybak
 - Tirin Kot
 - Qalat

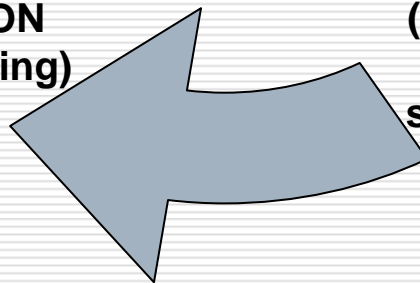


**POLITICAL
RECONSTRUCTION
(Nation State Building)**

**SOCIAL
RECONSTRUCTION
(Health, Education,
and Renewal of a
strong civil society)**

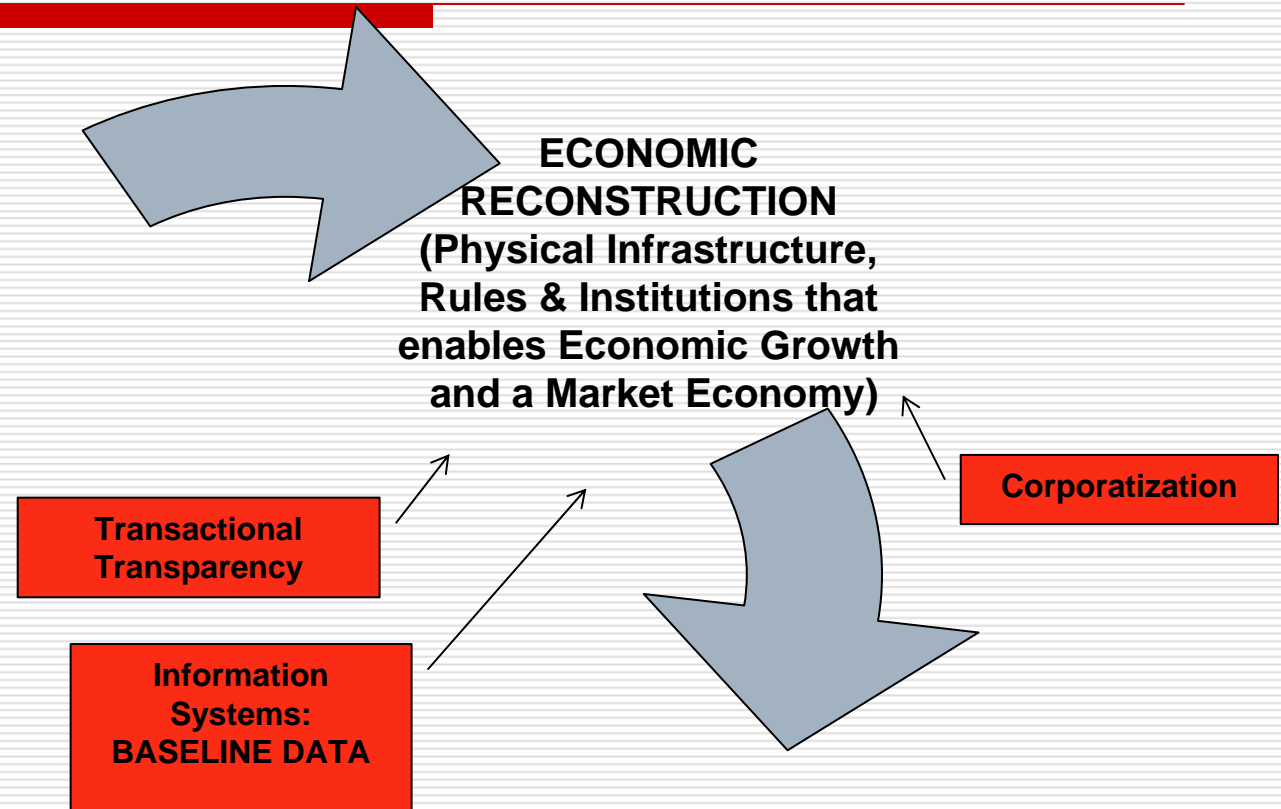
**Rural
Electrification,
Institutional
Development**

**Electrification via
Distribution Systems,
New and Rehabilitation
Social Safety Net**



AEAP Projects

- Thuraya Facilities- provided to MEW and DABM for system control
- MEW advisory, workshops, training
- DABM- Billing and Collections
- DABM- Physical Reconstruction
- Power Sector Model
- Power Sector Database



AEAP Projects

GENERATION

- Darunta Hydro Project
 - Rehab
 - Needs Assessment
- Kajaki Hydro Project
- NW Kabul
 - Unit 3 & 4 Rehabilitation
 - Spare Parts & Consumables
 - CMMS
 - Supply
 - Training
- Kandahar Diesels
 - Equipment Supply
 - Spare Parts & Consumables
 - Training
- Qalat Diesel
 - Equipment Supply
 - Spare Parts & Consumables
 - Training
- Lashkar Gah Diesel
 - Equipment Supply
 - Spare Parts & Consumables
 - Training
- Sheberghan Gas to Power Feasibility Study
- Soviet Diesels Assessment (abandon)

TRANSMISSION

- NETS
 - Assessment
 - Program Management
 - Donor / Contractor Coordination
- SETS
 - (Kajaki-Kandahar) - System Assessment

ECONOMIC RECONSTRUCTION
 (Physical Infrastructure, Rules & Institutions that enables Economic Growth and a Market Economy)

Power Generation Systems

Transmission Systems

Constraints to Achieving Objectives

- Ability to address the root causes of fragility, insecurity and poverty constrained by
 - Physical, political and regulatory infrastructure can't yet support systemic and sustainable economic growth
 - Human capacity limited, government institutions are weak
 - Transactional transparency is foggy, at best
 - Rule of law not proven; civil or commercial

Quantitative Assessment - Objectives

- Evaluate existing operations
- Assess power supply and demand, imports, domestic generation (Electric Energy Balance)
- Assess investment decisions: quantify strategy implementation
 - Donors' investments now; Must set foundation for:
 - Private sector investments later

Quantify Strategy Implementation: 3 Components

- **Software**

- Financial Model

- **Database**

- Baseline Data

- **Communication Process**

- Known investment programs
- Needed programs, financing
- Tariffs, Operations, Corporatization
- Correlate, cross-reference

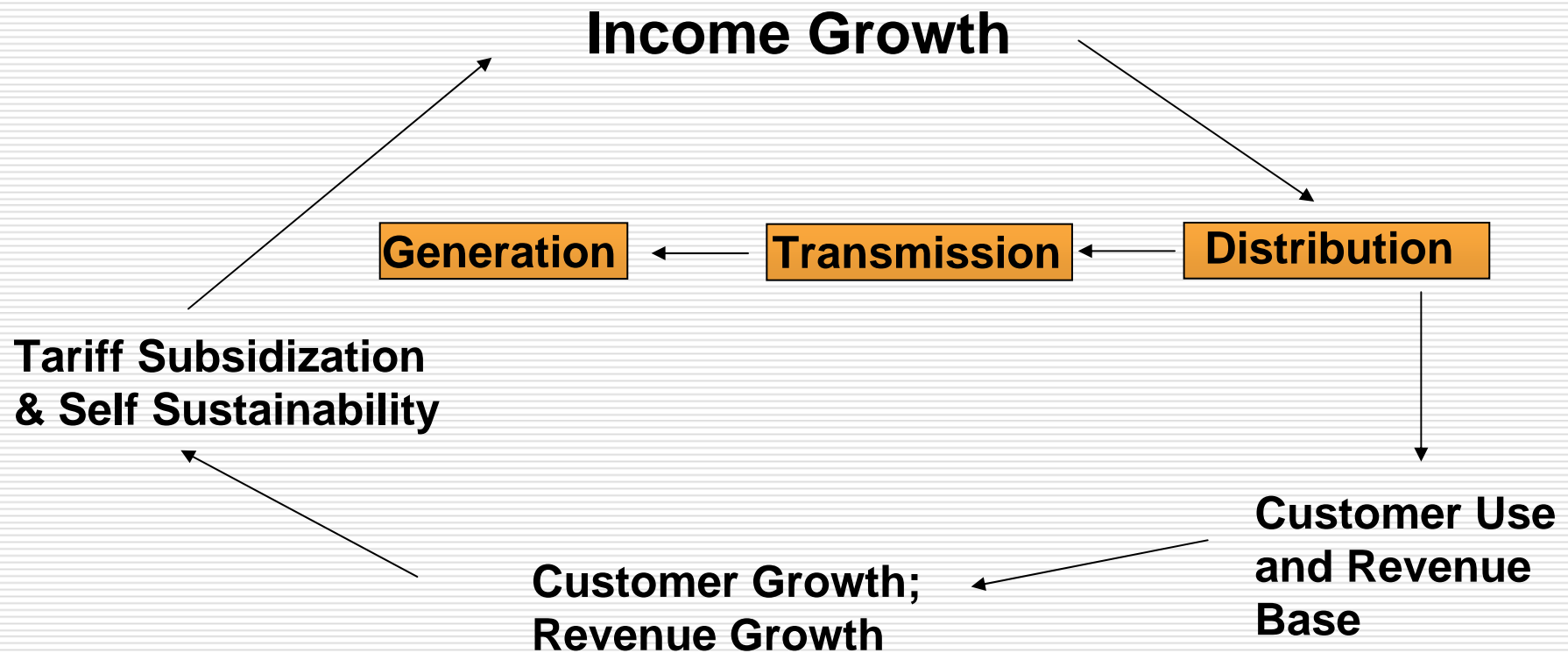
Outcomes: Predict cost recovery, assess sustainability of tariffs, examine subsidies needed, budgeting

