
بسم الله الرحمن الرحيم

ALTERNATIVE ENERGY DEVELOPMENT BOARD

AEDB HISTORY

- May 2003: Established as Autonomous Agency, under Cabinet Division
- Apr 2005: Presidential Ordinance for the establishment of AEDB
- Jan 2006: Presidential Ordinance
- Feb 2006: AEDB transferred to Ministry of Water and Power
- May 2006: Presidential Ordinance
- Feb 2007: National Assembly approved AEDB Bill
- Apr 2007: Presidential Ordinance
- Oct 2007: Presidential Ordinance
- Dec 2009: Presidential Ordinance
- May 2010: AEDB ACT -2010.

Alternative Energy Development Board (AEDB)

- Implement policies, programs and projects through private sector in the field of Alternative Energy
- Assist and facilitate development and generation of Alternative Energy to achieve sustainable economic growth
- Encourage transfer of technology and develop indigenous manufacturing base for AE Technology
- Promote provision of energy services that are based on Alternative energy resources
- Undertake RE projects on commercial scale (AEDB Act 2010)

Budget

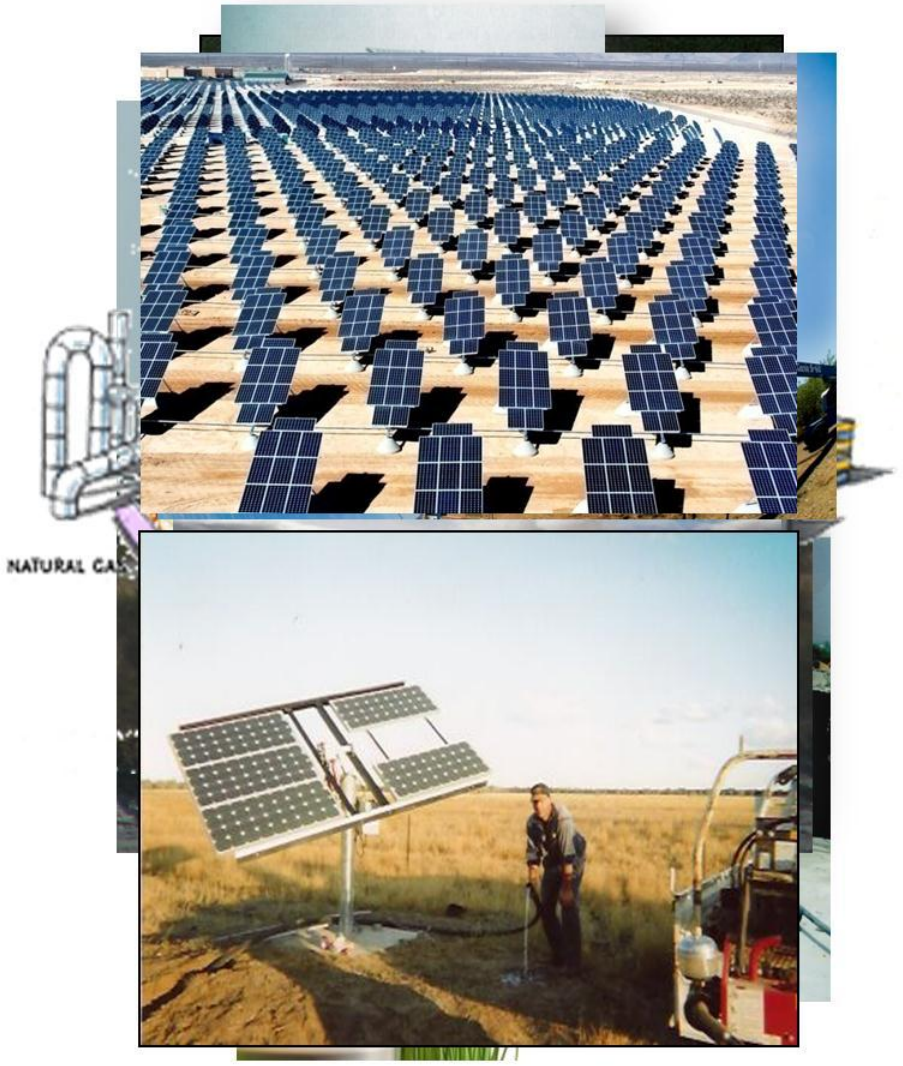
- **Revenue Budget Allocated:**

Year	2008-09	2009-10	2010-11	2011-12
PKR (Million)	54.25	61.66	61.66	66.59

- **No Development Budget allocated to AEDB for 2008-11**

Alternative Energy

- **Renewable Energy**
  - Wind
  - Solar
    - Photovoltaic
    - Thermal
  - Hydro
  - Geo-Thermal
- **Alternative Fuels**
  - Bio Diesel
  - Ethanol
  - Refuse Derived Fuel (RDF) – Waste-to-Energy
  - Biogas
- **Other Non-Conventional Energy**
  - Waste-to-Energy
  - Cogeneration
  - Conservation



