Print ISSN : 0022-2755
Indian Journal of
Power and River Valley Development
Contents available at: www.informaticsjournals.com/index.php/jmmf

Jayanta Bhattacharya
Chief Editor

Industry Direction™

How is Electricity Priced in the Efficient markets of the Developed World? And the Case of India

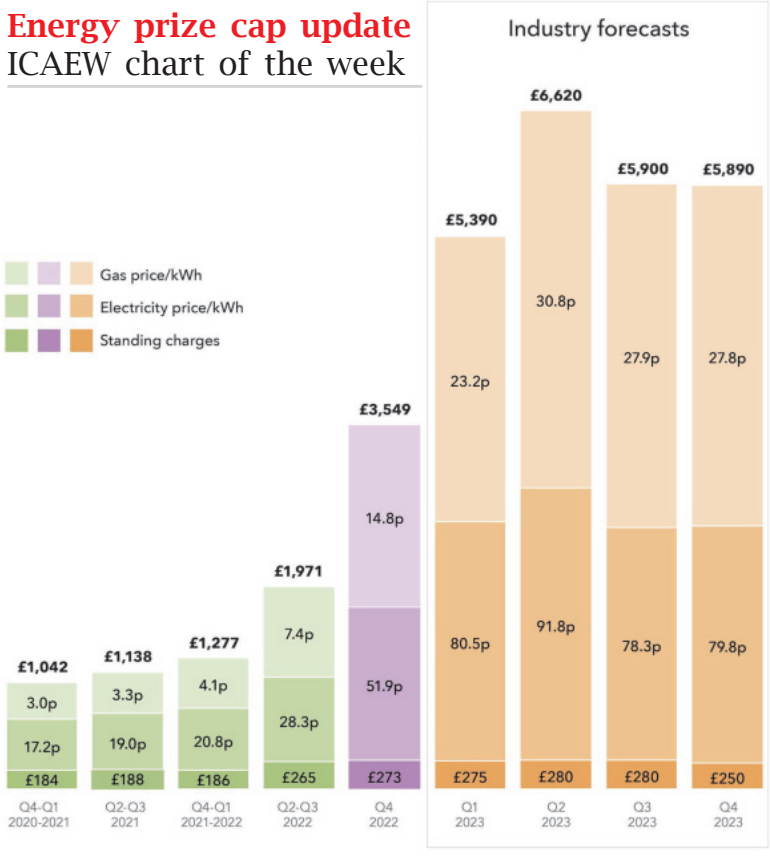
The electricity market in Great Britain is a complex intersection of engineering and economics. Generators supply the electricity that consumers demand. The physical connections between demand and supply make up the electricity grid, and the most important part of the price that consumers pay is the wholesale electricity price.

What is the wholesale electricity price?

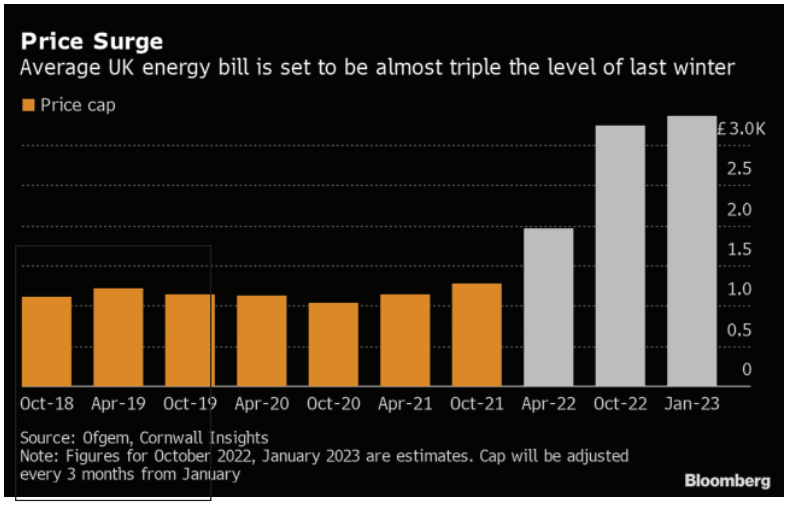
The wholesale electricity price is the price at which suppliers buy the electricity they use to supply to end consumers.It is the largest single component of a typical consumer bill. With the April 2022 price cap, wholesale electricity price makes up 50-60% of what consumers pay for their electricity. The rest is made up of other operational costs.

When it comes to calculating wholesale electricity price, countries use three main pricing models. Each option has a different locational granularity, or how a country draws up its pricing regions. While some countries – like Great Britain – have a single national price, others divide their markets into "zones" or "nodes", each with their own wholesale electricity price.

Energy prize cap update
ICAEW chart of the week



1 Sep 2022. Chart by Martin Wheatcroft FCA. Design by Sunday.
Sources: Ofgem; Cornwall Insights; ICAEW calculations. Average direct debit prices based on 'typical' annual household usage of 2,900kWh of electricity and 12,000kWh of gas.



National Pricing

At the highest level, there is national pricing. This is where there's one price for electricity across the country at any given moment.