Examples of Commercial Models

- Promod - production costing LOLP modeling
- Prosym - integrated utility financial planning
- EGEAS - S & W - Electric Generation Expansion Analysis System
- PTI - Siemens Load Flow Model
- GE - Load Flow Model
- NEMS (National Energy Modeling System) - Sub-modules-ECP- Electricity Capacity Planning, EFP-Electricity Finance & Pricing, EMM- Electric Market Model, LDSM-Load & Demand Side Management Model
- EPRI - Macro and micro models-for system analysis and assessment
- WASP - system planning, least cost planning, dispatching

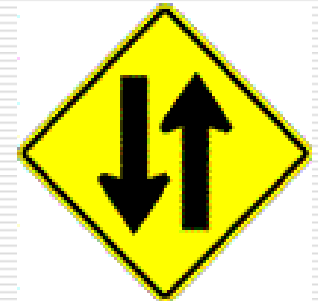
- All good, but
 - Useful for more mature and stable systems, need full historical database of operating parameters, good for fine-tuning optimizations
 - Not applicable in extreme operating conditions with limited information and considering radically changing elements

AEAI Energy Sector Model Power Sector Business Units



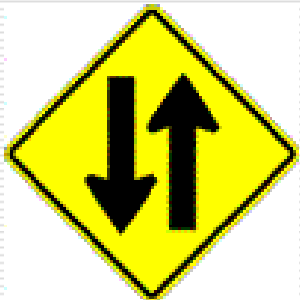
Communication

- Data from DABM, MEW, Central Dispatch, AEAI-run diesels, Management Reports go back
- Current and Future:
 - Capacity transfer to Afghan counterparts
 - Address cost recovery and tariff levels, subsidy reduction



- Donors

- planned programs
- Share interim results (i.e. cost of new connections)
- Identify funding gaps (i.e., distribution => generation)
- Create reliable, agreed-upon information



Baseline Assumptions Example : Daily Generation Data

Wednesday, January 25, 2006

Daily Power Production (MWH)

		Hours	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00	Daily Total	
Kabul/East																												
Asadabad	Hydro																											2.2
Darunta	Hydro																											189.4
Kbl-Sorobi	Hydro	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	216.0
Mahipar	Hydro	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	438.0
Naghlu	Hydro	1.0				1.0	3.0					2.0	2.0					27.0	53.0	53.0	53.0	53.0	53.0	53.0	43.0	2.0	398.0	
Ghazni	Thermal																											1.1
Khost	Thermal																											1.8
NW Kabul 3	Thermal																20.0	20.0	20.0	20.0	21.0	21.0	21.0				143.0	
NW Kabul 4	Thermal	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	21.0	21.0	21.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	525.0
<i>Hourly Total</i>		50.0	49.0	49.0	49.0	50.0	52.0	49.0	47.0	50.0	52.0	52.0	50.0	49.0	49.0	69.0	97.0	122.0	122.0	123.0	123.0	123.0	102.0	92.0	51.0		1,914.5	
North																												
Jabul-se-raj	Hydro																											5.6
Pul-e-Khomri 1	Hydro																											
Pul-e-Khomri 2	Hydro																											80.8
Andkhoy	Import																											48.6
Kunduz	Import																											158.2
Mazar-e-Sharif	Import																											330.0
Sar-e-Pul	Import																											10.4
Sheberghan	Import																											190.7
<i>Hourly Total</i>																												924.2
South																												
Grishk	Hydro																											33.0
Kajaki 1	Hydro																											
Kajaki 3	Hydro																											
Kandahar	Thermal	7.8	7.6	7.8	7.9	8.1	9.0	10.2	10.3	10.2	10.3	9.9	10.1	7.1	9.4	10.0	9.0	9.4	7.3	7.1	8.0	9.3	9.1	9.2	8.5		212.5	
Lashkar-Gah	Thermal																2.1	2.2	2.5	2.3	2.2	2.1	2.1	2.1	2.1		19.7	
Paktya	Thermal																											
Qalat	Thermal	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4			0.3			0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.3		6.0
Uruzgan	Thermal																											
<i>Hourly Total</i>		8.1	8.0	8.0	8.2	8.5	9.3	10.5	10.7	10.2	10.3	10.2	10.1	7.1	9.8	10.3	11.3	11.9	10.2	9.8	10.7	11.8	11.6	11.7	11.0		272.1	
West																												
Herat	Import																											480.9
Zaranj	Import																											59.8
<i>Hourly Total</i>																												540.7
Daily Grand Total MWH																										3,551.6		
		Daily percentage of MWH based on data provided: Hydro 38.4 % Thermal 25.6 % Import 36 %																										

Note: Blank means no data provided

Data Analysis

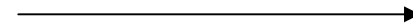
2005

Annual Production Report

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yearly Total
Kabul East														
Naghlu	Hydro								0	627	21456	13442	4771	40,296
Mahpar	Hydro								0	0	0	0	7503	7,503
Kbl-Surobi	Hydro								0	648	6678	5812	6601	19,639
Darunta	Hydro													0
Asadabad	Hydro													36
Khost	Thermal													1,770
Ghazni	Thermal													0
NW Kabul 3	Thermal													10,468
NW Kabul 4	Thermal													33,381
	<i>Monthly Total</i>													113,094
North														
Pul-e-Khormit 1	Hydro													0
Jabulsarag	Hydro													0
Pul-e-Khormit 2	Hydro													0
Mazar-e-Sharif	Import													23,721
Sare-e-Pul	Import								0	0	1645	787	246	2,678
Kunduz	Import													504
Sheberghan	Import													394
Andkhoy	Import													567
	<i>Monthly Total</i>													63
South														
Kajaki 1	Hydro													136
Kajaki 3	Hydro													350
Grishk	Hydro													599
Qalat	Thermal													154
Kandahar	Thermal													557
Lashkar-Gah	Thermal													545
Paktya	Thermal													0
Uruzgan	Thermal													0
	<i>Monthly Total</i>									8191	11106	20077	19646	75,241
West														
Zaranj	Import								0	0	48	249	829	1,125
Herat	Import			0	0	0	0	0	0	0	1752	3426	9966	15,145
	<i>Monthly Total</i>									0	0	1800	3675	16,270
													Yearly Grand Total (MWH)	245,668

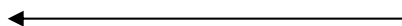
Priority #1:

Establish Going-Forward Data Collection Process



Priority #2:

Back-fill Historical Data



Next: Remote sensing (RFP is done, implementation by next contractor), computerization, internet links will improve data

Note: Blank means no data provided

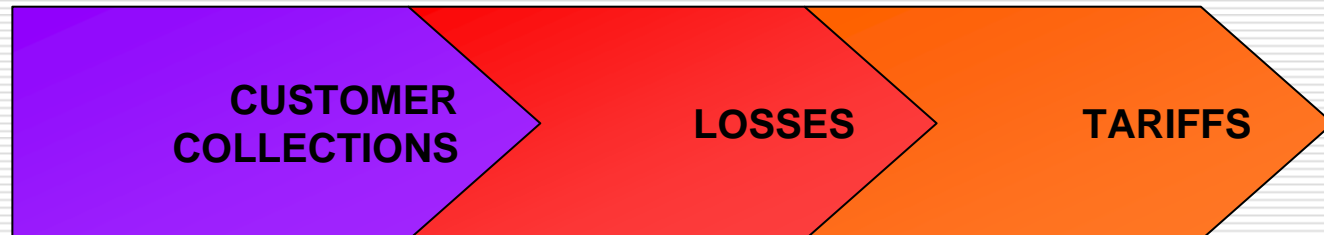
Capturing Iterative and Interactive Effects

Capital Programs



Linkages

Operating Parameters



Baseline Data

Baselines

- Existing supply and demand, transmission & distribution constraints. Reviewed prior studies and conducted field surveys.

Donors' programs

- NETS, SETS, new distribution, Sheberghan, rehab generation

Customer Behavior

- Energy usage, collection compliance, metering, commercial losses. Most difficult to get.

Technical improvements

- Corporatization, efficiency improvements, new low-cost power supply, loss reduction)



Goes into Quantitative Assessment, subject to continual refinement.

Validated data in hand is useful for initial analysis.