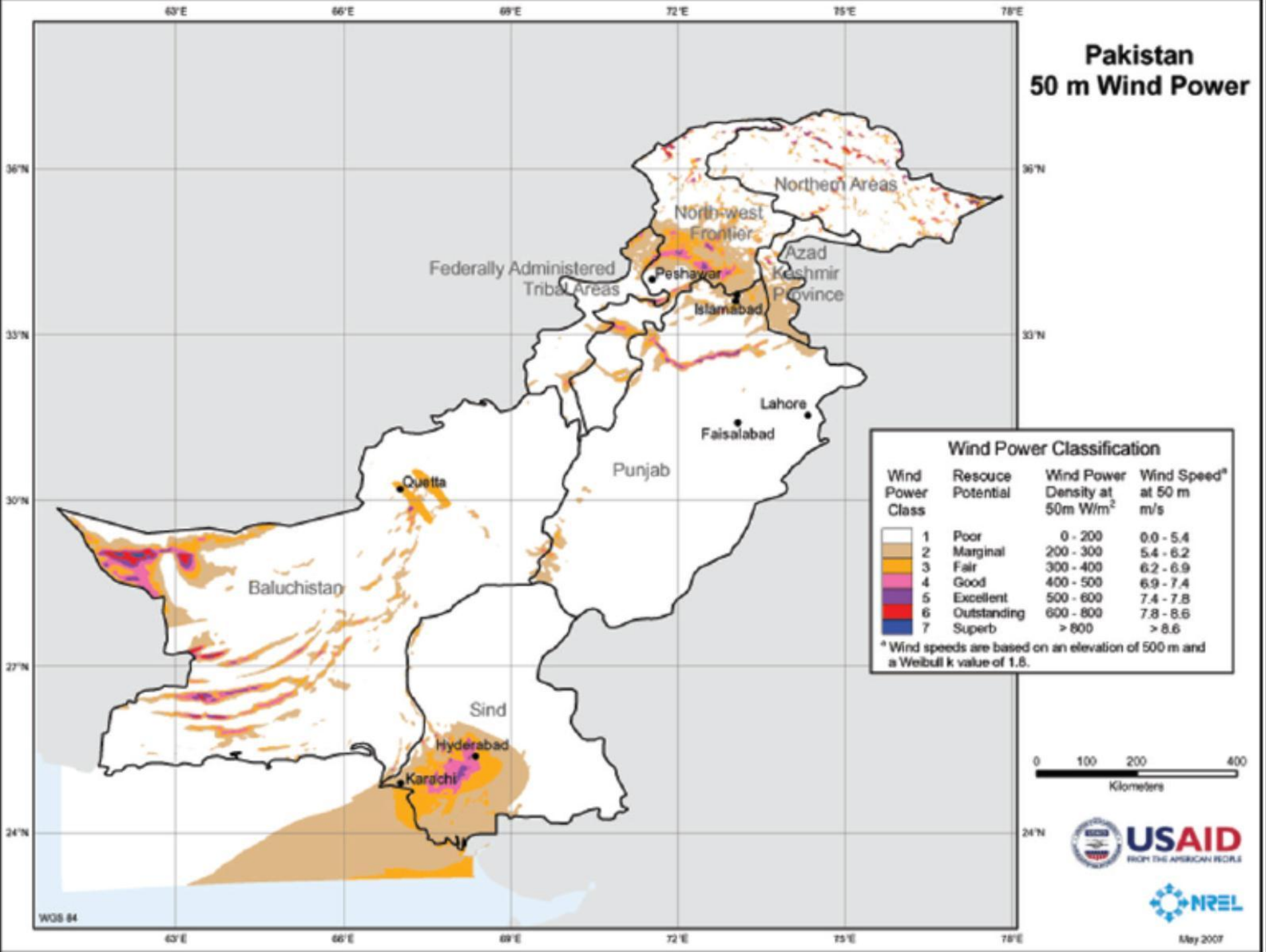
Renewable Energy Policy of Pakistan

- Resource Risk - responsibility of GoP
- Guaranteed Electricity Purchase
- Grid provision is the responsibility of the purchaser
- Attractive Tariff (17%-18% ROE)
- Attractive Feed-in Tariff (US Cents 14.6628/kWh) Announced for the Wind Projects
- Counter Guarantee by the ADB for first few projects
- Special Incentives by the State bank for upto 10 MW plants
- No Import Duties on Equipment
- Zero Sales Tax
- Net Metering
- Banking of Electricity
- Wheeling Provisions
- Grid Spill Over Concept introduced
- Carbon Credits

Fast Track Projects Policy being implemented for COD by March 2013

On-Grid Power Project facilitated by AEDB

Pakistan
50 m Wind Power



Wind Power Classification

Wind Power Class	Resouce Potential	Wind Power Density at 50m W/m^2	Wind Speed[a] at 50 m m/s
1	Poor	0 - 200	0.0 - 5.4
2	Marginal	200 - 300	5.4 - 6.2
3	Fair	300 - 400	6.2 - 6.9
4	Good	400 - 500	6.9 - 7.4
5	Excellent	500 - 600	7.4 - 7.8
6	Outstanding	600 - 800	7.8 - 8.6
7	Superb	> 800	> 8.6

[a] Wind speeds are based on an elevation of 500 m and a Weibull k value of 1.8.