For each settlement period in a national wholesale market, the wholesale price of electricity clears as a uniform price across the market's entire geographical area. In each trading period, this provides a single wholesale price to all market participants – both demand and supply – regardless of their location on the network.

Great Britain uses national pricing. In 2005, the British Electricity Transmission and Trading Arrangements (BETTA) introduced a GB-wide electricity market, setting one price for electricity in each trading period.

France, Germany, Poland and Greece also use the national pricing model.

Zonal Pricing

In zonal pricing – or regional pricing – the transmission system is split into several pre-determined zones, or geographical regions. In Italy, for example, there are six pricing zones.

For each settlement period in a zonal wholesale market, the wholesale price of electricity clears as a uniform, separate price for each zone. In each trading period, the wholesale price typically varies between each zone.

Countries usually draw the boundaries between zones at major transmission constraints, or where transmission links are most likely to become congested. Zone boundaries indicate where a different wholesale electricity price should apply at each side of the constraint.

Zonal pricing is used in Australia and several European countries, including Italy, Sweden, Norway and Denmark.

Nodal Pricing

At the most granular end of the spectrum, there's nodal pricing. Also called locational marginal pricing (LMP), this option divides the national network into hundreds or even thousands of nodes, each with their own unique wholesale electricity price.

The number of nodes a country has is influenced by a range of factors, including a nation's geography or network characteristics. In California alone, there are over ten thousand nodes. Nodes are associated with defined spots on the system. They can be where generation comes on to the system, or where demand takes from the grid.

Each node's price represents the cost to serve one additional unit of energy at each specific point. The wholesale electricity price typically varies between each node for each trading period. This option is used in New Zealand, Singapore and several United States markets.

The UK Price Cap

Britain's energy regulator announced it will raise its main cap on consumer energy bills to an average £3,549 ($4,197) from £1,971 a year, as campaign groups, think tanks and politicians call on the government to tackle a cost-of-living crisis.The price cap limits the standard charge energy suppliers can bill domestic customers for their combined electricity and gas bill in England, Scotland and Wales, but is recalculated by Ofgem throughout the year to reflect wholesale market prices and other industry costs.

It covers around 24 million households. The 4.5 million households on prepayment plans face an increase from £2,017 to £3,608.The cap does not apply in Northern Ireland, where suppliers can increase prices at any point after getting approval from a different regulator.

Gas prices have soared to record levels over the last year as higher global demand has been intensified in Europe by low gas storage levels and a drop in pipeline imports from Russia following its invasion of Ukraine. This has also increased electricity prices.

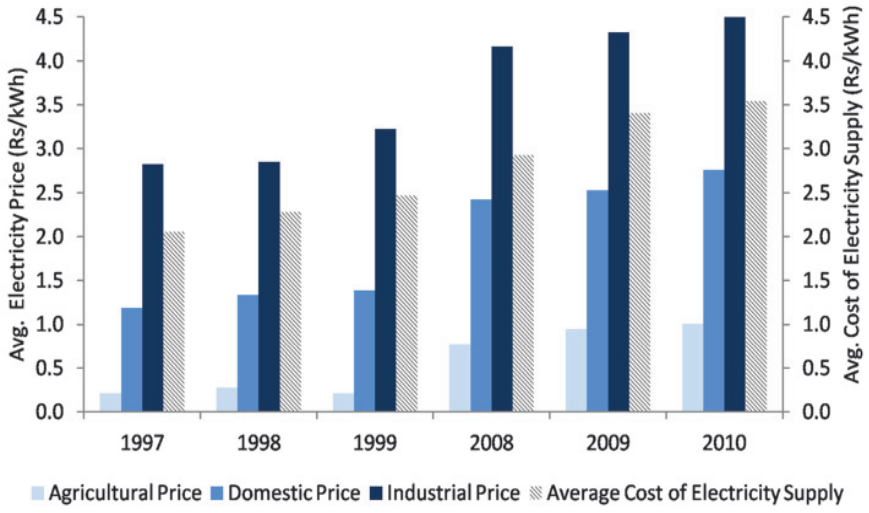
UK's Biggest Electricity Market Reform in a Generation

The Review of Electricity Market Arrangements (REMA) will seek views on a wide range of options to address the combined challenges of responding to higher global energy costs, the need to further boost energy security and move

the UK to a cleaner energy system.

Some of the changes being consulted on include:

- introducing incentives for consumers to draw energy from the grid at cheaper rates when demand is low or it's particularly sunny and windy, saving households money with cheaper rates
- reforming the capacity market so that it increases the participation of low carbon flexibility technologies, such as electricity storage, that enable a cleaner, lower cost system
- de-coupling costly global fossil fuel prices from electricity produced by cheaper renewables, a step to help ensure consumers are seeing cheaper prices as a result of lower-cost clean energy sources



Under the current system, gas prices often end up setting the wholesale electricity price, because it is often the last source of supply to meet demand. The ever-increasing participation of renewables in the system means over time, cheaper electricity produced by renewables energy will determine the price more often. This consultation will explore ways of updating this pricing system to further reflect the rise in cheaper renewable electricity - something that could have a direct impact on reducing energy costs, ensuring consumers reap the full benefits of the UK's world-leading and abundant supply of cheaper, cleaner energy.