Energy Sector Model Inputs & Outputs

● Inputs:

- Baseline Data
- Future (Coordinated View)
 - Customer Additions
 - NETS (\$420 million)
 - SETS (\$72 million)
 - Domestic Power Plants Rehabilitation
 - Corporatization

● Outputs (Time Determined)

- Energy Balance
- Financial Statements
- Tariffs Needed
- Subsidies Needed
- Reserve Margin
- Cash Position

Existing Customer Database

Customer Information January 2006 Date 11 Feb 2006

S.no	Province/City	Residential	Commercial	Governmental	Total
1	Badakhshan Faizabad	1,671	1,200	60	2,931
2	Baghlan (Ghoori)	8,859	1,125	231	10,215
3	Balkh (mazar-e-sharif	49,139	3,142	646	52,927
4	Balkh Hayratan	3,202	174	214	3,590
5	chack-e-wardak	1,350			1,350
6	Farah Electricity	90	100	4	194
7	Faryab Electricity	4,237	455	43	4,735
8	Faryab(Andkhai)	11,133	1,329	180	12,642
9	Ghazni(Electricity)	1,195	208	48	1,451
10	Ghoor Chaghcharan	554			554
11	Helmand Grishk	1,210	200	30	1,440
12	Helmand Lashkargah	23,640	4,410	50	28,100
13	Herat (Electricity)	45,440	1,340	220	47,000
14	Jawzjan Electricity	23,300	1,935	95	25,330
15	Kabul KD	128,872	5,650	1,242	135,764
16	Kabul Sarobi	2,388	200	12	2,600
17	Kandahar Electricity	19,365	4,845	188	24,398
18	Khost Electricity	697	469	19	1,185
19	Kunar Assad Abad	340	60	30	430
20	Kunduz Electricity	13,616	1,770	124	15,510
21	Laghman Metharlam	480			480
22	Nangarhar Eletricity	7,707	1,180	209	9,096
23	Nimroz Zaranj	4,994	1,182	24	6,200
24	Paktya Electricity	710	100	40	850
25	Parwan Electricity	5,053	1,500	430	6,983
26	Sammangan Aibak	2,300		1,120	3,420
27	Sar-e-pul Electricity	3,213	643	12	3,868
28	Takhar Talooqan	20	380		400
29	Zabul Qalat	446			446
30	Total	365,221	33,597	5,271	404,089

Connected Customers EOY 2005
Domestic Commerical Government

Group1	41883	4362	330
Group2	63500	3316	860
Group3	13616	1770	124
Group4	136254	7032	1278
Group5	7707	1180	209
SETS	44215	9455	268
NETS	262960	17660	2801
Total	307175	27115	3069

Customer Usage Profile, Current Snapshot

	<u>avg Watts</u>	<u>Load Factors</u>
Domestic	1,000	40.0%
Commercial	5,000	45.0%
Government	20,000	45.0%

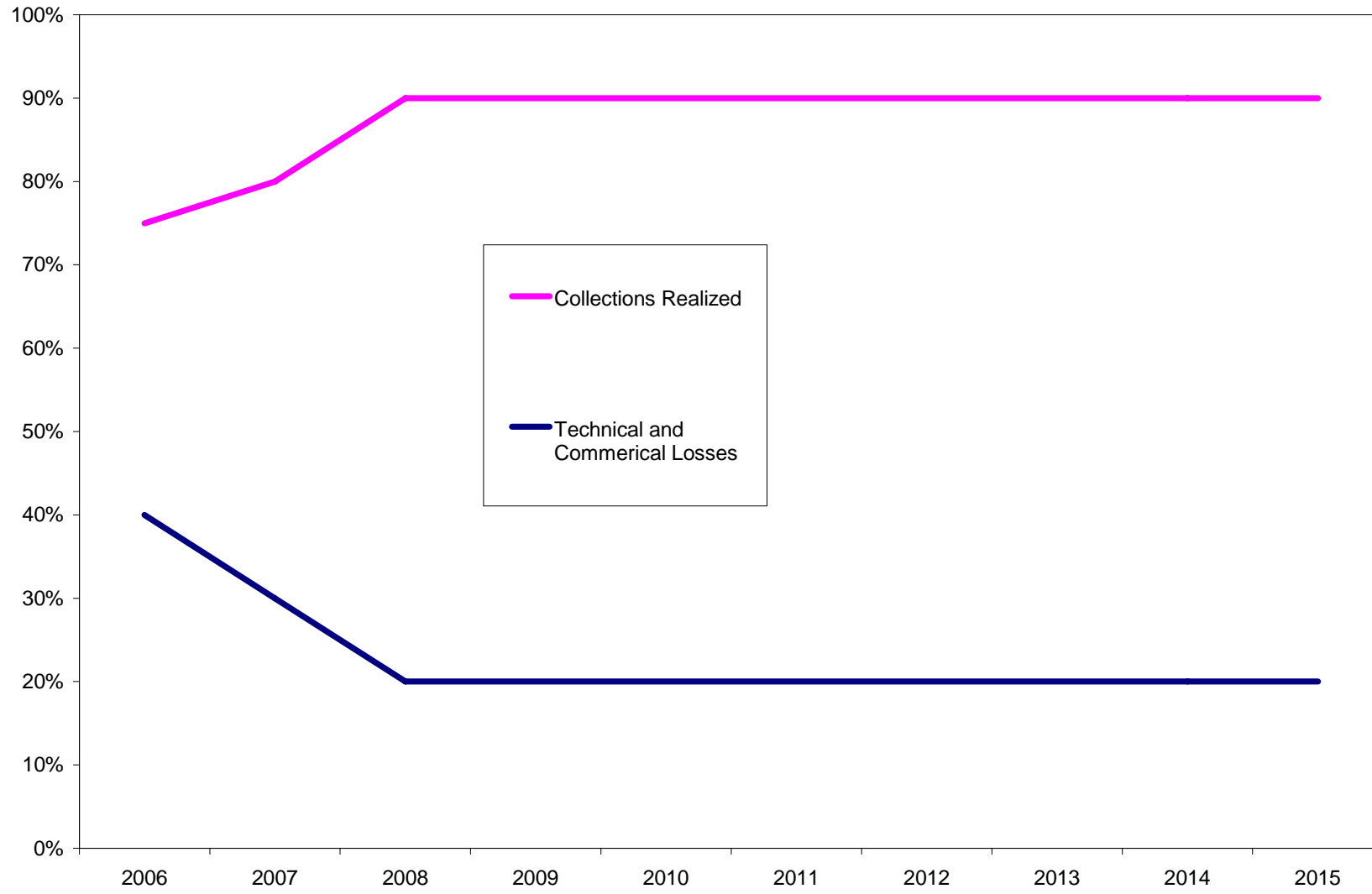
Profile of power usage nationwide

Andkhoy,
Maimana,
Sheberhgah,
Pul-e-Khumri

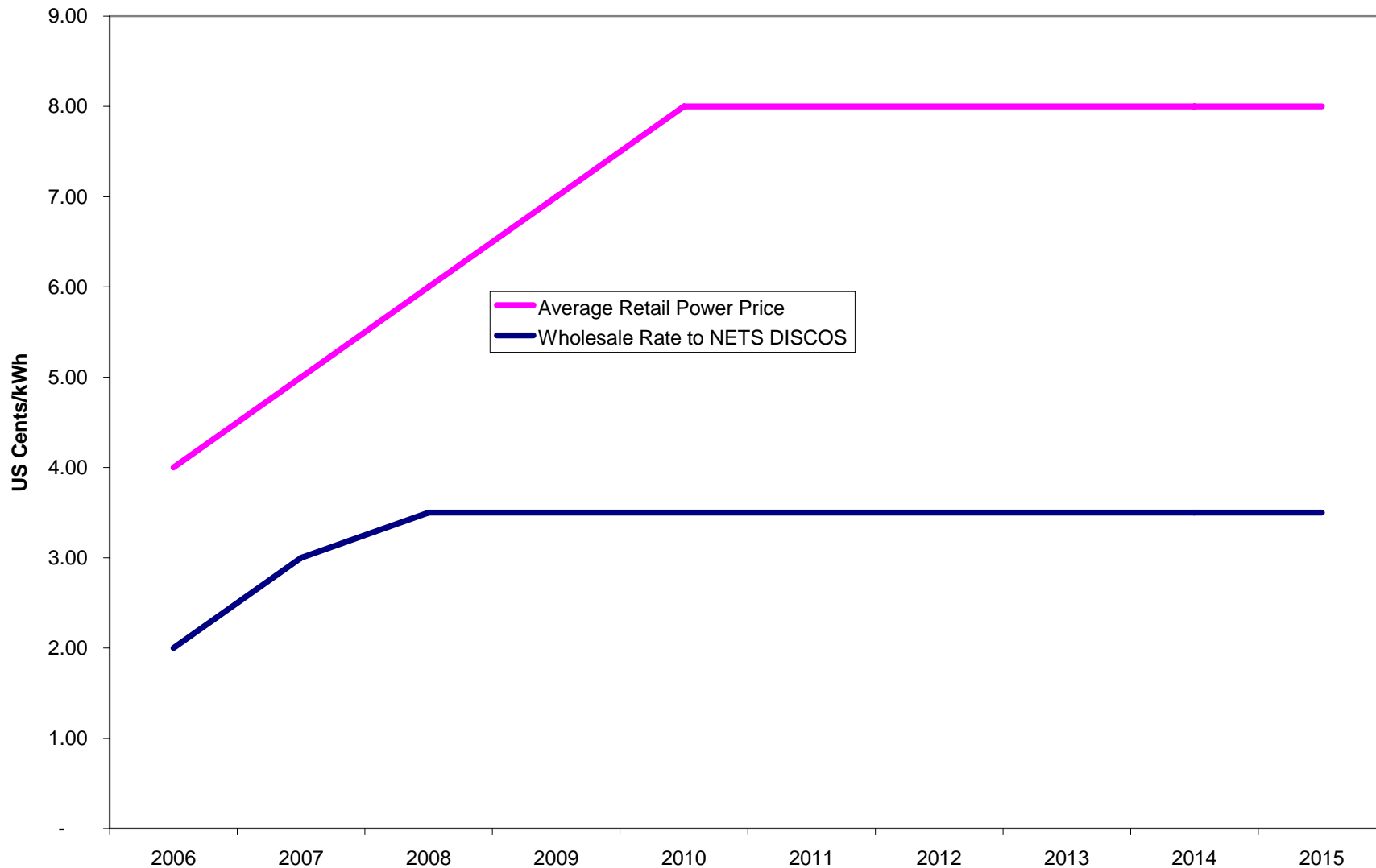
DEMAND		Tot. Customers						
Group1	peak Watts	46,575	46,575	46,575	46,575	46,575	46,575	
Domestic	1,000	41,883	41,883	41,883	41,883	41,883	41,883	
Commercial	5,000	4,362	4,362	4,362	4,362	4,362	4,362	
Government	20,000	330	330	330	330	330	330	
Load Factors		MWh						
Domestic	40.0%	12,464	11,258	12,464	12,062	12,464	12,062	
Commercial	45.0%	7,302	6,595	7,302	7,066	7,302	7,066	
Government	45.0%	2,210	1,996	2,210	2,138	2,210	2,138	
Import Supply available		21,976	19,849	21,976	21,267	21,976	21,267	
		3,080	2,782	3,080	2,981	3,080	2,981	