0 100 200 400
Kilometers

USAID
FROM THE AMERICAN PEOPLE

NREL

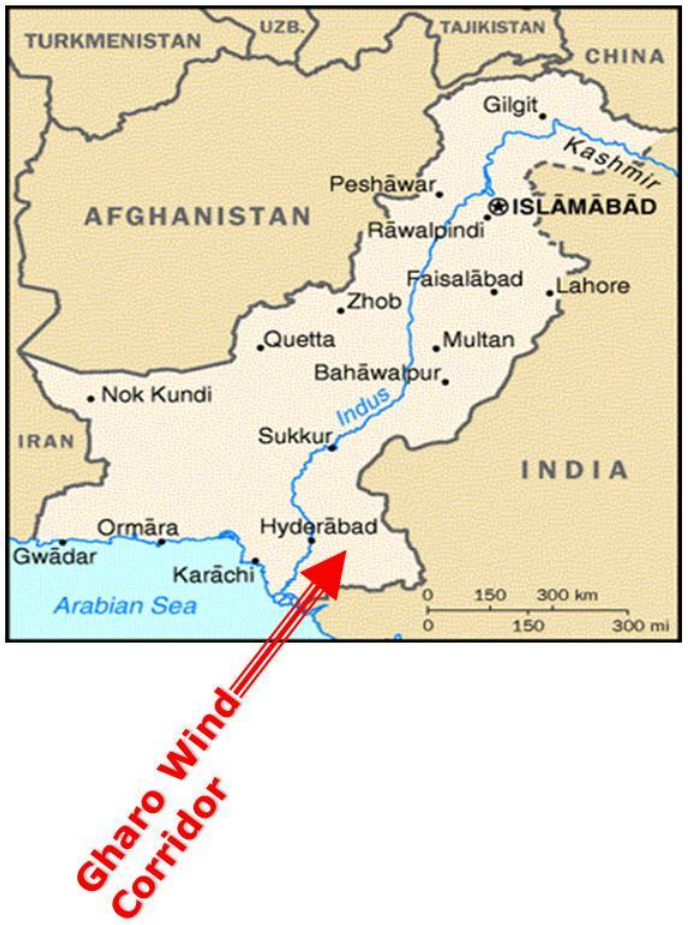
May 2007

Wind Resource in Pakistan

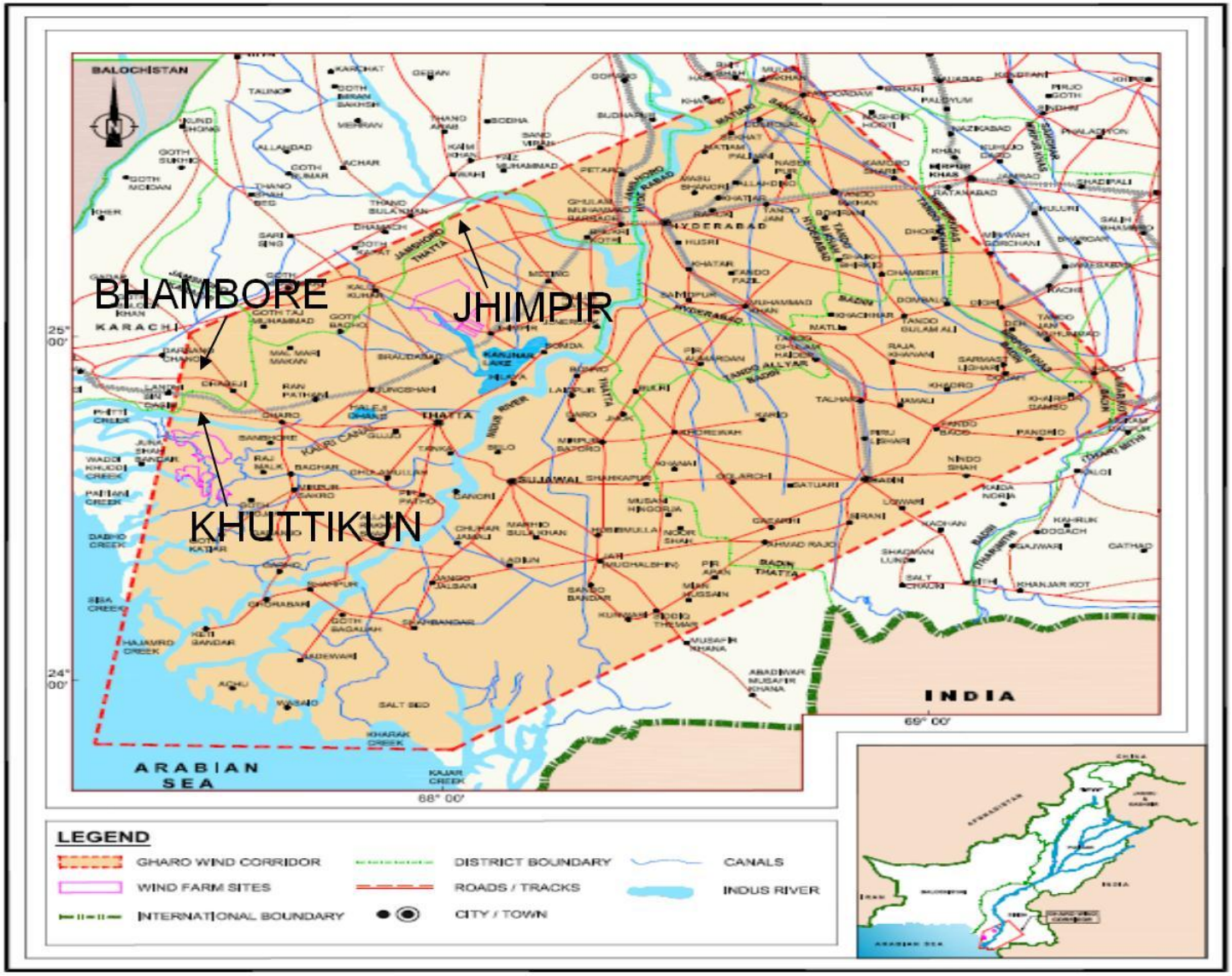
350,000 MW National Potential

50,000 MW in Sindh

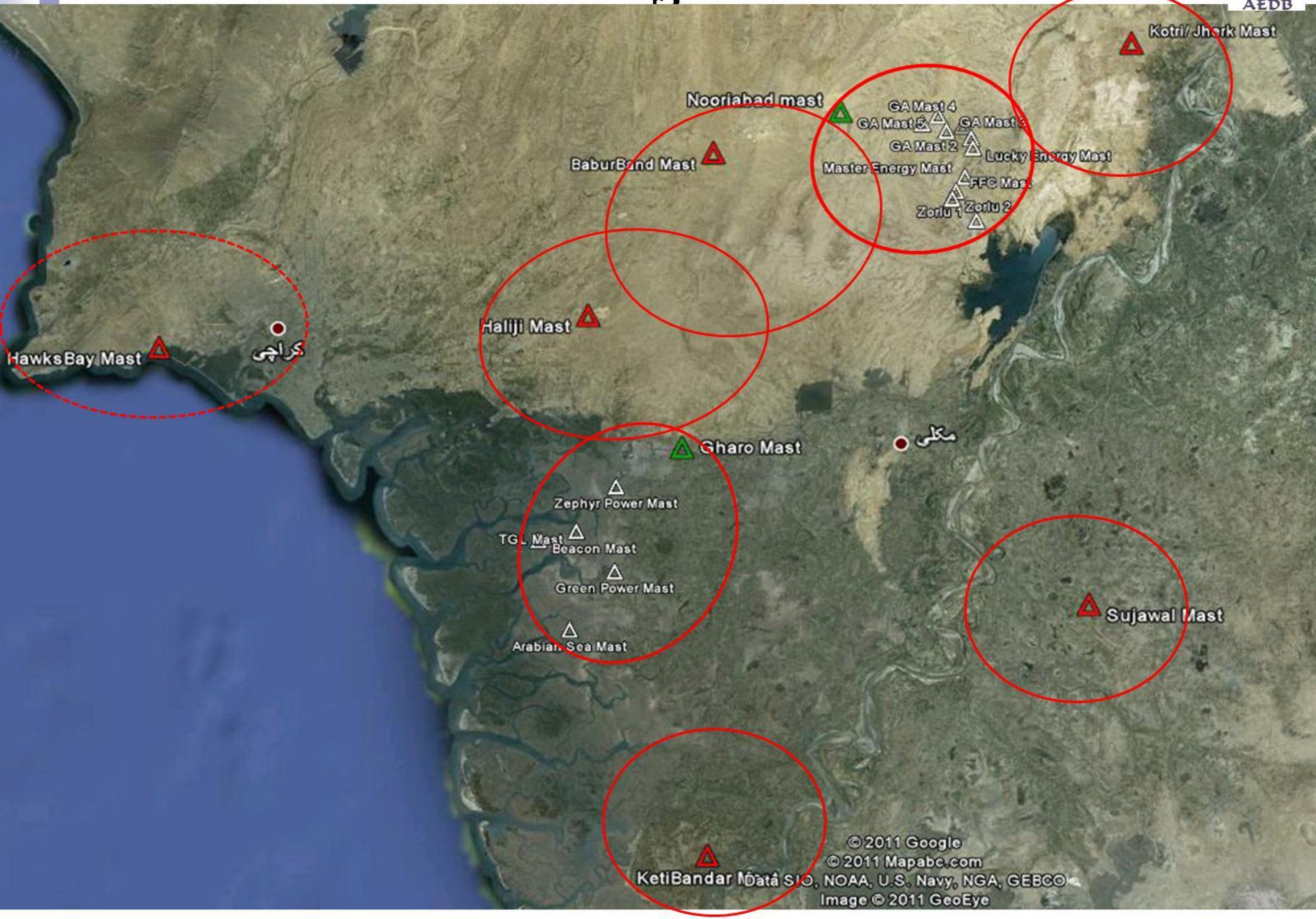
Sites in Baluchistan, Punjab and Northern Areas being mapped.



Wind Corridor



Wind Measuring Masts Gharo



Developing the Wind Sector (2008-2011)

Created Enabling Environment:

- Feed-in-Tariff as well as Cost Plus tariff with Wind risk available
- Grid Code Amended for Wind Power
- Streamlined Land Issues by developing standardized, legally vetted documentation

Created Lender / Investor Confidence

- Circular Debt Concerns Addressed – ADB Counter Guarantee in place
- Regained Lenders Confidence – OPIC supporting **4**, IFC, ADB and IDB **3** Projects.
- Lender Acceptable Standardized the Project Documents (PPA / IA / Wheeling) Available
- Regional Environment Impact Analysis, approved by donors available to investors

Reduced Lead Times And EPC Contract From Turbine Manufacturers

- All major turbine manufacturers now offering 4-6 months delivery and EPC contract

Encouraged Local Manufacturing

- DESCON now producing Wind Masts for Nordix Machines. HIT negotiating Turbine Assembly with CWE.

Inclusive / Cooperative Approach

- All Provinces now a full member of AEDB Board, and RE Policy Review team.
- New corridors identified. New wind masts installed Sindh, Baluchistan and Punjab through UNDP asst.

Progress Status of First 550 MW WPPs

	Name of Project	Capacity (MW)	Project Cost (Million USD)		Expected Financial Close	Expected Completion	Cumulative
1	Fauji Fertilizer	50	133.56	Under Construction	11-Jun	12-Sep	50 MW
2	Zorlu Enerji Pak	56	143.60	Under Construction	12-Mar	12-Nov	106 MW
3	Three Gorges	50	134.75	Under Construction	12-Jun	12-Nov	156 MW
