

# Potential of Solar Irrigation Water Pumps in Pakistan

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# PAKISTAN POWER SECTOR AT A GLANCE



# Pakistan Electricity Mix - 2013

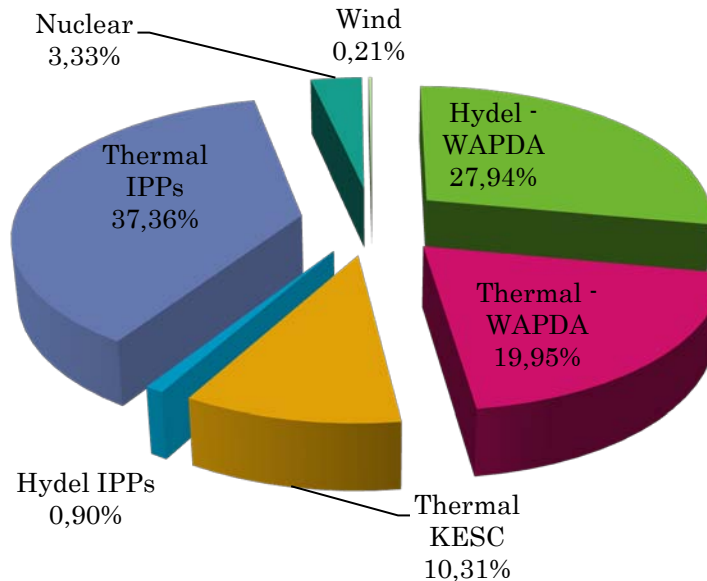


TYPE	MW	%
Hydel - WAPDA	6,612	27.94%
Thermal - WAPDA	4,720	19.95%
Thermal KESC	2,440	10.31%
Hydel IPPs	214	0.9%
Thermal IPPs	8,840	37.36%
Nuclear	787	3.33%
Wind	50	0.21%
<b>Total</b>	<b>23,663</b>	<b>100.00%</b>