AEAI's statistics were cross-referenced against data from DABM, World Bank, SMEC, Norconsult, and PISU

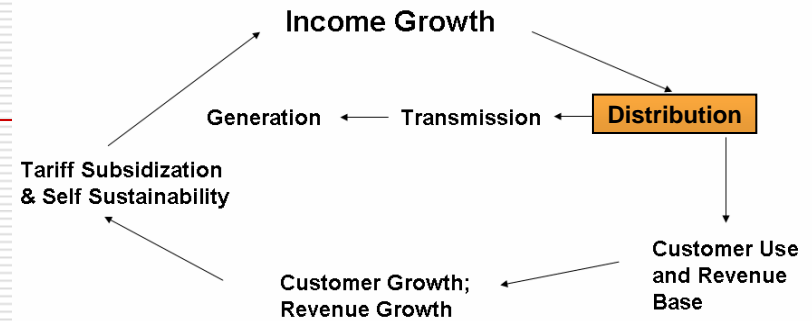
NETS Losses and Collections – A Scenario



NETS Tariffs Transmission & Distribution



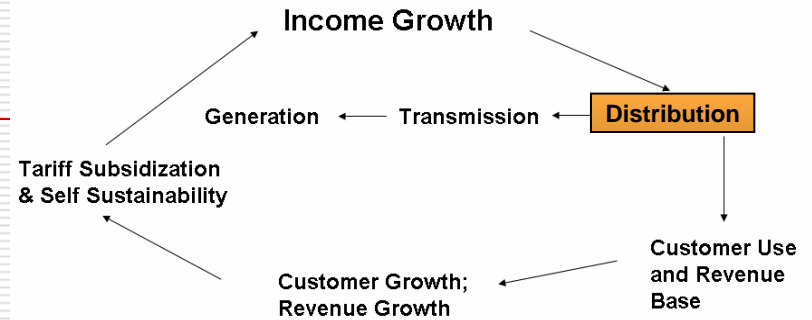
Distribution Company Sample Run



<u>INCOME STATEMENT DISCO</u>	<u>NETS</u>	<u>Year</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>	<u>2009</u>	<u>2010</u>	<u>2011</u>	<u>2012</u>
REVENUE: Elect. Energy Sales		\$ 000	14,881	25,260	60,196	162,242	222,504	244,754	269,230
EXPENSES:									
Interest expense	4%	\$ 000	-	-	1,200	2,800	4,800	6,800	8,800
Power acquisition from TRANSCO		\$ 000	16,534	27,065	48,770	112,668	135,202	148,722	163,594
Distribution Capital Recovery		\$ 000	1,842	3,684	5,895	8,548	11,731	13,641	15,742
Payroll	10.0% of revenue	\$ 000	1,488	2,526	6,020	16,224	22,250	24,475	26,923
Training	1.0% of revenue	\$ 000	149	253	602	1,622	2,225	2,448	2,692
Material (Inventory)	2.0% of revenue	\$ 000	298	505	1,204	3,245	4,450	4,895	5,385
Routine Maintenance	5.0% of revenue	\$ 000	744	1,263	3,010	8,112	11,125	12,238	13,461
Other Expense	1.0% of revenue	\$ 000	149	253	602	1,622	2,225	2,448	2,692
Social Charges	5.0% of payroll	\$ 000	74	126	301	811	1,113	1,224	1,346
Total Expenses		\$ 000	21,279	35,675	66,403	152,854	190,322	210,091	231,837
Operating Profit		\$ 000	(6,397)	(10,415)	(6,207)	9,389	32,182	34,664	37,393

Financial statements could be done for regional discos, cooperatives, non-contiguous discos, i.e., this is one possible organization, not a recommendation.

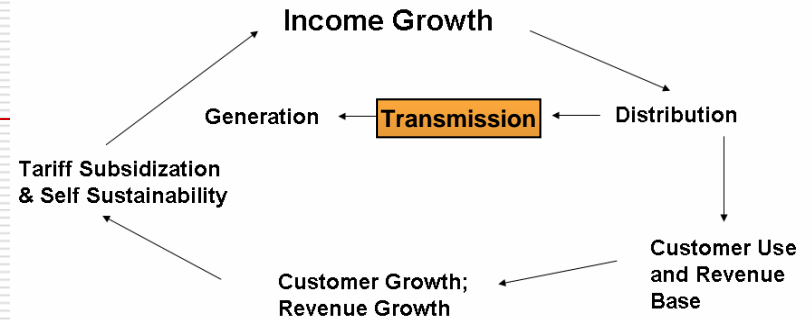
Distribution Company Sample Run



	Year	<u>2006</u>	<u>2007</u>	<u>2008</u>	<u>2009</u>	<u>2010</u>	<u>2011</u>	<u>2012</u>
CASH FLOW DISCO								
NETS								
Net Income	\$ 000	(6,397)	(10,415)	(6,207)	9,389	32,182	34,664	37,393
Depreciation		1,842	3,684	5,895	8,548	11,731	13,641	15,742
CapX annual		73,689	73,689	88,427	106,113	127,335	76,401	84,041
Grant/GoA Transfer	0	50,000	40,000	45,000	45,000	30,000	-	-
Debt		30,000	40,000	50,000	50,000	50,000	30,000	30,000
Cash Flow		1,755	(420)	6,261	6,824	(3,422)	1,904	(906)
BALANCE SHEET								
Cash	0	1,755	1,336	7,596	14,420	10,998	12,902	11,996
Assets	0	<u>71,847</u>	<u>141,852</u>	<u>224,384</u>	<u>321,949</u>	<u>437,553</u>	<u>500,313</u>	<u>568,612</u>
Total Assets	0	<u>73,603</u>	<u>143,188</u>	<u>231,981</u>	<u>336,370</u>	<u>448,552</u>	<u>513,215</u>	<u>580,608</u>
Debt	0	30,000	70,000	120,000	170,000	220,000	250,000	280,000
Equity	0	<u>43,603</u>	<u>73,188</u>	<u>111,981</u>	<u>166,370</u>	<u>228,552</u>	<u>263,215</u>	<u>300,608</u>
Total Liabilities and Owners' Equity	0	<u>73,603</u>	<u>143,188</u>	<u>231,981</u>	<u>336,370</u>	<u>448,552</u>	<u>513,215</u>	<u>580,608</u>

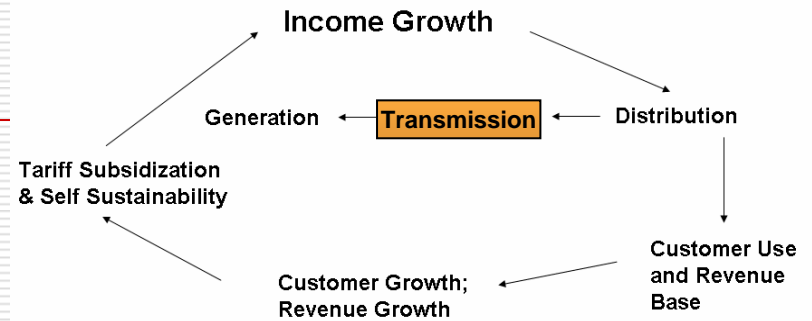
Balance sheet tells what you created and how it was financed.