4	Foundation 1	50	128.69	-do-	12-Mar	13-Mar	206 MW
5	Foundation 2	50	128.70	-do-	12-Mar	13-Mar	256 MW
6	Lucky Energy	50	132.53	-do-	12-Apr	13-Apr	306 MW
7	Sapphire Power	50	128.87	-do-	12-Jun	13-Jun	356 MW
8	Tenaga Generasi	50	129.67	-do-	12-Jun	13-Jun	406 MW
9	Metro Power	50	132.56	-do-	12-May	13-May	456 MW
10	Master Energy	50	133.68	-do-	12-Aug	13-Aug	506 MW
11	Gul Ahmed	50	132.87	-do-	12-Jun	13-Jun	556 MW

List of Fast Track Wind Power Projects

Sr. No.	Company Name	Project Capacity
1.	NBT Wind Power (Norway)	500 MW
2.	Titan Energy Pakistan (Pvt.) Ltd.	10 MW
3.	Tapal Wind Energy (Pvt.) Ltd.	10 MW
4.	Ismail Power Limited	10 MW
5.	Fina Energy (turkey)	250 MW
6.	FFC Energy (conditional acceptance)	100 MW
7.	Japan Green Power (Japan)	50 MW
8.	Associate Technologies	100 MW
9.	Anadulo Wind Pakistan	50 MW
10.	China Sunnec Energy (Pvt.) Ltd	2.4+50 MW
11	System Wind Energy (Turkey)	50 MW
12.	Hydro China (conditional acceptance; need 15 clear months after possession of land)	300 MW
13.	HZ Wind Power (CHINA)	100 MW
		1582.4 MW

Turbine Foundation – With 62 Ton Steel


30/11/2008


Roter – Weights 72 tonnes


Requires 600 Ton Crane – Not Available in Pakistan

Zorlu Wind Farm

Target 2013:	**1000 MW**
Land Available:	**550 MW**
Issue:	**Availability of Land**
Investors Awaiting Land:	**2500 MW**

HYDRO SECTOR

Hydro Power

- AEDB building capacities for private sector investment in KPK and Punjab through SHYDO and PPDB
- Detailed feasibility for 8 Hydel Plants (3 KPK, 5 Punjab – total 80 MWs) prepared under the ADB financing. PC – 1s under approval.
- 25 Pre-Feasibility Studies completed with GIZ assistance for interest of Private sector.
- 103 micro hydel projects (15 MW) initiated in Chitral (Khyber Pakhtunkhwa) and Giligit Baltistan with AKRSP / UNDP-GEF collaboration under preperation. Project for another 250 under preperation.