Indian Case

The retail electricity market in India comprises power distribution companies and end-user consumers of electricity, other than those who procure power from the open-access market. The retail electricity market structure is akin to a near-monopoly in India as respective regulators determine retail electricity tariffs through tariff orders on a cost-plus basis. Most electricity is purchased under long-term power purchase agreements by distribution companies; therefore, the end-users of electricity are also tied through long-term contracts. DISCOMs who must supply electricity to their consumers mainly rely on supplies through these long-term contracts. As per the national tariff policy 2016, the Regulatory Authorities take the overall cost incurred by DISCOMs, including procuring power through these contracts, into account while finalizing tariff orders. Therefore, the tariff structure should be conducive to the overall development and sustainability of the electricity industry.

It may be noted that while determining tariff and the procurement cost of power, the accumulated losses of distribution companies are also considered. Predictably, this has contributed to the gradual and sustained rise in power tariff, which is reflected for all classes of consumers except agriculture (Chart 2).

While calculating Wholesale Price Index (WPI) and Consumer Price Index (CPI) for electricity, their underlying nuances are ignored. Both indices differ in terms of the type of prices samples used for estimation. The electricity prices reported in the wholesale price index (WPI) is arrived at by taking the All India Average rate of sale of power based on data collected from various power utilities (central, state, and private sector) by the Central Electricity Authority (CEA). This is different from the earlier practice of treating multiple items based on usage in various sectors such as agriculture, industry, domestic, commercial, and railways. Hence, the WPI electricity inflation moves very closely with average sale prices of power generating stations which historically includes mostly thermal power. The consumer price index (CPI), on the other hand, considers electricity tariffs paid by individual consumers and hence does not include prices paid by industries and commercial establishments. An assessment of inflation in electricity tariffs measured in terms of CPI shows that it has generally hovered below the 4 per cent inflation target set for All India CPI while also witnessing a temporary phase of deflation. Even when CPI inflation remains low, electricity inflation faced by industrial and commercial establishments can be high. This can be brought down only if the cost of electricity generation comes down and is passed on to all types of consumers, which requires settling the business right by the power distribution companies.

What is the Tariff of Electricity in India?

State	Minimum tariff (in Rs/kWh)	Maximum tariff (in Rs/kWh)
Haryana	5.85	6.35
Jammu & Kashmir	2.55	4.55
Rajasthan	5.60	6.25
Himachal Pradesh	4.70	4.60/kVAh
Gujarat	4.25	4.75
Panjab	6.57	6.71
Delhi	8.80	9.95/kVAh
Maharastra	8.93	10.39
Chandigarh	4.30	4.70
Uttarakhand	4.00	4.55

Electrical 4U

Price of Power
Tariffs for industrial consumers

	2016-17	2017-18
	(Range of tariff of different load	
Andhra Pradesh	5.25-6.14	5.44-6.33
Assam	6.85	7.5
Bihar	5.-5.3	6.1-6.2
Chhattisgarh	5.2-5.35	5.6-6.1
Odisha	4.15-4.2	4.2-4.25
Maharashtra	7.13-7.95	7.16-7.9
Gujarat	4.3	4.3
Madhya Pradesh	4.25-5.55	4.5-6
Uttarakhand	3.85	4.0
Meghalaya	5.65-5.89	6-6.5

Reforms in India

As part of the reform strategy to help facilitate savings and at the same time offering the customers the efficient price, the Indian Union power ministry has come out with a discussion paper that calls for "One Nation, One Grid, One Frequency, One Price." The full benefit of physical integration would be realizable when India transits to an optimization at the national level and a country-wide balancing area instead of the siloed self-scheduling and balancing mechanisms currently followed within state or regional boundaries. Thus, the next step in reforming electricity market operations is to implement Market Based Economic Dispatch (MBED). MBED will ensure that the cheapest generating resources across the country are despatched to meet the overall system demand and will thus be a win-win for both the distribution companies and the generators and ultimately result in an estimated annual savings in excess of INR 12,000 crores for the electricity consumers. India has a significant inter-regional power transmission capacity through its complex interconnected power grid that requires close coordination between grid operators and power project generators across coal, gas, hydro, nuclear and green energy sources run by the Centre, states, and the private sector."With significant investments over the last decade, the Indian power system has achieved larger inter-regional transfers of electricity and eliminated most constraints to realise its status as "One Nation, One Grid, One Frequency",,"

India's power market design developments
Two key mechanisms substantially improve the market

Market based economic dispatch (MBED)

Optimise power generation resources

Shift from state-level resource pool to central clearing Mechanism

Impact could reduce annual power procurement costs by $1.6 billion

Frequency control ancillary services (FCAS)

Maintain grid frequency close to 50Hz, within allowable band

Provide price signal for batteries / PHS to provide important grid services

Will relieve congestion in transmission network and support grid stability