NETS Transmission Company Sample Run



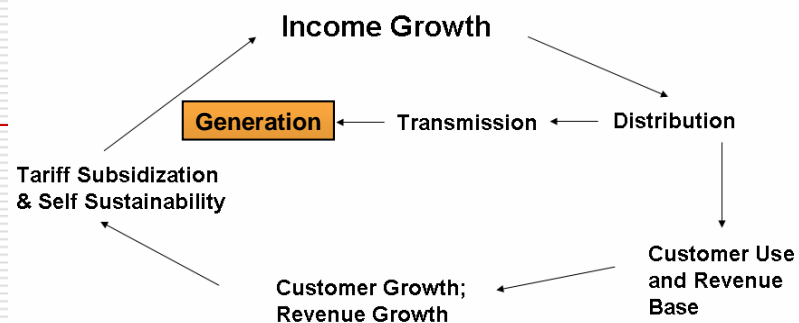
<u>INCOME STATEMENT</u>	<u>NETS</u>	<u>Year</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>	<u>2009</u>	<u>2010</u>	<u>2011</u>	<u>2012</u>
REVENUES:									
Sales of energy to Discos		\$ 000	16,534	27,065	48,770	112,668	135,202	148,722	163,594
EXPENSES:									
Total Power Purchases		\$ 000	60,457	86,240	84,387	84,045	92,634	101,905	112,103
Expenses other than Power Purchase:									
Interest expense	4%	0	-	5,600	11,200	16,800	16,000	15,200	14,400
Depreciation expense - 40 years		\$ 000	-	3,500	7,000	10,500	10,500	10,500	10,500
Transmission operating expenses		\$ 000	2,235	2,603	3,763	7,414	9,493	10,265	11,115
Payroll	1.0% of revenue	\$ 000	165	271	488	1,127	1,352	1,487	1,636
Training	1.0% of revenue	\$ 000	165	271	488	1,127	1,352	1,487	1,636
Material (Invent	2.0% of revenue	\$ 000	331	541	975	2,253	2,704	2,974	3,272
Routine Mainte	1.0% of Cap Inst	\$ 000	1,400	2,800	4,200	4,200	4,200	4,200	4,200
Other Expense	1.0% of revenue	\$ 000	165	271	488	1,127	1,352	1,487	1,636
Social Charges	10.0% of payroll	\$ 000	17	27	49	113	135	149	164
Total Expenses other than Power Purchase:			4,478	10,284	17,450	27,860	31,088	32,550	34,158
TOTAL EXPENSES		\$ 000	64,936	96,524	101,838	111,905	123,722	134,455	146,261
NET OPERATING PROFIT		\$ 000	(48,401)	(69,459)	(53,068)	763	11,480	14,268	17,333

NETS Transmission Company Sample Run



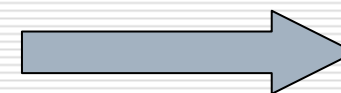
CASH FLOW	<u>Year</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>	<u>2009</u>	<u>2010</u>	<u>2011</u>	<u>2012</u>
Net Income		(48,401)	(69,459)	(53,068)	763	11,480	14,268	17,333
Adjustments to net Income								
Depreciation		-	3,500	7,000	10,500	10,500	10,500	10,500
Capx		(140,000)	(140,000)	(140,000)	-	-	-	-
Grant/GoA Transfer		50,000	70,000	50,000		-	-	-
Debt		<u>140,000</u>	<u>140,000</u>	<u>140,000</u>	<u>-20,000</u>	<u>-20,000</u>	<u>-20,000</u>	<u>-30,000</u>
Cash Flow		1,599	4,041	3,932	(8,737)	1,980	4,768	(2,167)
BALANCE SHEET								
Cash	0	1,599	5,639	9,571	834	2,815	7,582	5,416
Assets	0	<u>140,000</u>	<u>276,500</u>	<u>409,500</u>	<u>399,000</u>	<u>388,500</u>	<u>378,000</u>	<u>367,500</u>
Total Assets	0	<u>141,599</u>	<u>282,139</u>	<u>419,071</u>	<u>399,834</u>	<u>391,315</u>	<u>385,582</u>	<u>372,916</u>
Debt	0	140,000	280,000	420,000	400,000	380,000	360,000	330,000
Equity	0	<u>1,599</u>	<u>2,139</u>	<u>(929)</u>	<u>(166)</u>	<u>11,315</u>	<u>25,582</u>	<u>42,916</u>
Total Liabilities and Owners' Equity	0	<u>141,599</u>	<u>282,139</u>	<u>419,071</u>	<u>399,834</u>	<u>391,315</u>	<u>385,582</u>	<u>372,916</u>

Existing Generation Capacity, NETS



	Year Month	2006					
		1	2	3	4	5	6
POWER SUPPLY - INSTALLED CAPACITY		MW	MW	MW	MW	MW	MW
	<u>Status</u>						
Turkmenistan 110kV	NTS1	existing	30	30	30	30	30
Uzbekistan 110kV	NTS2	existing	30	30	30	30	30
Tajikistan 110 kV	NTS3	existing	10	10	10	10	10
Turkmenistan 220kV	NTS	planned	-	-	-	-	-
Uzbekistan 220kV	NTS	planned	-	-	-	-	-
Tajikistan 220 kV	NTS	planned	-	-	-	-	-
Sheberghan	NTS	planned	-	-	-	-	-
Mahipar	NTS4	in rehab	18	18	18	18	44
Naghlu	NTS4	in rehab	75	75	75	75	75
Sorobi	NTS4	in rehab	9	9	9	9	9
NW Kabul	NTS4	existing	44	44	44	44	44
Kabul Small Diesels	NTS4		0	0	0	0	0
Darunta	NTS5	in rehab	10	10	10	8	8
Kajaki	STS	in rehab	16	16	16	16	16
Kandahar Small Dies	STS	existing	17	17	17	17	17
Kajaki II	STS	planned	-	-	-	-	-
Total Capacity			259	259	259	257	283

Monthly Projections for 120 months, to year 2015



Operating Assumptions: NETS Region Existing Generation

POWER SUPPLY - AVAILABILITY: Technical, Fuel, Water, Commerical	Year	2006											
	Month	1	2	3	4	5	6	7	8	9	10	11	12
Turkmenistan 110kV		25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%
Uzbekistan 110kV		60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%
Tajikistan 110 kV		50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
Turkmenistan 220kV		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Uzbekistan 220kV		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tajikistan 220 kV		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Sheberghan		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Mahipar		70%	70%	70%	70%	33%	0%	0%	0%	0%	33%	33%	70%
Naghlu		30%	30%	30%	30%	30%	50%	50%	50%	30%	30%	30%	30%
Sorobi		95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%
NW Kabul		60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%
Kabul Small Diesels		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Darunta		82%	71%	95%	95%	95%	95%	95%	82%	71%	71%	82%	82%
Kajaki		95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%
Kandahar Small Diesel		60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%

Line, Substation Constraints

Hydrology Expectation

Cross-referenced against daily data received from DABM

Result: How much energy is deliverable

NETS Tariffs - Generation

		<u>Year</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>	<u>2009</u>	<u>2010</u>	<u>2011</u>	<u>2012</u>
TARIFFS									
	Annual Tariff Incr		0%	0%	0%	0%	0%	0%	0%
Turkmenistan 110kV	US Cents/kWh		2.00	2.00	2.00	2.00	2.00	2.00	2.00
Uzbekistan 110kV	US Cents/kWh		2.60	2.60	2.60	2.60	2.60	2.60	2.60
Tajikistan 110 kV	US Cents/kWh		2.00	2.00	2.00	2.00	2.00	2.00	2.00
Turkmenistan 220kV	US Cents/kWh				2.00	2.00	2.00	2.00	2.00
Uzbekistan 220kV	US Cents/kWh				2.60	2.60	2.60	2.60	2.60
Tajikistan 220 kV	US Cents/kWh				2.00	2.00	2.00	2.00	2.00
Sheberghan	US Cents/kWh				3.00	3.00	3.00	3.00	3.00
Mahipar	US Cents/kWh		2.30	2.30	2.30	2.30	2.30	2.30	2.30
Naghlu	US Cents/kWh		2.30	2.30	2.30	2.30	2.30	2.30	2.30
Sorobi	US Cents/kWh		2.30	2.30	2.30	2.30	2.30	2.30	2.30
NW Kabul	US Cents/kWh		30.00	30.00	30.00	30.00	30.00	30.00	30.00
Kabul Small Diesels (If any)	US Cents/kWh		20.00	20.00	20.00	20.00	20.00	20.00	20.00
Darunta	US Cents/kWh		2.30	2.30	2.30	2.30	2.30	2.30	2.30
Kajaki	US Cents/kWh		2.30	2.30	2.30	2.30	2.30	2.30	2.30
Kandahar Small Diesel	US Cents/kWh		20.00	20.00	20.00	20.00	20.00	20.00	20.00
Kajaki II	US Cents/kWh						3.00	3.00	3.00

New Generation and New Transmission, NETS

2008	Month	1	2	3	4	5	6	7	8	9	10	11	12
	POWER SUPPLY	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW
Turkmenistan 220kV	-	-	-	-	-	-	-	-	-	-	-	-	-
Uzbekistan 220kV	-	-	-	-	-	-	-	-	-	-	300	300	300
Tajikistan 220 kV	-	-	-	-	-	-	-	-	-	-	-	-	-
Sheberghan	-	-	-	-	-	-	-	-	-	-	100	100	100

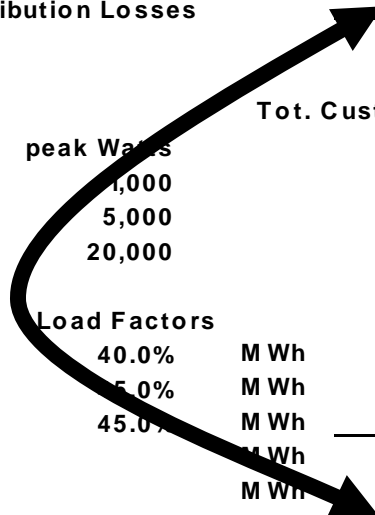
2009	Month	1	2	3	4	5	6	7	8	9	10	11	12
	POWER SUPPLY	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW
Turkmenistan 220kV	-	-	-	-	-	-	-	-	-	-	-	-	-
Uzbekistan 220kV	300	300	300	300	300	300	300	300	300	300	300	300	300
Tajikistan 220 kV	-	-	-	-	-	-	300	300	300	300	300	300	300
Sheberghan	100	100	100	100	100	100	100	100	100	100	100	100	100