Public Sector Projects - Hydro Power

- **KhyberPakhtunkhwa** **US $ 150.99 Million**
  - Ranolia (17.0 MW)
  - Daral Khwar* (36.6 MW)
  - Machai (2.6 MW)

  Feasibility Studies 03

- **Punjab** **US $ 138.74 Million**
  - UCC Main Lower (Chianwali) (5.38 MW)
  - Deg fall Sheikhpura (4.04 MW)
  - Pakpattan Canal (2.82 MW)
  - LBDC Okara (4.16 MW)
  - UCCM Marala (7.64 MW)

  Feasibility 05

- **Gilgit Baltistan** **US $ 71.12 Million**
  - 26 MW Hydro Power Plant at Shegherthang in Skardu
  - 4 MW Hydro Power Plant at Chilas

  Feasibility 30

* May shift to KPK HDF

Waste to Energy

Biomass to Energy Projects

- Projects Operational:
  - 7 MW Biomass to Power Project, Shakargang Sugar Mills, Jhang
  - 27 MW Biomass to Power Projct at Al-Moiz sugar industries, D.I.Khan.
- New Projects in Advance stages
  - M/s SSJD- 12 MW Biomass to Energy Project at Sindh.
  - M/s Lumen Energia- 11 MW Biomass to Energy Project at Punjab.
  - M/s Pak Ethanol- 09 MW Biogas Power Project at Sindh.

- 12 MW Biomass to Energy Project, Sindh-M/s SSJD
  - LOI: September, 2010
  - Location: Mirwah Gorchani, District Mirpurkhas.
  - Status:
  - The Feasibility Report Approved.
  - Tariff Petition Filed
  - Energy Purchase Agreement under negotiation.
  - Financial Close: Expected April / May 2012.
- 09 MW Biogas Project, Sindh - M/s Pak Ethanol Project
  - LOI: November, 2011
  - Fuel base: Biogas from Molasses
  - Location: Matli, Sindh.
  - Status:
  - Tariff being negotiated directly with HESCO
  - Applied for generation license
  - Financing: State Bank of Pakistan
  - COD Expected December 2012.
- 11 Mw Biomass to Power at Jhang - M/s Lumen Energy.
  - LOI: September 2010
  - Fuel base: Bagasse Cotton-stalk, rice Husk etc.
  - Location: Jhang, Punjab.
  - Status:
  - Feasibility completed
  - Financial Close – Expected June 2012.

- 14 New Waste to Energy Projects (213 MW) awarded Generation License.

1. Al-Noor Sugar Mills Ltd. 21.8 MW;
2. Brother Sugar Mills Ltd. 13 MW;
3. Indus Sugar Mills Rajanpur 11MW;
4. Ghotki Sugar Mills 12 MW;
5. JDW Sugar Mills Rahim Yar Khan 22 MW;
6. RYK Sugar Mills Ltd. 12MW;
7. Sheikhoo Sugar Mills Ltd. 12 MW;
8. Shakarganj Energy Ltd 20 MW;
9. Hamza Sugar Mills Ltd. 23 MW;
10. Layyah Sugar Mills Ltd. 9.2 MW);
11. Etihad Sugar Mills Limited 22MW;
12. Al-Abbas Sugar Mills Ltd. 15 MW;
13. Ashraf Sugar Mills Bhawalpur 8 MW;
14. Deharki Sugar Mills (Pvt) Limited 12 MW.

Other Initiatives

- Pilot Phase of Landhi Cattle Colony Biogas Project completed.
- US $ 325 K Waste to Energy Study being carried out for Karachi to generate 10 MW power.
- World Bank Financing arranged for detailed Municipal Solid Waste, Liquid Waste and Animal Waste to Energy Studies in 20 cities of Pakistan . A USA based firm, M/s H&J INC has been selected to carry out this feasibility Study. Contract signing is awaited.
- 14000 Biogas Plants being constructed through RSPN (Rs. 356 Million Dutch Grant)
- RDF / WTE plants are operational/in advanced stages of implementation in Lahore, Karachi, Sheikhupura, Faisalabad, Hyderabad, Dera Ghazi Khan and Peshawar, Islamabad

RDF PLANTS:

•1000 TONS/DAY RDF PLANT, PESHAWAR:

Estimated Cost: Rs. 1.2 Billion.
Client: City District Government Peshawer.
Status: Construction Started.
Completion: December 2012.

•6 MW BIOMASS BASED POWER PLANT, LAHORE:

Estimated Cost: US$ 25 Million.
Client: Nishat Group.
Status: Machinery Installation in process.
Completion Date: May 2012.

•5 MW BIOMASS BASED POWER PLANT, LAHORE:

Estimated Cost: US$ 20 Million.
Client: Saphire Group.
Status: Financial Closure Completed.
Completion Date: June 2013.

