

Pakistan — supply and demand of power

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Pakistan's power sector is in crisis and if not quickly fixed could bring the whole system down with it. This article presents a view on the important aspect of supply/demand and is part of a series of discussion papers that will be presented on the various aspects of Pakistan's power sector. It does not profess to provide the whole solution as the issues are difficult and complex, but it gives a view on an important aspect which should hopefully trigger further debate and deeper thought.

Most governments in Pakistan have mishandled the power sector never addressing the issues, which were swept under the carpet; never looking beyond their few years in office, failing to understand that power planning transcends the term of a single government and must be done on a national level for 50 years or at least 25 years. The previous PML-N government is no exception and the power czars had a myopic vision without the courage to think outside the box. Development of hydropower and renewables was banned in the name of overcapacity caused by hastily added thermal generation on imported fuels which they themselves had banned. The modus operandi is to create a crisis and then add thermal capacity as a quick fix.

Pakistan is now caught in the same trap as in the 1990s when some 3,000MW of imported fuel-based IPPs were added — once again at neck-break speed. Those power plants were constructed when oil prices were low, but generation costs quickly spiraled out of control when the price of oil spiked. Once again, some 6,000MW of capacity was added when the price of oil had dipped but now we are once again holding a hot potato because oil has hit new highs! Can we never learn?

Out of about 30,000MW power capacity, we have some 10,000MW with generation cost around Rs 14/kWh or more. These need to be replaced with cheaper generation but how can this be done if we lock our capacity on the pretext of balanced supply/demand?

The ex-Wapda Gencos and the IPPs are all guzzling fuel in old and inefficient plant using steam turbine, reciprocating engine and gas turbine technology with RFO and RLNG fuels. These plants have a low capacity charge of between Rs 1-3/kWh. Renewables have a negligible variable cost with no fuel cost. The life of hydropower is around 100 years or more, with lowest lifecycle costs, while solar and wind have useful lives of 25 years each.

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The hydropower, wind and solar tariff lifecycles, based on Nepra-determined tariffs (extrapolated for hydel) are shown below:

Generation Technology	Yr-1	Yr-11	Yr-13	Yr-25	Yr-31	Yr-57
	Rs/kWh	Rs/kWh	Rs/kWh	Rs/kWh	Rs/kWh	Rs/kWh
Hydropower (Azad Pattan)	8.52		4.47	4.47	1.22	1.22
Wind (Western Energy)	6.66	2.19	2.19	2.19	6.66	6.66
Solar (Access Solar)	7.79	2.98	2.98	2.98	7.79	7.79

A snapshot of aging, capacity price and variable (fuel/variable O&M) for the high cost thermal generating plants is shown below:

Category	Total MW	Age (MW)			Var. Cost Rs/kWh
		20 yrs +	5 yrs +	8 yrs +	
GENCOS	3,166	3,166			13.34
"	1,172		1,172		13.34
Steam turbine	2,025	2,025			16.66
Reciprocating Engine	124	124			14.37
"	1,357			1,357	14.37
Combined cycle gas turbine	1,882	1,882			13.16
"	819			819	13.16
Total (MW)	10,545	7,197	1,172	2,176	
Capacity Price (Rs/kWh)		1.50	2.00	2.75	

Information is extracted from CPPA G power purchase data published by Nepra.

The so-called supply/demand balance without addition of cheap power generation would lock us into expensive electricity for years to come. Cheap renewable capacity needs to be added as fast as we can so that there is an opportunity to replace expensive thermal power with cheap renewables; while continuing to pay the contractual capacity price of Rs 1.50/kWh to Rs 2.75/kWh, depending on the stage of debt servicing, for the thermal plants. Each capacity price level has been simulated to show the total cost of the renewable source together with the imputed capacity price.

Replacing thermal generation with renewables (capacity price at Rs 1.50/kWh):

Generation Technology	Cost	Cap. Price	Total	Generation Replaced
	Rs/kWh	Rs/kWh	Rs/kWh	Rs/kWh
Hydropower	8.52	1.50	10.02	14.00
Wind	6.66	1.50	8.16	14.00
Solar	7.79	1.50	9.29	14.00

Replacing thermal generation with renewables (capacity price at Rs 2.00/kWh):

Generation Technology	Cost	Cap. Price	Total	Generation Replaced
	Rs/kWh	Rs/kWh	Rs/kWh	Rs/kWh
Hydropower	8.52	2.00	10.52	14.00
Wind	6.66	2.00	8.66	14.00
Solar	7.79	2.00	9.79	14.00

Replacing thermal generation with renewables (capacity price at Rs 2.75/kWh):

Generation Technology	Cost	Cap. Price	Total	Generation Replaced
	Rs/kWh	Rs/kWh	Rs/kWh	Rs/kWh
Hydropower	8.52	2.75	11.27	14.00
Wind	6.66	2.75	9.41	14.00
Solar	7.79	2.75	10.54	14.00

In each case, there is a saving as the renewable cost plus imputed capacity price is lower than the cost of thermal generation replaced; thus, reducing the average cost of electricity. But due to bad policy, creating hurdles and stalling development of the renewable, including hydropower, there are no projects ready to replace expensive thermal power. Not only has a lot of time wasted, but investor sentiment never remains constant and the interest in developing projects two years ago may not be the same today — due to growing economic constraints and specific issues plaguing the power sector, including hugely delayed tariff payments caused by circular debt. Notwithstanding the contractual arrangements, who would invest massive amounts without certainty of repayment! Pakistan has suffered immense loss of credibility and reputation due to non-payment to generators for a product supplied and consumed.

As renewables have a lower plant factor and quantum of generation compared with thermal plants; replacing 10,000MW of thermal generation would require approximately 20,000MW of hydropower; 30,000MW of wind, 50,000MW of solar or a combination of the same to produce the required kWh to replace the displaced thermal generation. Even if the full 10,000MW of thermal generation is replaced, the power system would still have plenty of "dispatchable" power to satisfy the system's demand when required. So, can we afford to be complacent, sit back, talk about supply/demand being in balance and decide to do nothing?

It is about time that the lesson is learnt that renewables including hydropower should not be supply/demand bound but must be constructed at a fast and furious pace while investor interest is alive. Renewables not only provide cheap, renewable, clean energy but also lock in the cost, save precious foreign exchange and are insulated from the vagaries and uncertainty of international oil prices.

This is what sensible governments worldwide have done thus reducing their basket power price dramatically through competitive energy and capacity markets. Pakistan needs to move quick to fix its exploding power sector, through innovative and out-of-the box solutions.

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