2010	Month	1	2	3	4	5	6	7	8	9	10	11	12
	POWER SUPPLY	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW
Turkmenistan 220kV	300	300	300	300	300	300	300	300	300	300	300	300	300
Uzbekistan 220kV	300	300	300	300	300	300	300	300	300	300	300	300	300
Tajikistan 220 kV	300	300	300	300	300	300	300	300	300	300	300	300	300
Sheberghan	100	100	100	100	100	100	100	100	100	100	100	100	100

Current best estimate, not a confirmed consensus

Apportioning Supply to Demand Pre-NETS

<u>Group1</u>	<u>Year</u>	<u>2006</u>	1	2	3	4	5	6
NET ENERGY AVAILABLE			31	28	31	30	31	30
			Winter	Winter	Winter	Summer	Summer	Summer
Distribution Technical Losses			40%	40%	40%	40%	40%	40%
Turkmenistan 110kV	M Wh	5,134	4,637	5,134	4,968	5,134	4,968	
Total Supply Group1		5,134	4,637	5,134	4,968	5,134	4,968	
Total Supply after Distribution Losses		<u>3,080</u>	<u>2,782</u>	<u>3,080</u>	<u>2,981</u>	<u>3,080</u>	<u>2,981</u>	
DEMAND								
Group1								
			Tot. Customers					
	peak Watts		<u>46,575</u>	<u>46,575</u>	<u>46,575</u>	<u>46,575</u>	<u>46,575</u>	<u>46,575</u>
Domestic	1,000		41,883	41,883	41,883	41,883	41,883	41,883
Commercial	5,000		4,362	4,362	4,362	4,362	4,362	4,362
Government	20,000		330	330	330	330	330	330
			Load Factors					
Domestic	40.0%	M Wh	12,464	11,258	12,464	12,062	12,464	12,062
Commercial	5.0%	M Wh	7,302	6,595	7,302	7,066	7,302	7,066
Government	45.0%	M Wh	<u>2,210</u>	<u>1,996</u>	<u>2,210</u>	<u>2,138</u>	<u>2,210</u>	<u>2,138</u>
		M Wh	21,976	19,849	21,976	21,267	21,976	21,267
Import Supply available		M Wh	3,080	2,782	3,080	2,981	3,080	2,981
Total Consumption			3,080	2,782	3,080	2,981	3,080	2,981
Total Supply Applied to Consmption			3,080	2,782	3,080	2,981	3,080	2,981



Energy Flows After NETS is Completed



North of Salang		
Supply (bef Dist losses)		
Turkmenistan 110kV		
Uzbekistan 110kV		
Tajikistan 110 kV		
Turkmenistan 220kV		
Uzbekistan 220kV		
Tajikistan 220 kV		
Sheberghan		
Total Supply North of Salang		
220 Imports & Sheberghan		
220/Sheb supply after dist. Losses		
DEMAND GROUP 1+ GROUP 2 + GROUP 3		
North of Salang		
Domestic	1,000	
Commercial	5,000	
Government	20,000	
	Load Factors	
Domestic	40.0%	M Wh
Commercial	45.0%	M Wh
Government	45.0%	M Wh
	Demand	M Wh
220 Used North of Salang aft dist los		M Wh
Remaining 220/Sheb BEFORE dist. Loss		M Wh
Remaining 220/Sheb AFTER dist. Loss		M Wh
Limit of Salang Pass Line	575	M Wh
Available to send over Salang BEFORE DIST LOSS		

Calculation of Serving Kabul		
Available from North of Salang AFT dist losses		
Mahipar	after.dist. Losses	M Wh
Naghlu	after.dist. Losses	M Wh
Sorobi	after.dist. Losses	M Wh
Darunta	after.dist. Losses	M Wh
NW Kabul	after.dist. Losses	M Wh
Kabul Small Die	after.dist. Losses	M Wh

KABUL		
<u>Year</u>		
Kabul Area Total Supply after dist losses		
Hydro Only Supply after dist. Losses		
DEMAND Tot. Customers		
Group4+Group5 peak Watts		
Domestic	1,000	
Commercial	5,000	
Government	20,000	
	Load Factors	
Domestic	40.0%	M Wh
Commercial	45.0%	M Wh
Government	45.0%	M Wh
	Demand	M Wh
Hydro Supply Available for in Kabul		
Remaining demand after hydro all used up		
Supply Procured from NTS - Salang		

220 Supply used in the North Before dist. Losses
 Supply Procured from NTS - Salang bef dist losses
 Total 220 + Sheberghan bef dist losses

Remaining demand in Kabul after N. Salang

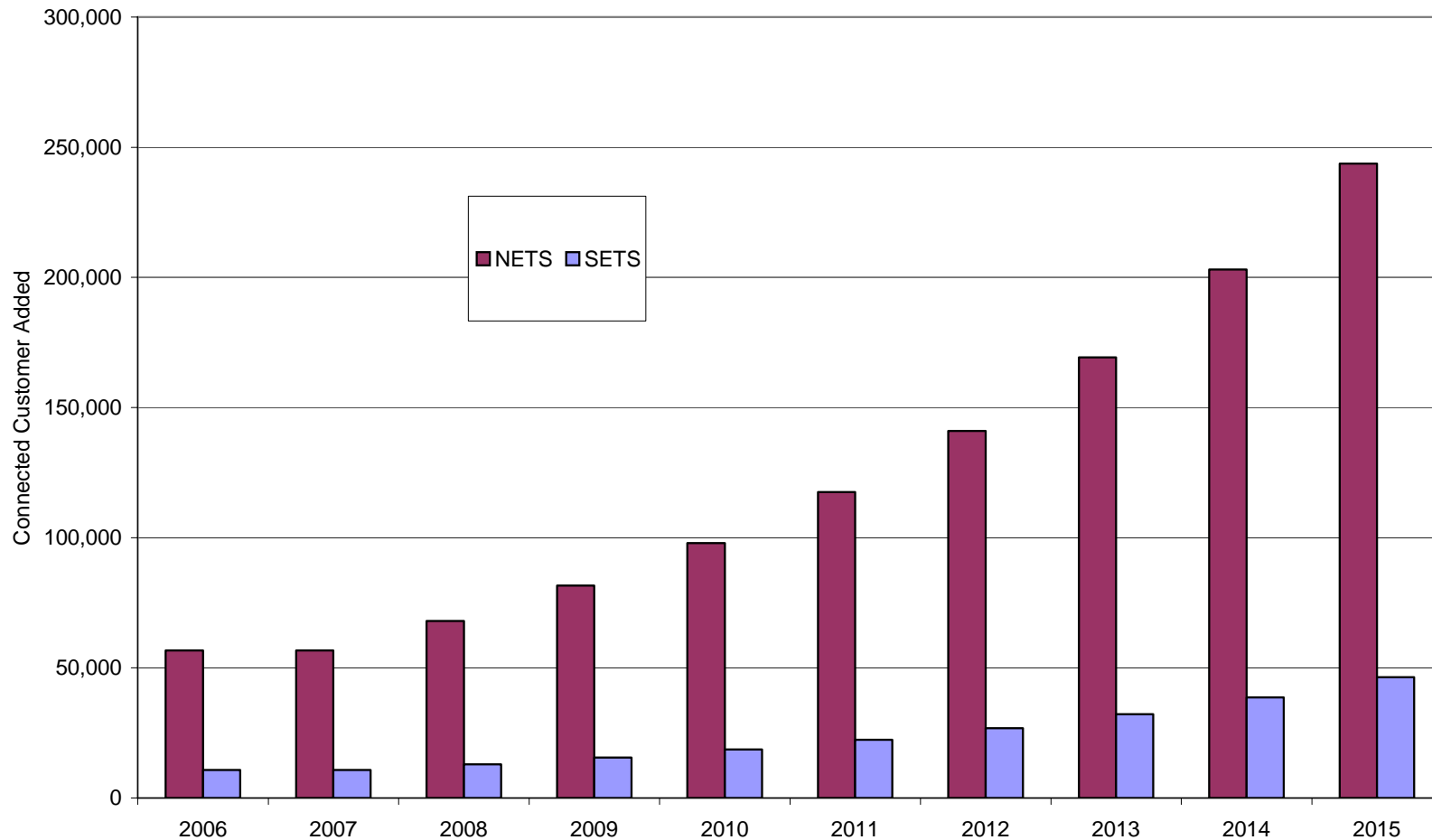
Thermal Supply applied to remaining demand

Dispatching level hydro
 Dispatching level Thermal
 Dispatching level 220 Imports & Sheb - Kabul

Assumes:

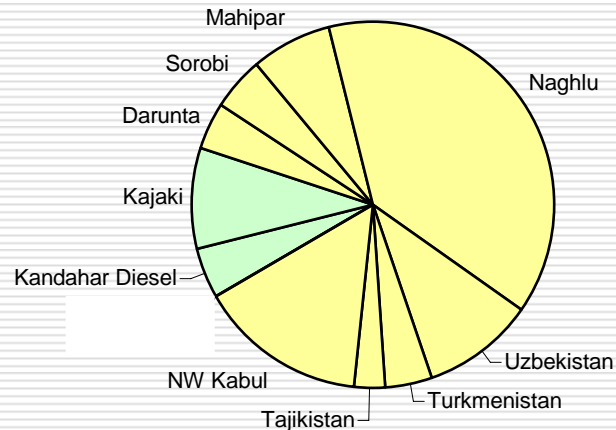
- 1) Use Hydro in Kabul
- 2) Use Low-Cost Imports
- 3) Use NW Kabul as a last resort