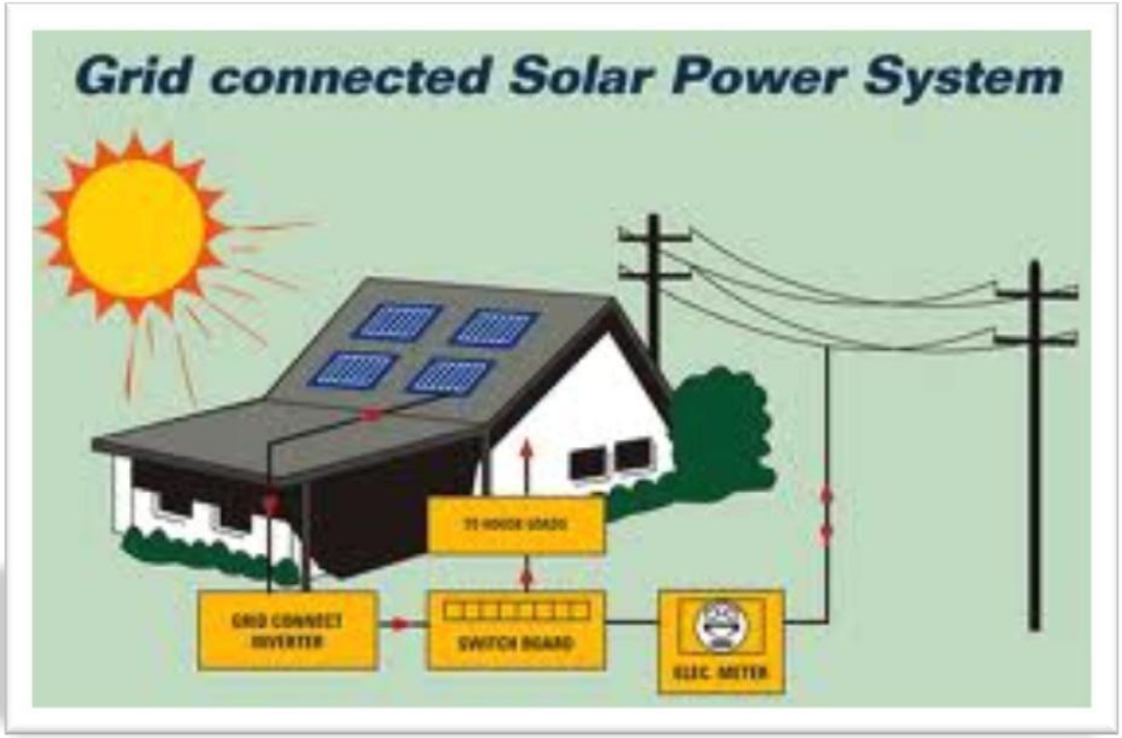
•1000 TONS/DAY RD PLANT, RAWALPINDI:

Estimated Cost: US$ 12 Million.
Client: Xenel Group Saudi Arabia.
Status: Awaiting approval of CDGR.
Completion Date: April 2013.

•05 MW BIOMASS BASED POWER PLANT, LAHORE CANTT:

Estimated Cost: US$ 25 Million
Client: Defence Housing Authority
Status: Agreement signed with DHA
Completion Date: March 2013

On Grid Solar



Solar Energy

1.	Solar Energy Pakistan Ltd.	34+1MW	Dhabeji, Dist. Thatta
2.	First Solar	2 MW	Southern Punjab
3.	AM Pak Energy	50MW	Southern Punjab
4.	DACC LLC Canada	50 MW	Sindh
5.	Wah Industries Ltd.	1 MW	POF Taxila
6.	TechAcess	2 x 5 MW	Punjab
7.	CWE	50 MW	Cholistan Dist. Bhawalpur
8.	Roshan Power (Pvt.) Ltd.	10 MW	Kasur Punjab
9.	Buksh Energy (Pvt.) Ltd.	20 MW	Lodhran Punjab

- Expected tariff for solar US $ 0.25+ /kWh. India offering US $ 0.39/ kWh. Canada & France offer over US $ 0.60.

Thank You

BIODIESEL

BIO-DIESEL

Biodiesel

- ECC target: 5% by volume of the total Diesel consumption by the year 2015 and 10% by 2025
- Energy plantations for Biodiesel cultivated on 650 acres.
- Biodiesel production on a pilot scale initiated with PSO
- First Biodiesel refinery (18,000 Tons / annum Capacity) setup at Karachi.
- SRO 474(I)/2008 exempts custom duties and sales tax on Biodiesel production equipment and material.
- Amendments in OGRA Ordinance for Biofuels pricing notified
- PC-II approved for pilot project of production of 10,000 tons of Biodiesel per annum. Funds awaited.
- Barriers to implementing Biodiesel Policy identified at National Stakeholders Conference. Task force for barrier removal established.
- Seed certification process underway by Seed Certification Department

Jatropha Nursery


JATROPHA PLANT AT PSO NURSERY

Ripening Jatropha Seed Pods

Final Product

Off Grid & Decentralized RE

Technologies

- Solar Home Systems
- Solar Water Heater
- Solar Water Pumping
- Clean Drinking Water
- Street lights
- RE for Businesses
- Small and Micro Hydro
- Heat pumps
- Bio Gas
- Off Grid Wind/Solar

Solar Village Electrification

Solar Home Systems (SHS)

- **80 Watt System Capable of operating**
  - 6-8 lights
  - 1 DC fan
  - Mobile Charger
- **Cost per SHS - $ 700 (Rs. 61,000)**
  (Replaces Rs. 800 / month in Kerosene)
- **Installation** by ESCOs
- **O&M** by local partners with community
- **Benefits**
  - Additional working hours after dark
  - Stimulates Income generating activities
  - Increased Security
- **Implementation**:
  - Parliamentary Program, REP, NGO.
  - Cost recoveries through COs

Rural Electrification Projects - SHS

- Four rural electrification projects approved by CDWP for electrification of 100 villages each in:
  - Sindh (Coastal Belt) District Tharparker
  - Central Balochistan (Districts Bolan, Chaghi, Qilla Abdullah)
  - Southern Balochistan (Districts Lasbela, Awaran, Khuzdar)
  - Northern Balochistan (Districts Zhob, Loralai, Qilla Saifullah)
- The funding of the project was made through KPP-II (now PWP-II)
- 3000 Solar Home System installed and commissioned in District Tharparkar Sindh

