

Prosumers in India's Future Grid: Challenges and Opportunities

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Old Grid vs. Future Grid

- Old Grid
 - Over-engineer to ensure supply is always equal to (rather, greater than) demand
 - Demand was the uncertainty
- Future Grid
 - Now, supply is itself variable
 - Options are
 - Over-engineer more?
 - Make demand CONTROLLED VARIABLE to match supply
 - Load shed more (bad idea)

How do consumers engage?

- Their bill?
- Their supply
 - Quantity
 - Quality
- What *can* they do?
 - Change their demand?
 - Short run - operations
 - Long run – capital stock
 - Change their supplier?

A Sample Bill

- What info does it convey?
 - Everything statutory!
- Is it nudging energy saving?
- Is it educating?

ರಿಯಾಯಿತಿ/ Rebates, TOD charges
 ಪವರ್ ಫ್ಯಾಕ್ಟರ್ ದಂಡ / PF Penalty
 ದ.ಲೋ. ದಂಡ / Ex.Load/MD Penalty: (140039)
 ಒಟ್ಟು / Interest
 ಇತರ / Others MSC4EH
 ತೆರಿಗೆ / Tax : 95
 ಒಟ್ಟು ಬಿಲ್ ಮೊತ್ತ / Current Bill Amt.: 1

ಬಾಕಿ / Arrears
 M/s Pebble Bay Developers Pvt Ltd, NO
 19, 1ST STAGE, SANJAY NA
 BANGALORE
 ಸರ್ಕಾರಿ ಸಹಾಯ / Govt Subsidy:
 ಪಾವತಿಸಬೇಕಾದ ಮೊತ್ತ / Net Amt. Due
 ಪಾವತಿ ಕಡೆ ದಿನಾಂಕ / Due Date 0.00HP+5.00KW
 12/09/16-12/10/16
 12/10/16
 9578087000-12/10/2016
 9578087573

ಬಿಂಗಳೂರು ವಿದ್ಯುತ್ ಸರಬರಾಜು ಕಂಪನಿ ನಿಯಮಿತ
 O/O Asst. Exe. Engr. 17161 Sub Divn.
 ವಿದ್ಯುತ್ ಬಿಲ್ / ELECTRICITY BILL
 565
 ಆರ್.ಆರ್.ಸಂಖ್ಯೆ / RR Number:
 ಖಾತೆ ಸಂಖ್ಯೆ / Account ID :
 ಮಾ.ನಿ. ಸಂಖ್ಯೆ/Mtr. Rdr. Code :

ಹೆಸರು ಮತ್ತು ವಿಳಾಸ / Name and Address		
1.00	30.00	30.00
4.00	40.00	160.00

ಜಕಾತಿ / Tariff :
 ಮಂ. 30.00 Sanct. Load 3.00 90.00
 ಬಿಲ್ ಪರಿಧಿ / Billing Period 4.40 308.00
 ರೀಡಿಂಗ್ ದಿನಾಂಕ / Reading Date 5.90 590.00
 ಬಿಲ್ 565 / Bill Number 0.90 2518.50
 ಮೀಟರ್ ಸಂಖ್ಯೆ / Meter Sl. No. : 0.00 0.00
 ಇಂದಿನ ಮಾಪನ / Pres. Rdg. : 0.00 0.00
 ಹಿಂದಿನ ಮಾಪನ / Prev. Rdg. : 0.00 0.00
 ಮಾಪನ ಸ್ಥಿರಾಂಕ / Constant : 0.00 0.00
 ಬಳಕೆ / Consumption : 210.39
 ಸರಾಸರಿ / Average : 3906.85
 ದಾಖಲಿತ ಬೇಡಿಕೆ/Recorded MD:
 ಪವರ್ ಫ್ಯಾಕ್ಟರ್ / Power Factor: 0.00 0.00
 ನಿಗದಿತ ಶುಲ್ಕ / Fixed Charges (Unit, Rate, Amount)

3907.00
 26/10/2016
 95780870003907
 12/10/2016 16.04

A "better" bill (more info)

- What's the main difference?
 - WHERE does this come from
- Lots of small things that matter
 - 107 days of billing!
- Let's also worry about
 - TMI (complexity)
 - Cybersecurity/Privacy


DAKSHIN HARYANA BIJLI VITRAN NIGAM
 (A Govt. of Haryana Undertaking)
 Website: www.dhbvn.org.in
Electricity Bill
(62)

Customer's Name		Old Account No. 12226GD1TUL60191		Account No. 97	
Address C-20 GAIL 30 R, IND		Mobile No.		Net Payable Amount(₹) 5859.00	
Email		Bill No. 973011303033		Date of Issue 08/08/17	
CIN No.		Date of Issue		Due Date for Payment 25/08/17	
SubDivision G26-South City		Cycle/Group ANR2/GD1		Bill Month JUL/2017	
Division SUB URBAN GURUGRAM		Net Payable Amount in words Five thousand eight hundred fifty-nine rupees onl			
Circle GURUGRAM CIRCLE-2		Y			

Meter and Read Details (* Latest MCO is shown in case of multiple MCO in one billing cycle)													
Meter No.	Meter Reading Date		Prd Days	MDI	Unit	Meter Reading		M. F.	Units Consumed	Units Billed	Bill Basis	Read Rmrk	Mtr Status
	Old	New				Old	New						
6433293	18/04/17	03/08/17	107	0	KWH	6699	7718	1	1019	1019	OK	OK	A