Customer Additions “Snapshot”: Financed by Donors, GoA Transfers, and Internally Generated Funds



New Sources of Low-Cost Power Supply

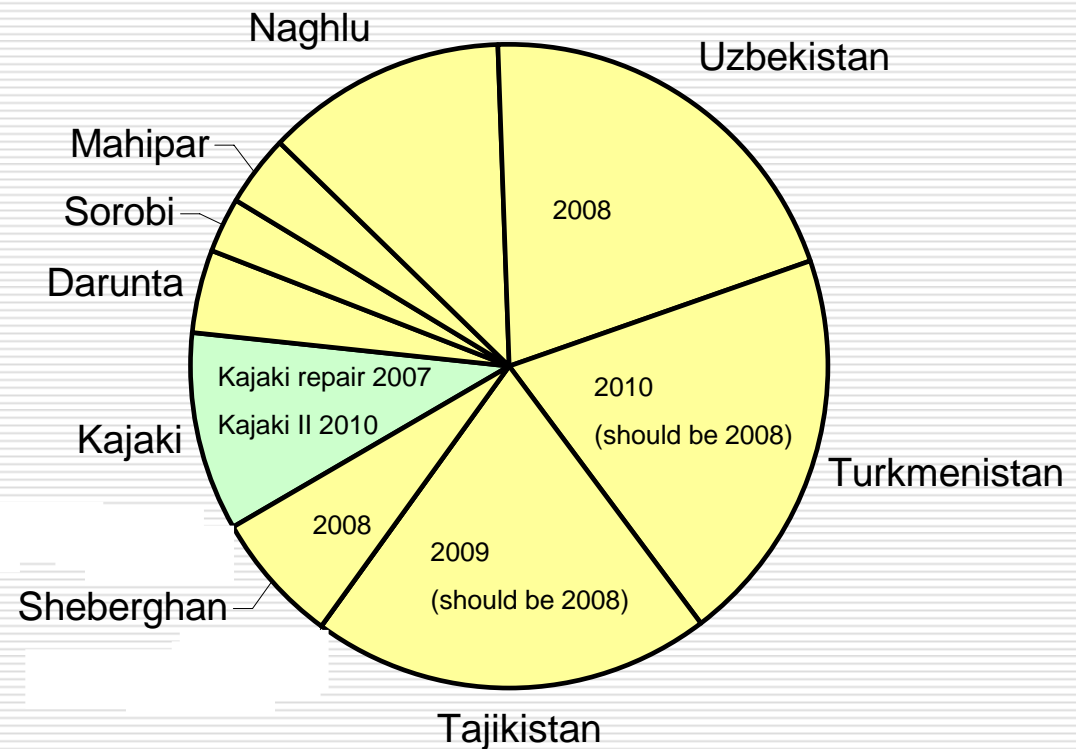
2006 Power Supply Existing



NETS

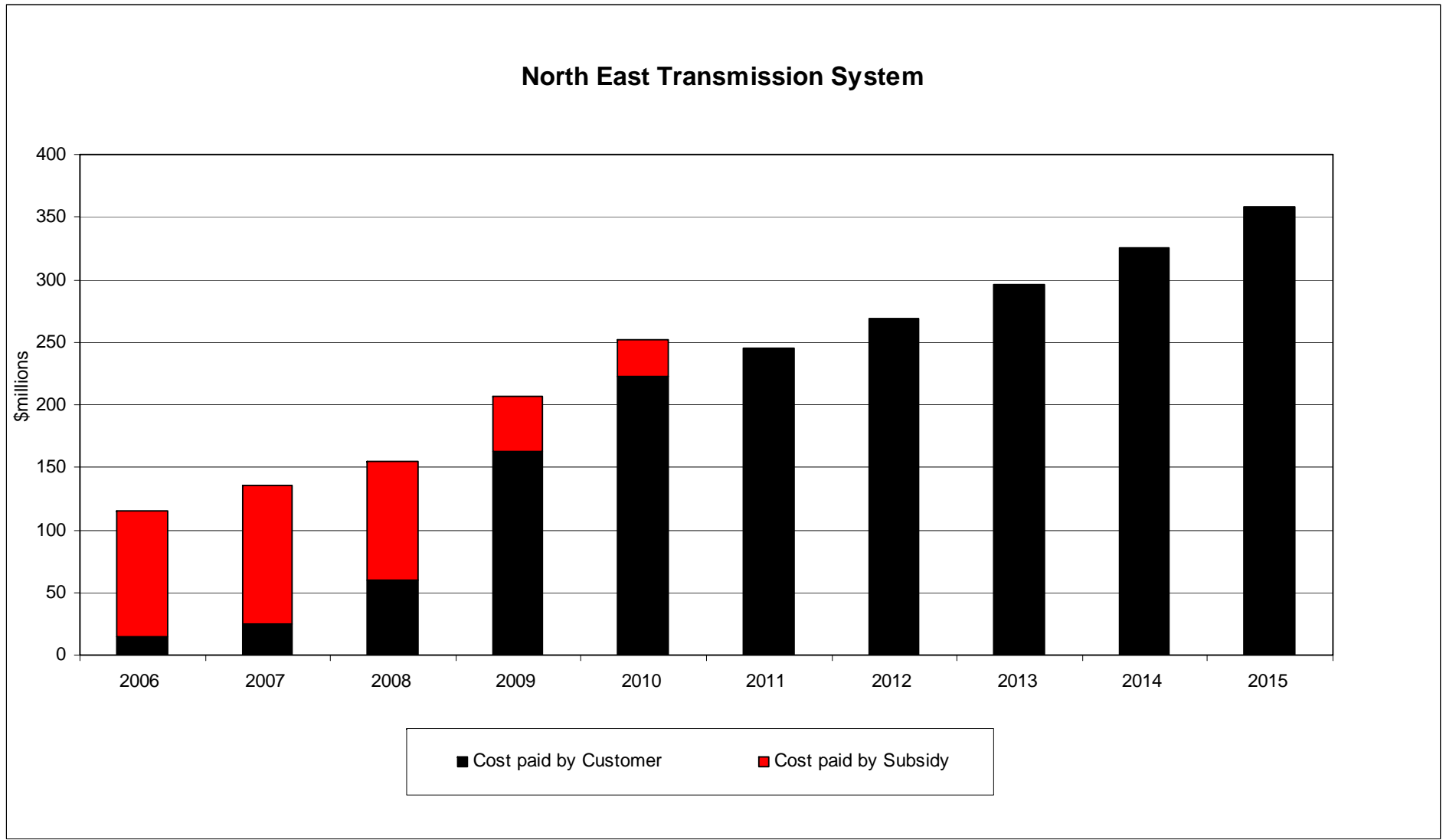
SETS

2010 Power Supply



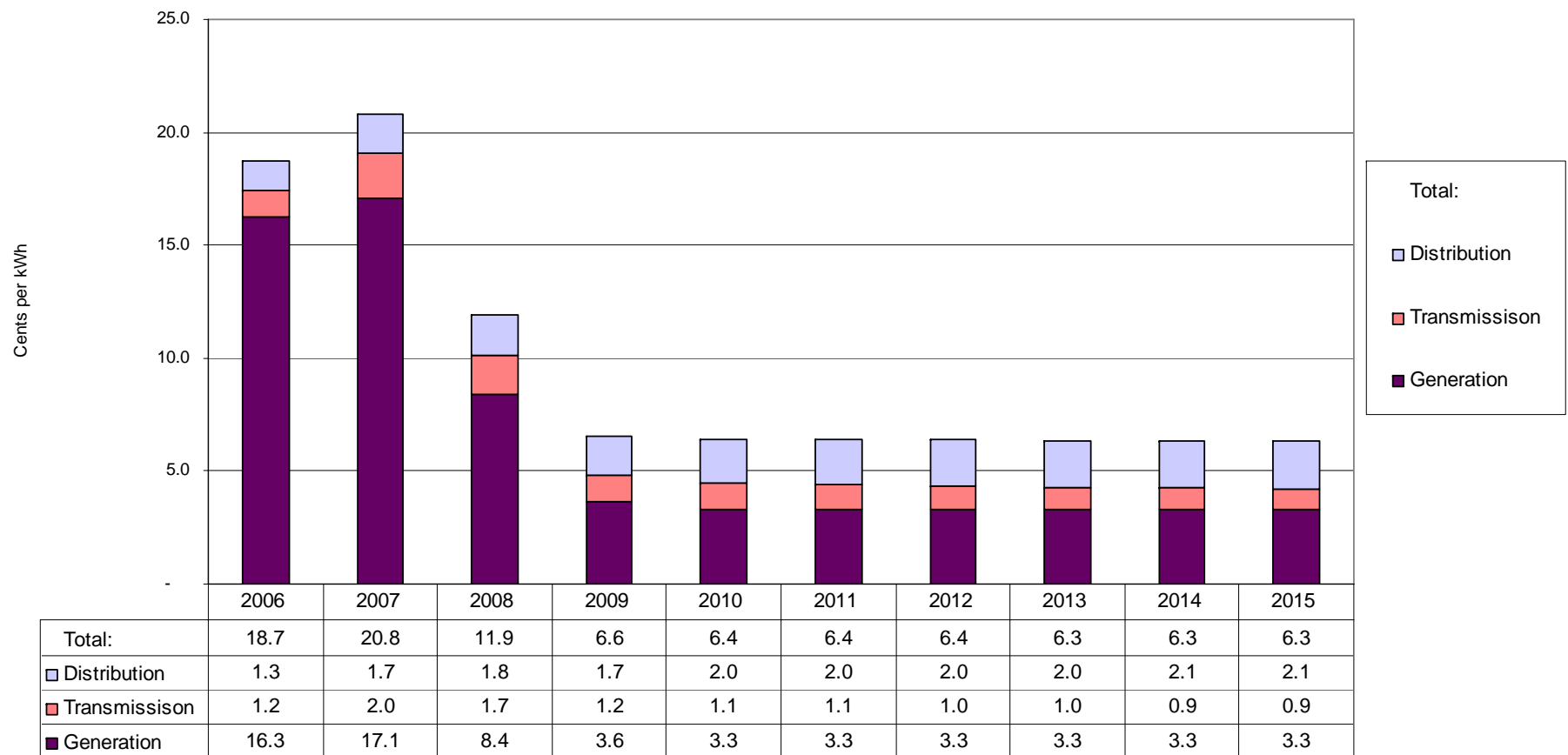
		2,006	2,010
Kandahar Diesel	M WH	89,352	89,352
Kajaki	M WH	216,810	840,522
Darunta	M WH	72,372	103,958
Sorobi	M WH	39,864	68,167
Mahipar	M WH	47,520	90,288
Naghlu	M WH	306,960	306,960
Uzbekistan	M WH	157,680	1,046,553
Turkmenistan	M WH	65,700	1,046,553
Tajikistan	M WH	43,800	1,046,553
NW Kabul	M WH	144,778	-
Sheberghan	M WH	-	348,851
Total		1,184,836	4,638,907