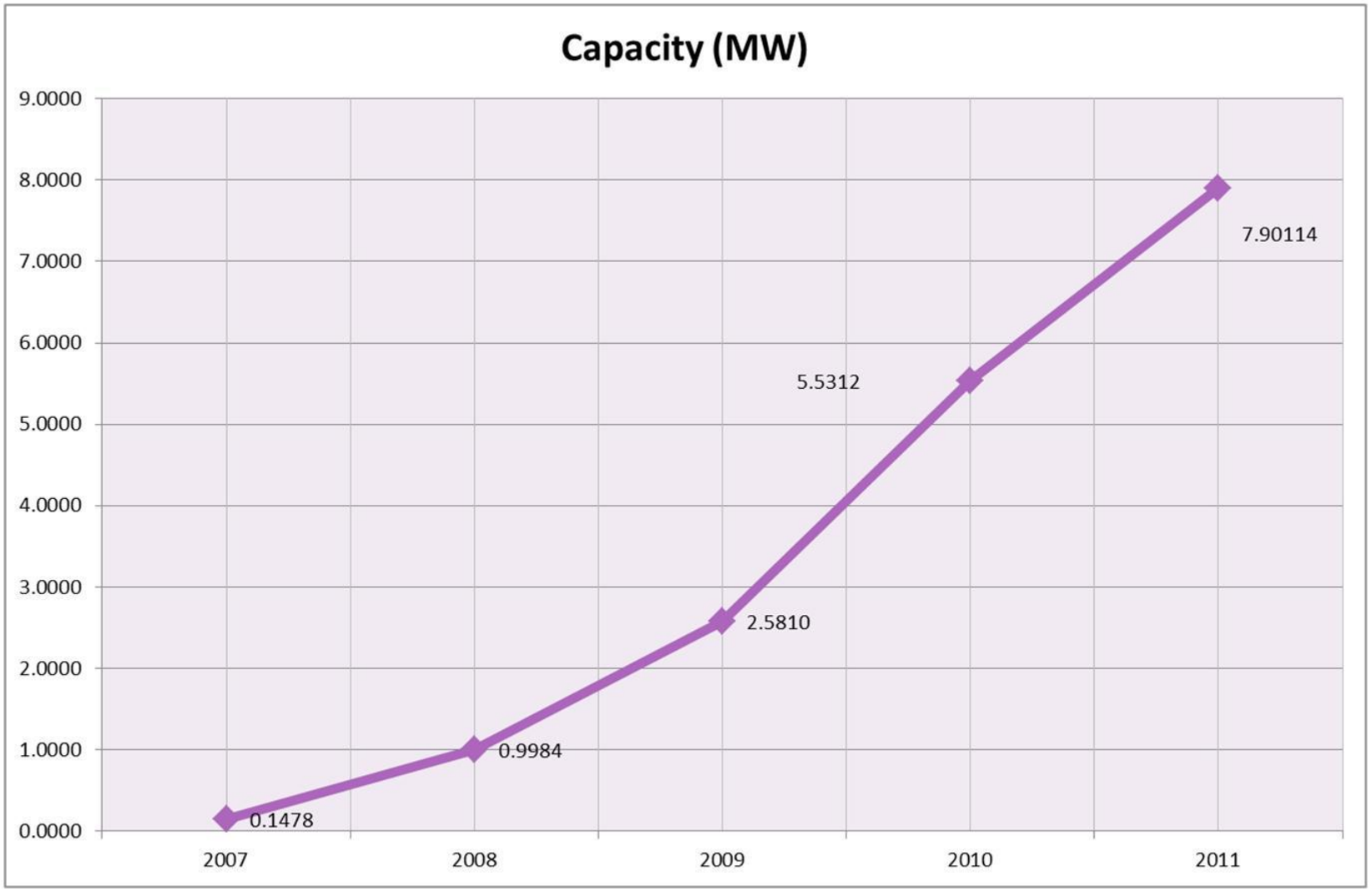
SHS Installed in Village in Mithi

Outside installation


05/03/2009

Mobile Charging Facility Introduced

PV sales in Pakistan (2007 - 2011)