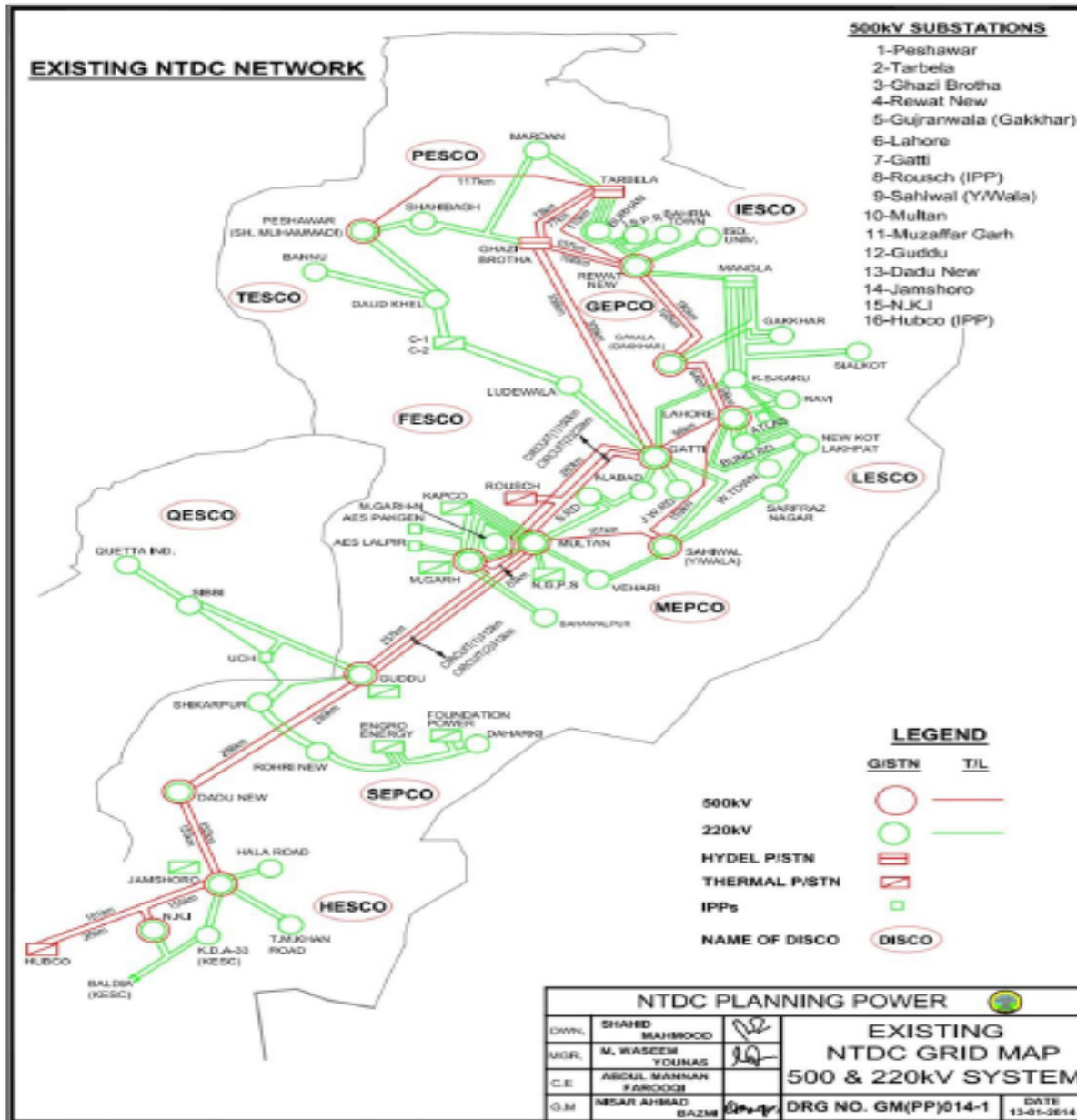
Dependable capacity summer:  
17,897 MW

Dependable capacity winter:  
13,215 MW

## Pakistan Power Mix



# Electricity Grid Map of Pakistan

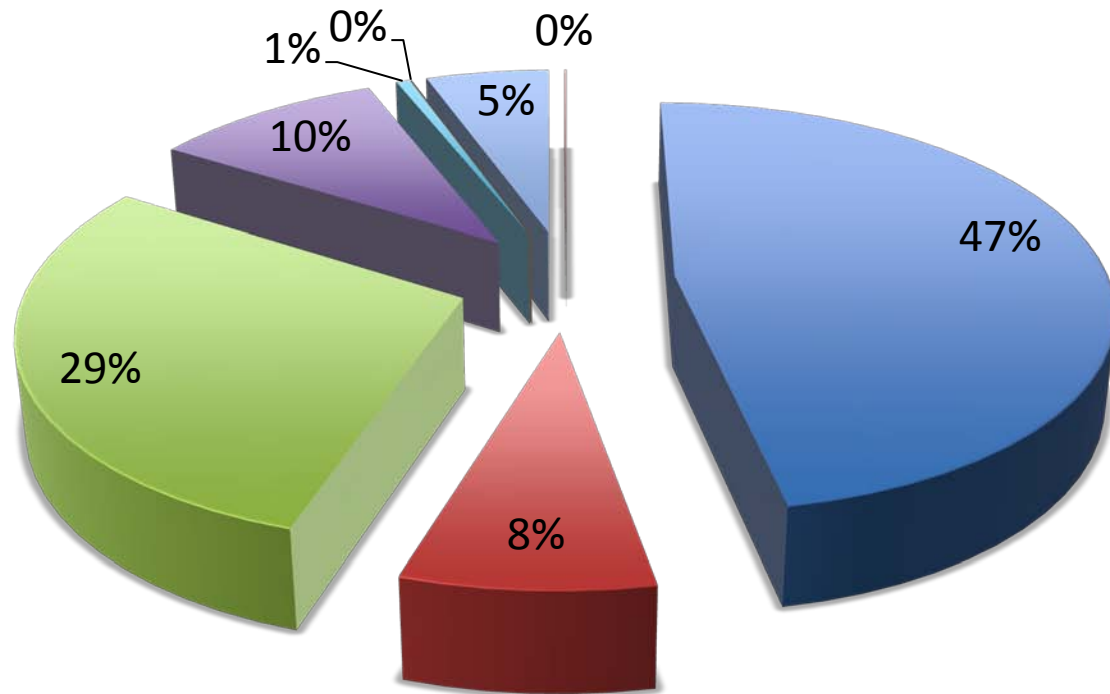