One Snapshot of Cost Recovery: NETS Including Distribution



Components of Power Cost - NETS

**North East Transmission System NETS
Projected Cost of Power in Afghanistan by Component**



NETS Tariff Requirements

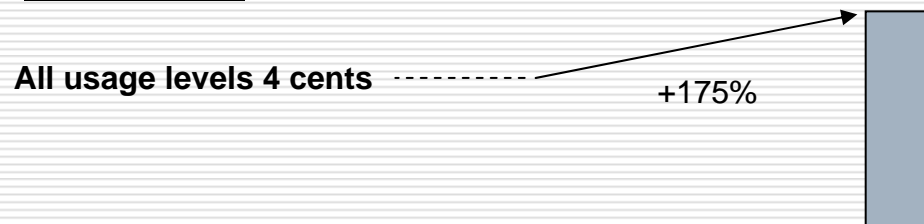
Kabul

7 Cents, Full Cost Recovery in 2010

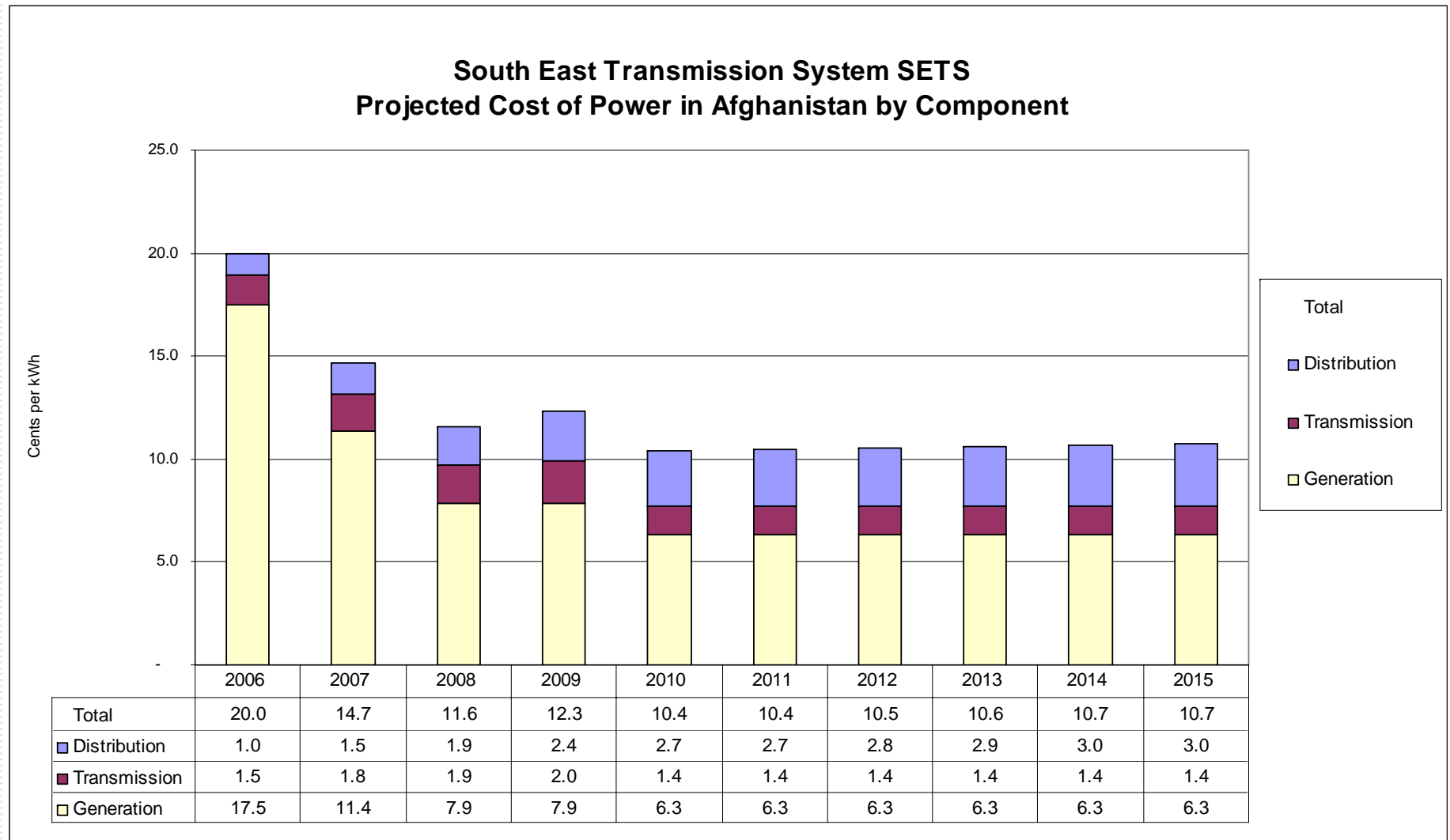


Mazar-e-Sharif

7 Cents, Full Cost Recovery in 2010



Components of Power Cost - SETS



Customer Growth Impacts Cost, Reserve Margin

-----2015 Results-----

-----Varying Growth Rates 2006-2015 -----

Annual Rate of Customer Growth	2015 Cost per kWh		Dispatching		Surplus / Shortfall	
	<u>NETS</u>	<u>SETS</u>	<u>NW Kabul</u>	<u>Kand Diesel</u>	NETS	SETS
0.0%	6.54	9.22	0%	0%	417%	144%
2.0%	6.51	8.99	0%	0%	354%	114%
4.0%	6.47	8.80	0%	0%	300%	89%
6.0%	6.44	8.63	0%	0%	253%	67%
8.0%	6.42	8.48	0%	0%	212%	47%
10.0%	6.41	9.83	0%	57%	177%	30%
12.0%	6.40	10.38	0%	100%	145%	16%
14.0%	6.37	10.46	0%	100%	118%	3%
16.0%	6.35	10.54	0%	100%	94%	-8%
18.0%	6.33	10.64	0%	100%	73%	-18%
20.0%	6.31	10.74	0%	100%	55%	-27%
22.0%	6.29	10.85	0%	100%	38%	-35%
24.0%	6.27	10.98	0%	100%	24%	-41%
26.0%	6.33	11.12	30%	100%	11%	-48%
28.0%	6.90	11.27	100%	100%	0%	-53%
30.0%	6.98	11.43	100%	100%	-10%	-58%

“Snapshot” Quantitative Assessment of Current Strategy Implementation

	<u>2006</u>	<u>2010</u>	<u>Net Gain</u>
Power Produced (MWH)	1.2 million	4.6 million	+392%
Electric Power Customers	337,359 (3.4 Million People)	699,548 (7.0 Million People)	+100%
Predicted GDP (\$billions)	\$3.9 billion	\$15.5 billion	+392%
GDP per Capita	\$252 per person (based on \$5.8 billion GDP and 23 million population)	\$988 per capita (range of Cote d'Ivoire, Yemen, Paraguay)	+392%
Subsidy (\$millions)	\$100 million grant \$140 million soft loan	\$25 million	N.A.
Cost of Service (cents/kWh)	19.0	7.1	62% reduction
Residential Power Price (cents/kWh)	4.0	7.1	175% Increase

Conclusion

- Quantitative Assessment tool was created
- AEAP/AEAI's Quantitative Assessment is Version 1.0
- Quantitative Assessment can be measured, reported, discussed
- Policy issues can be quantitatively framed
- Quantification of AEAP Program Activities can be exhibited
- Linkage of USAID strategy, all AEAP activity is captured
- Next Steps: USAID planning, Donor coordination, capacity building, MEW planning, Closeout/Transfer