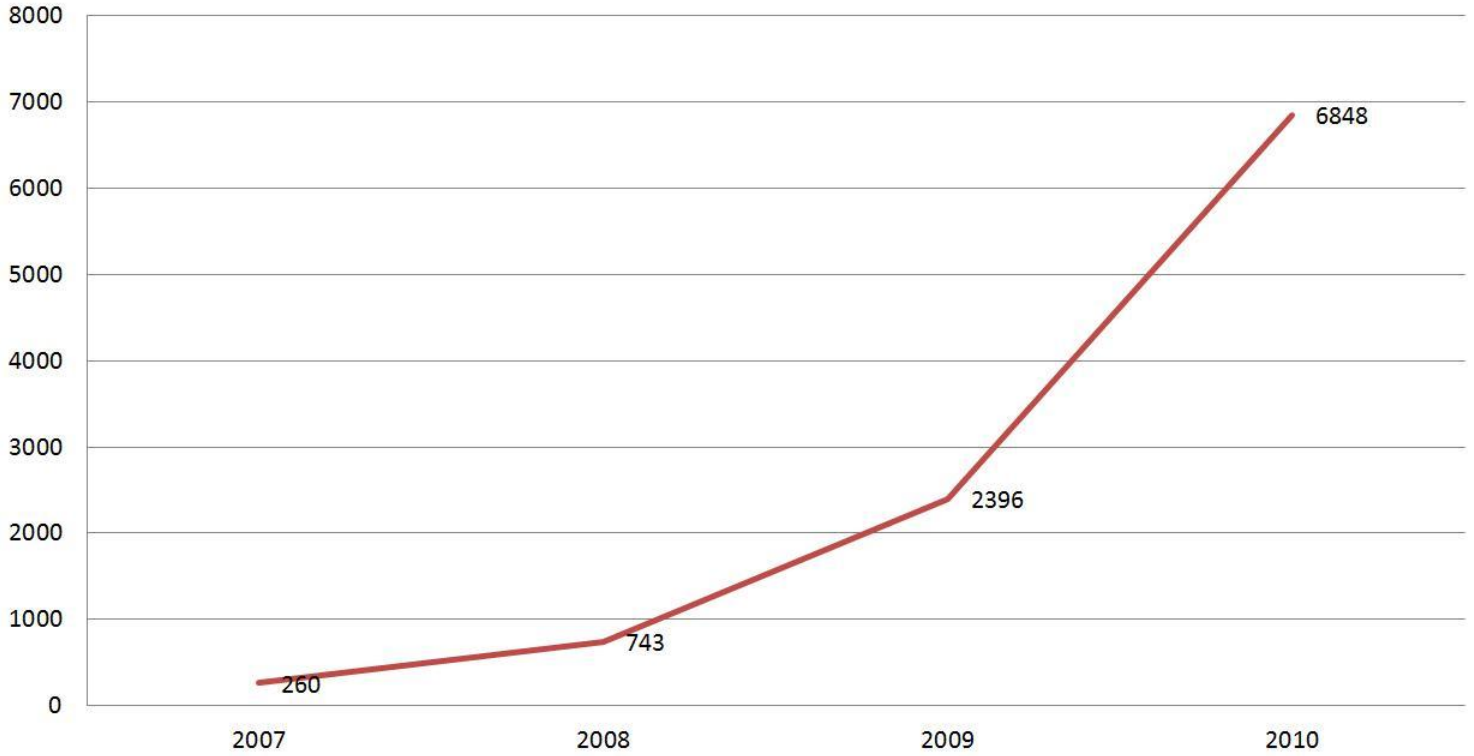
Solar Water Heaters

Solar Water Heaters

- Standalone SWH (with hybrid options) for domestic and commercial uses
- **Capable of providing**
  - Hot water up to 80 °C for up to 72 hours
  - Hybrid Systems increases reliability
- **Cost per SHS –** Rs 150 / liter (Rs. 20,000 / 130 liter sys)
- **ESCO based service delivery.** Local entrepreneurship**.**
- **Benefits**
  - Payback 2 years if replacing gas/electric heater
  - Easy to install and maintain
  - Carbon Credit

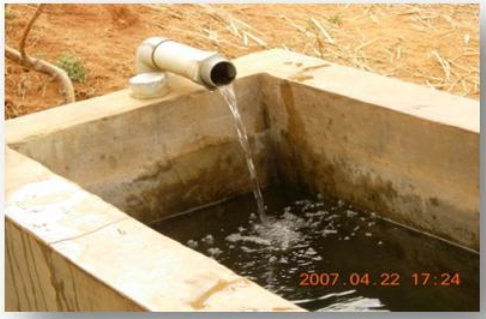
- 30,000 families in the urban areas of Gilgit Baltistan pay Rs.70,000/year for water heating (GTZ).
- **Implementation:**
  - Pilot demonstration and national programme development project is underway with World Bank assistance
  - Local manufacturing capacity encouraged; 42 local vendors in Pakistan
  - Support SWH through subsidies/micro-financing/recovery mechanisms.

Solar Water Heater Sales (Pakistan)



Local Manufacturing Capacity 20,000 units /year

Solar (Agriculture) Water Pumping



Solar Water Pumping Option

- **Applications**
  - Community / Drinking Water Supply
  - Livestock & Irrigation
- **Economics**
  - Average Capital cost – Rs. 850,000 (for 5 hp)
  - Payback – 5 years
- **Benefits**
  - Water Availability on Demand
  - Improved agriculture & livestock
  - Improved health & poverty indicators
- **Present Status:**
  - 300,000 Electric Tubewells have a sanctioned load of 3100 MW.
  - 900,000 Diesel Tube-wells running on Pump-set efficiency of 17-21%
  - 200 Solar pumps operational.
  - World Bank /AEDB preparing a project for replacing 50,000 pumps in 3 years – saving about 600 MW

Micro Hydro

Micro Hydro Technology

- **Applications**
  - Domestic & Commercial power supply
  - Productive use
- **Capacity – 100 KW to 500 KW**
- **Economics**
  - Capital cost – Rs. 85,000 / KW
  - Payback – 2 – 3 years
- **Benefits**
  - Increased working hours & poverty alleviation
  - Access to communication
  - Improved health and education services
  - Carbon Credits
- **Installation** by local companies with the locally built turbines
- **Sustainability** established.

  AEDB / AKRSP / GEF establishing 103 + 250 MHP stations at Chitral, GB and AJK.


2009/06/02

Other Off-Grid Options

- **Domestic Biogas Plants**
  - 14000 Being installed in the Central Punjab
  - 3000 Being installed by PCRET in other parts

- **Solar Street Lights & Neon Sign (Load 500 MW)**
  - High-upfront cost.
  - LED bases Solar Street Lights – payback period 4 years.
  - All NEON Signs being converted to Solar PV

- **Geothermal Heat Pumps (Heating and Air Conditioning)**
  - Capital cost less than conventional Air-conditioning (HVAC) systems
  - Low Maintenance Cost
  - Electricity Saving: 70 % of conventional systems
  - Free Hotwater.
  - Long Life (50 years)

Targets for On-Grid RE Applications - 2015

Serial	Technology	(MW)	Investment (M.US $)
1	Wind	1750	4,375
2	Small Hydel	310	775
3	Solar Thermal	50	250
4	Solar PV	130	455
5	Waste to Energy	300	900
6	Geothermal	-	-
Total		2440	6755

Targets for Off Grid-RE Applications - 2015

	Technology	(MW)	Investment ($ Million)
1	Solar Water Pumps	10000	120
2	Solar Street Lights	20000	20
3	Heat Pumps	10000	20
4	Solar Home Systems for Rural Electrification	30000	35
5	Solar Water Heaters	100000	35
6	Bio-diesel	2% replacement	270
Total			500


thank
you!