# Pakistan Electricity Consumption – 2013 (by sectors)

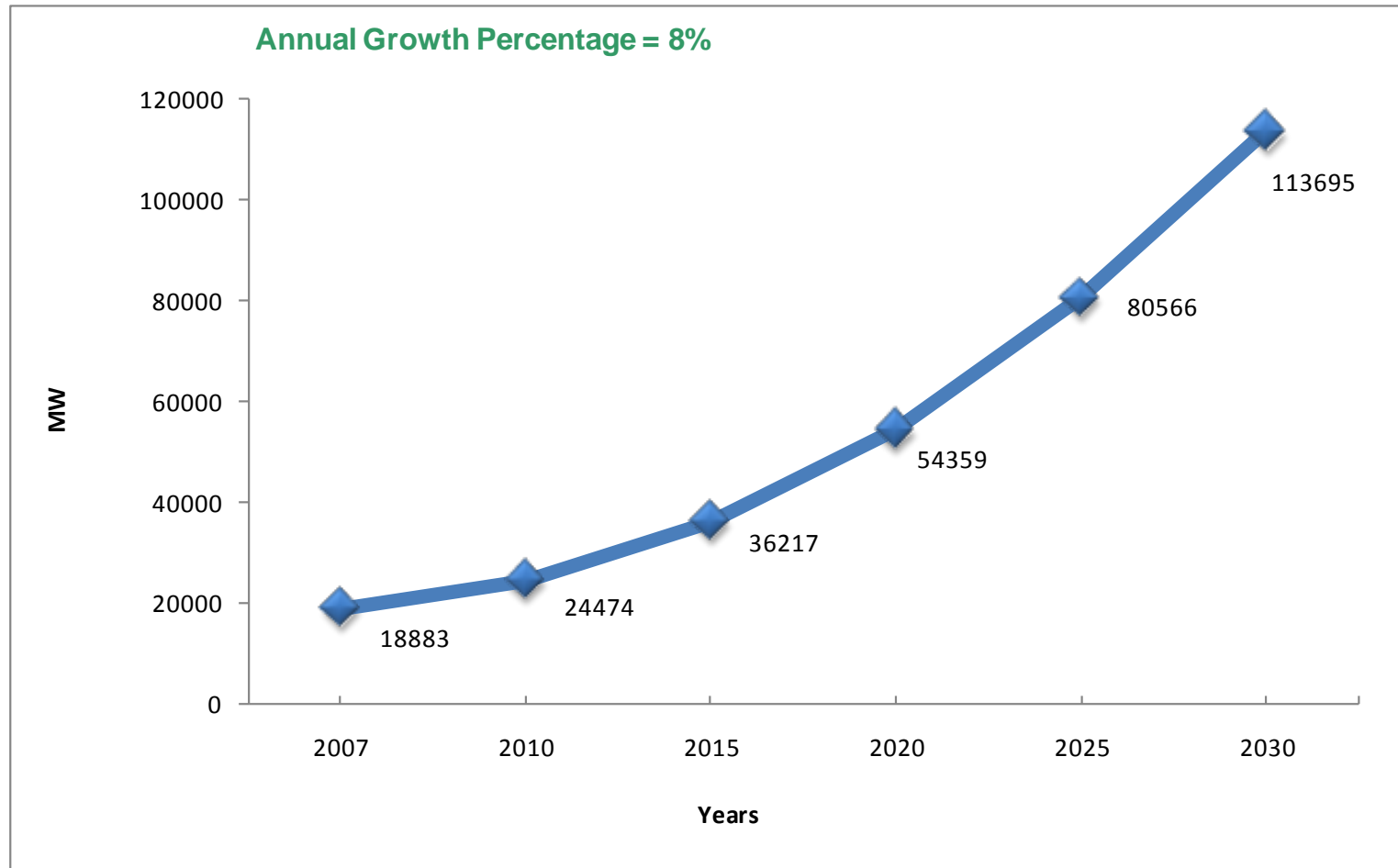


## Electricity Consumption by Sector

- Domestic
- Commercial
- Industrial
- Agriculture
- Street Light
- Traction
- Bulk Supplies
- Other Govt.



# Peak Demand Projections 2007 – 2030 (Countrywide)



Source of Growth Rate: PEPCO, P & D Div



# PAKISTAN IRRIGATION SECTOR OVERVIEW





# AGRICULTURE: The Backbone of Economy

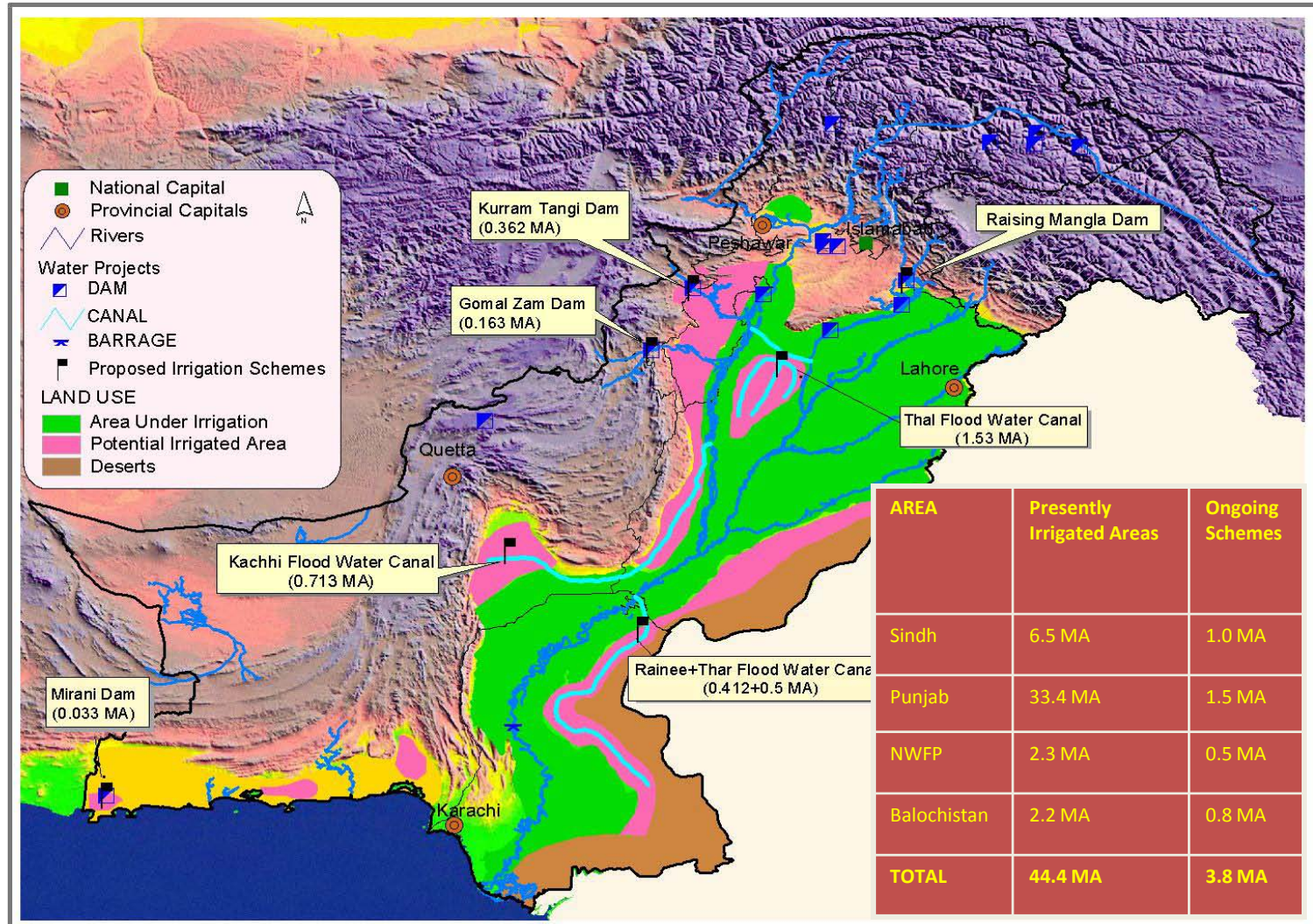


- Agriculture is the main player of the economy of Pakistan with 21% contribution to GDP and more than 45% contribution in labour force
- Pakistan's agriculture rely heavily on irrigation.
- Pakistan has the world's largest contiguous irrigation system
- Pakistan ranks 4<sup>th</sup> in the world as for as irrigated area ( About 7%) is concerned. About 36 MA ( About 75% of the cultivated area) in Pakistan is irrigated land.
- Pakistan has invested heavily in the irrigation sector. Allocated about \$ 8 billion in this sector upto the year 2011-12

**Irrigation: Life blood of agriculture**



# Presently irrigated areas and proposed water projects



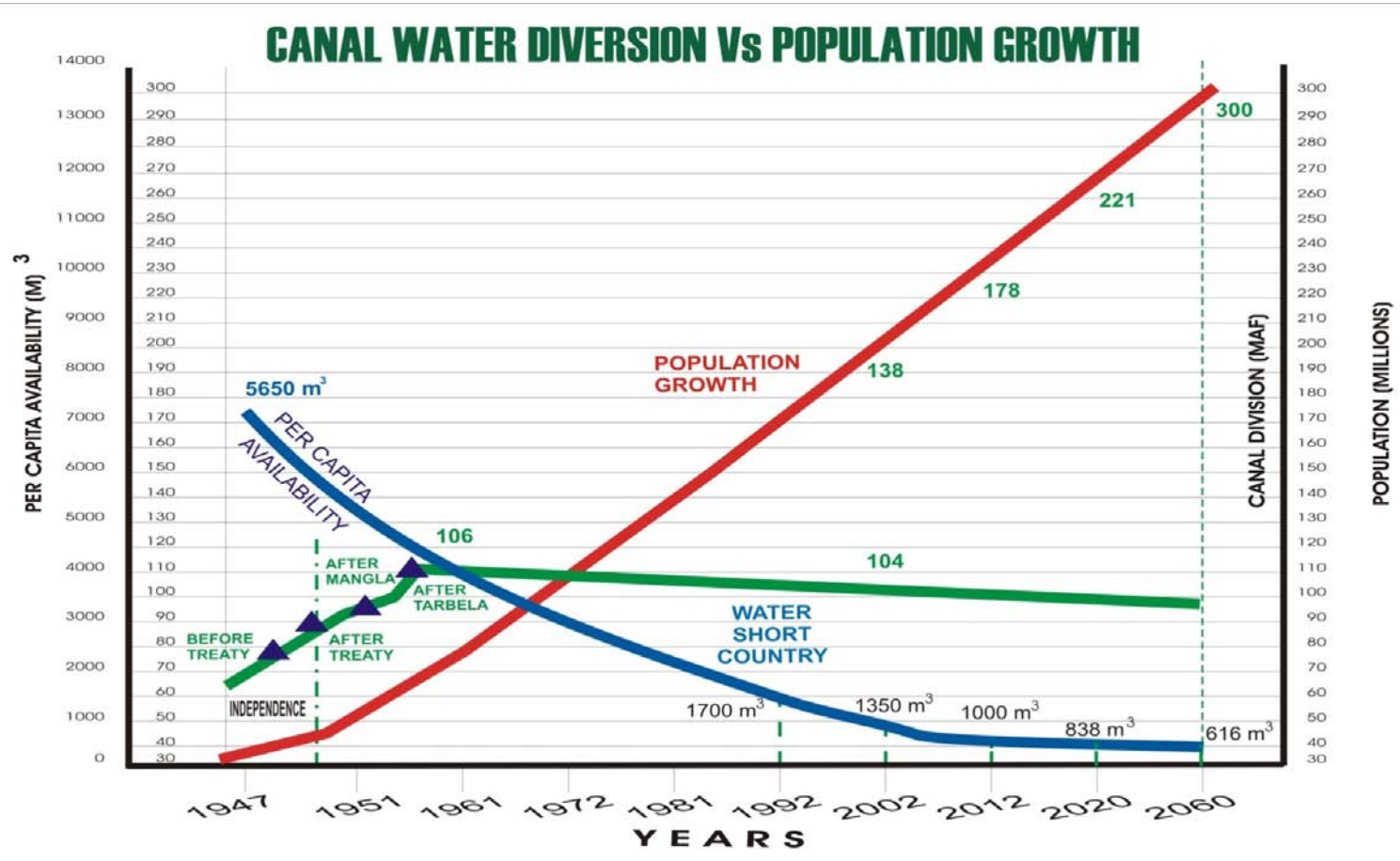


## Freshwater availability scenario (Per person)

- Global
  - 1950 – 16,800 cubic meters per annum
  - 2000 – 6,800 cubic meters per annum
  - **Reduction: 60 % in 50 years**
  
- Pakistan
  - 1950 – 5,300 cubic meters per annum
  - 2000 – 1,200 cubic meters per annum !!!!
  - **Reduction: 77 % in 50 years**
  
- **Critical limit 1,000 cubic meters per person per annum**



# Rising water demand but stagnant water availability





# Pakistan's Agriculture Sector Overview



Agriculture Land Ownership pattern of Punjab					
	FARMS			Acres	Average Farm Size
	Number	%			
Under 1 Acres	703,638	18%	<b>85%</b>	496,747	0.7
1 to under 2.5	617,265	16%		1,134,738	1.8
2.5 to under 5	844,219	22%		2,881,880	3.4
5 to under 7.5	597,863	15%		3,467,635	5.8
7.5 to under 12.5	536,361	14%		5,141,298	9.6
12.5 to under 25	368,362	10%		5,983,145	16
25 to under 50	149,018	4%		4,590,651	31
50 to under 100	36,696	1%		2,245,857	61
100 to under 150	5,712	0.15%		649,845	114
150 and above	4,932	0.13%		1,159,065	235
<b>All Farms</b>	<b>3,864,066</b>	<b>100%</b>		<b>27,750,860</b>	<b>7</b>



# Overview of Agricultural Tube wells in Pakistan



Type	Area	Number of Tube wells/Lift Pumps by Horse Power					Total
		Less than 10 Hp	10hp to 15 hp	16hp to 20 hp	21hp to 25 hp	Greater than 25hp	
Diesel	Punjab	3,224	110,890	542,419	25,404	89,701	771,638
	Sindh	540	6,671	33,554	524	1,408	42,697
	KPK	1,712	2,891	4,854	542	1,020	11,019
	Balochistan	284	2,123	5,270	802	1,078	9,557
	<b>Total Diesel</b>	<b>5,760</b>	<b>122,575</b>	<b>586,097</b>	<b>27,272</b>	<b>93,207</b>	<b>834,911</b>
Electric	Punjab	34,651	53,781	61,865	2531	70,990	223,818
	Sindh	6,328	9,765	6,824	252	5,588	28,757
	KPK	18,761	4,874	3,837	898	3,581	31,951
	Balochistan	5,617	8,402	6,519	1343	8,129	30,010
	<b>Total Electric</b>	<b>65,357</b>	<b>76,822</b>	<b>79,045</b>	<b>5,024</b>	<b>88,288</b>	<b>314,536</b>
<b>Total</b>		<b>71,117</b>	<b>199,397</b>	<b>665,142</b>	<b>32,296</b>	<b>181,495</b>	<b>1,149,447</b>



## Present depth of water tube wells



PRESENT DEPTH OF WATER TABLE		TUBEWELLS TOTAL *
1		2
10 FEET		25434
11	TO 20 FEET	125382
21	TO 30 FEET	224027
31	TO 40 FEET	188707
41	TO 50 FEET	116750
51	TO 75 FEET	112765
76	TO 100 FEET	87351
101	TO 150 FEET	108290
151	TO 200 FEET	78357
201 FEET AND ABOVE		82384
		<b>1149447</b>

# Revenue Recovery Efficiency of Electrical Tube Wells



Agriculture Tube well Data Abstract														
2014	Calendar Year			(Jan 2014 to Oct 2014)										
Utility Company	Total No. Tube Well	No. of Operational Tube Well	No. of Disconnected Tube Well	Operational load	Disconnected	Total Load (MW)	Type of Connection (Operational)		Type of Connection (Disconnected)		Unit Billed (Mil Kwh)	Billing (Mil. Rs.)	Amount Recovered (Mil. Rs)	%age Recovery
				Load (MW)	Load (MW)		Upto 5 KW	Above 5 KW	Upto 5 KW	Above 5 KW				
LESCO	57,896	41,534	16,362	406	184	590	12,555	28,979	4,103	12,259	975	10,134	9,618	95%
GEPCO	42,232	36,110	6,122	255	47	302	13,536	22,574	1,879	4,243	267	3,342	3,336	100%
FESCO	39,451	36,241	3,210	414	37	451	7,285	28,956	583	2,627	710	8,790	9,252	105%
IESCO	8,096	5,748	2,348	65	22	87	2,903	2,845	1,138	1,210	79	1,085	1,079	99%
MEPCO	76,143	62,809	13,334	1,000	180	1,180	573	62,236	2,060	11,274	1,735	19,762	22,485	114%
PESCO	23,403	11,158	12,245	100	70	170	6,000	5,158	8,455	3,790	79	1,052	999	95%
HESCO	16,318	12,744	3,574	187	37	224	899	11,845	1,062	2,512	369	5,334	3,359	63%
SEPCO	12,439	7,592	4,847	125	45	170	726	6,866	1,793	3,054	202	2,830	1,627	58%
QESCO	30,010	27,872	2,138	789	42	831	984	26,888	234	1,904	2,549	38,275	8,859	23%
TESCO	8,548	7,793	755	86	7	93	1,080	6,713	322	433	47	544	344	63%
<b>Total</b>	<b>314,536</b>	<b>249,601</b>	<b>64,935</b>	<b>3,426</b>	<b>671</b>	<b>4,097</b>	<b>46,541</b>	<b>203,060</b>	<b>21,629</b>	<b>43,306</b>	<b>7,012</b>	<b>91,148</b>	<b>60,959</b>	<b>67%</b>



# CONVERTING ELECTRICAL & DIESEL OPERATED TUBE WELLS TO SOLAR



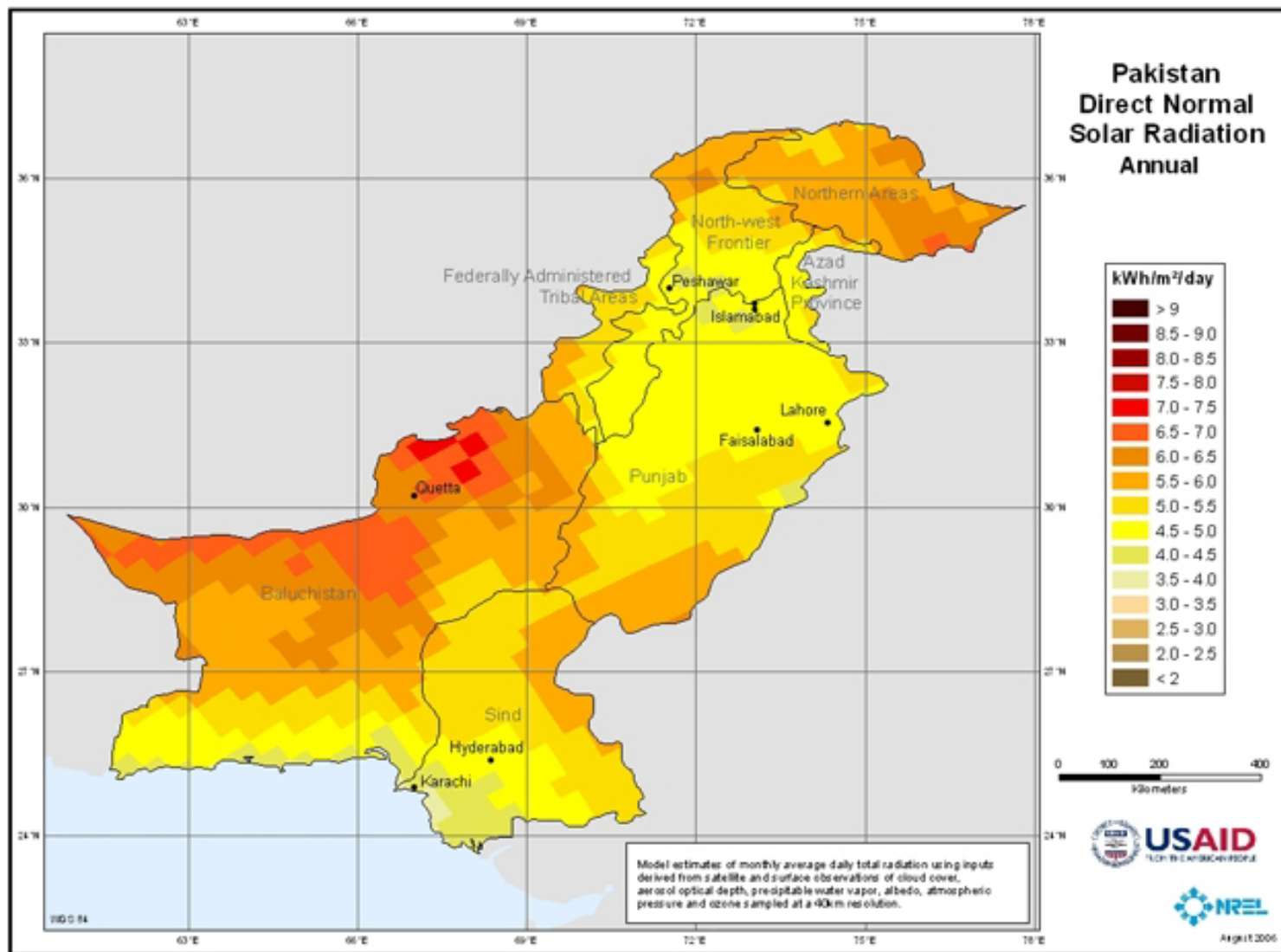


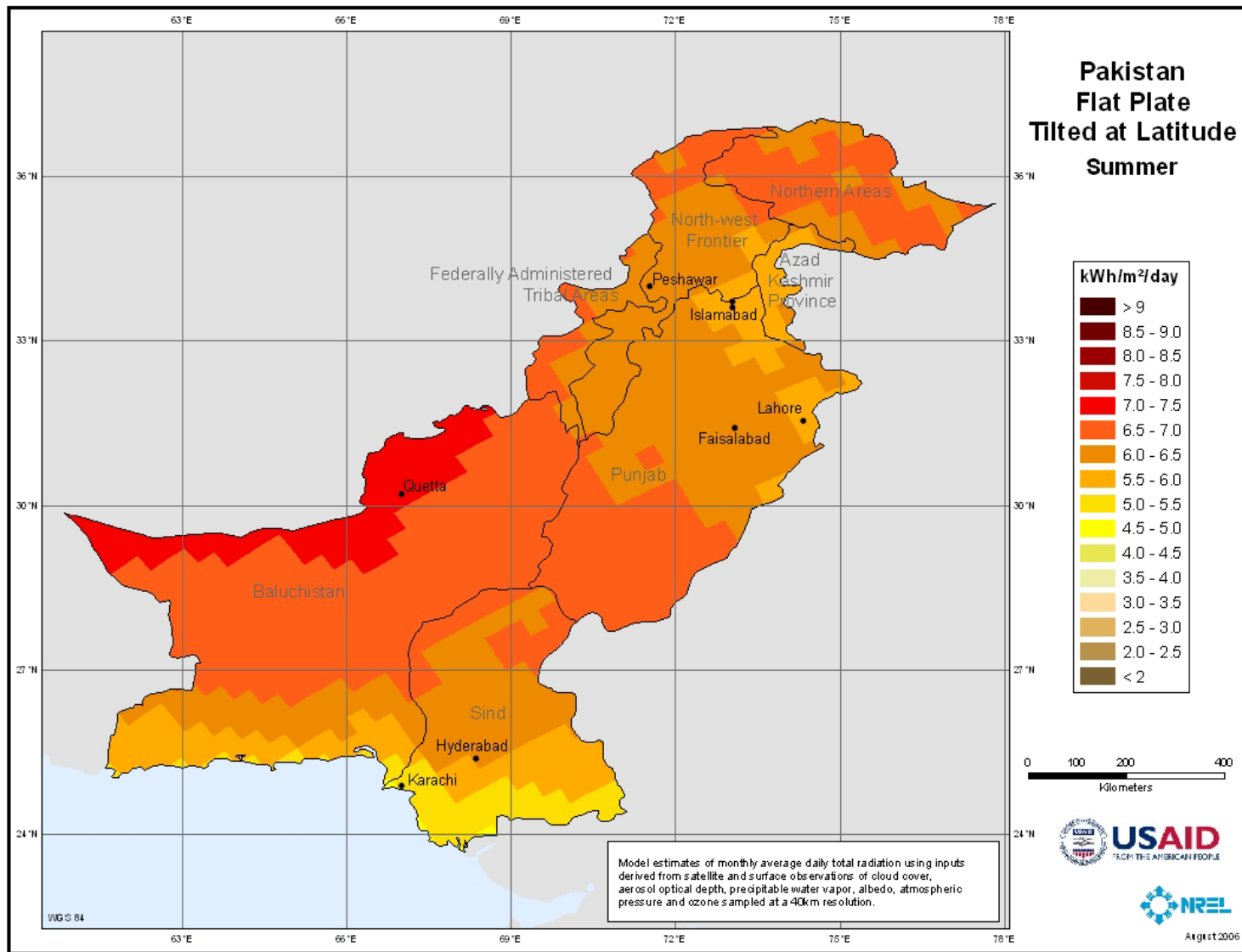


## Current Situation

- Current Total Annual Subsidy = Rs. 100 Billion - Rs. 82 Billion alone towards Balochistan
- Additional Connections will increase
- Subsidy will increase with time with the increasing electricity tariff
- Loss of agriculture productivity because of non-availability of electricity

**Government is considering Alternate options Solar Water Pumping – A possible option**







# Tube well irrigated land and potential for Solar PV



- Total number of Farms +8.26 Million (+3.8 Million in Punjab only)
- Total Farm Area =52.91 Million Acre
- Total Cultivated Area=42.6 Million Acre
- o/w irrigated by canal and tube wells both=13.89 Million Acre
- and irrigated by tube wells only=6.08 Million Acres
- Estimated coverage of Tube wells=12 Million Acre
- @0.5 kW per acre, Solar PV potential=6000 MW



# Existing Tube Well Statistics and Solar PV Potential



- Average HP per Tube Well=17 H.P.(12.68 kW)
- Typical Capacities:5,10,15,20,22,25 HP
- Diesel, number of days of operation=125 days per year
- Electric, number of days of operations=184 days per year
- Solar PV ,optimal number of days of operation=300 days per year
- Estimated Solar PV demand for 300 days of operations=8400 MW
- Assumed Target 50% conversion in 10 years=4200 MW
- Yearly conversion =420 MW(110,000+ solar pumps)



## Benefits of the Proposed Mechanisms



- Conversion of 50% diesel & electric operated pumps to solar
- Reduction of 4200 MW electricity load that can be served to productive use
- Help in reducing annual subsidy of more than Rs.40 billion for life of solar pumps
- Reducing consumption of diesel, thereby reducing fuel import bill
- Improving efficiencies and crop production
- Making available electricity to farmers at times when water pumping is not required for irrigation



## Business Opportunities

- **Solar Water Pump Manufacturers:** Supply their efficient solutions to serve the requirement
- **Solution Providers:** design efficient water pumping solutions to satisfy consumers' requirements
- **Energy Service Companies:** Evolve optimum business solutions for the farmers
- **Lenders/Financers:** Announce attractive financing solutions to cover high initial capital cost and soft term loan pay back schemes
- **Bilaterals/Multilaterals/Carbon Financing Institutions:** account replacement of pumps to solar as option for poverty alleviation, economic well being and addressing water scarcity in agriculture, plus mitigating GHG emissions, thereby contributing towards global cause of emissions reduction to address climate changes



# Thank you

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