Time of Day (TOD) Consumption (* Only KVAh TODs are displayed)							
TOD	22:00-05:30	05:30-08:00	08:00-18:00	18:00-18:30	18:30-19:00	19:00-21:00	21:00-22:00
Old Reading							
New Reading							
Consumption							

Details of Meter Existing on Date of Reading					
Meter No	Meter Make/Manufacturer	MCO	Meter No	Meter Make/Manufacturer	
Meter CT Ratio	Meter PT Ratio	Meter MF	Date of MCO	Meter CT Ratio	Meter PT Ratio
Installed CT Ratio	Installed PT Ratio	Overall MF	Date of Meter Change	Installed CT Ratio	Installed PT Ratio

Arrears Outstanding for the Financial Year (₹)				Slab Calculation			Connection Details	
Description	Previous	Current	Total (₹)	Unit	Rate	Amount (₹)	Tariff Category/ No. of Flats	
Fixed Charges	0.00	0.00	0.00				DS/D	
S.O.P Charges	0.00	0.00	0.00	365.00	4.50	1642.50	Supply / Metering Vol. (kV)	23KV
F S A	0.00	0.00	0.00				Sanctioned Load (kW)	4.00
Surcharge (LPS)	0.00	0.00	0.00	243.00	5.00	1215.00	Contract Demand (kVA)	
Electricity Duty	0.00	0.00	0.00				MMC (₹)	2756.00
Municipal Tax	0.00	0.00	0.00				PLERs Exemption (%)	
Excess Credit	0.00	-0.22	-0.22				Consumer Security (₹)	2000.00
Total Arrear	0.00	-0.22	-0.22				Meter Security (₹)	0.00
							Meter Ownership / Type	NM/1-PH-MTR

Details of Charges for Current Cycle				Details of Amount Payable		Last Payment Details	
Description	Amount (₹)	Description	Amount (₹)	Amount(₹)	2288.00	Amount(₹)	2288.00
Fixed Charge	0.00	Current Cycle Charge	5859.27	Receipt No	973016007552		
Energy Charge	10000.80	Arrears/Outstanding Dues	-0.22	Date of Payment	23/05/17		
MMC/FC (Re Connection)	0.00	Sundry Charges/Allowances	0.22/-0.22	Mode of Payment	Cheque		
Amount to Cover MMC	0.00	Provisional Adjustment/BR Adj.	0.00				
Low Voltage Surcharge	0.00	Delayed Surcharge Adj.	0.00				
Steel Furnace Surcharge	0.00	Other Non Energy Charges	0.00				
Fuel Surcharge Adjustment	1269.36	Net Payable Amount	5859.00	Bill month	May-17	Units (KWH)	420
Reliability Charge	0.00	Due Date for Payment	25/08/17	Jun-17	479	Units (KVAH)	0
Excess Load Surcharge	0.00	Delayed Payment Surcharge	171.00	Jul-17	433	MDI	0
Capacitor Surcharge	0.00	Amount Payable after Due Date	6030.00	Aug-17	0	Status	OK
PL Exemption Charge	0.00	Brief detail of Sundry Charges/Allowances		Sep-16	580		OK
PL Violation Charge	0.00			Oct-16	869		OK
Penalty for Exceeding CD	0.00			Nov-16	636		OK
Meter Service Charge	142.68	Transfer Adjustment from Pre-Payment					
Line Service Charge	0.00	Transfer Adjustment from Pre-Payment					
Capacitor Service Charge	0.00						
Electricity Duty	101.90						
Municipal Tax	101.90						
Court Stay amount	0.00						
Woman Rebate	0.00						
Solar Rebate	0.00/0.00						
Total Current Cycle Charge	5859.27						

अति आवश्यक सूचना
 आपसे यह प्रार्थना है कि इस बिल की अद्यतनी बिल में दी गई देय तिथि तक कर दें।
 ऐसे न होने पर अविनियम 2003 की धारा 56 के अधीन नोटिस समझा जाए और आपका
 कनेक्शन बंदित देय तिथि के 15 दिनों के पश्चात काट दिया जाएगा और तब तक नहीं
 लगाया जाएगा जब तक कि इस बिल में दी हुई देय तिथि और निगम के प्रकाश की सूची
 के अनुसार बिजली के कटने और लगाने पर निगम द्वारा किए गए खर्च का सुमान
 नहीं किया जाता। अगले बिल बनने तक अगर पिछले बिल की अद्यतनी नहीं हुई व
 कनेक्शन भी न कटा हो तो अगला बिल लाल रंग का भेजा जाएगा और बिल तिथि
 का सुमान देय तिथि तक न होने पर बिना किसी अन्य नोटिस के कनेक्शन को
 काट दिया जाएगा।

SD0 G26-South City, -DHBVN
 Cheque/DD to be Drawn in Favour of :

Do you believe in the “Prius Effect”?

- US Dept. of Energy cited the value of information displays to guide behavior
- 2 problems
 - Many behaviors regressed back after a short time
 - Could “information” alone save money?
[SENSE, THINK, ACT]
 - Priuses (?Prii) have a hybrid drivetrain
 - Early designs called for an “in-home display”
 - We don’t necessarily need those any more

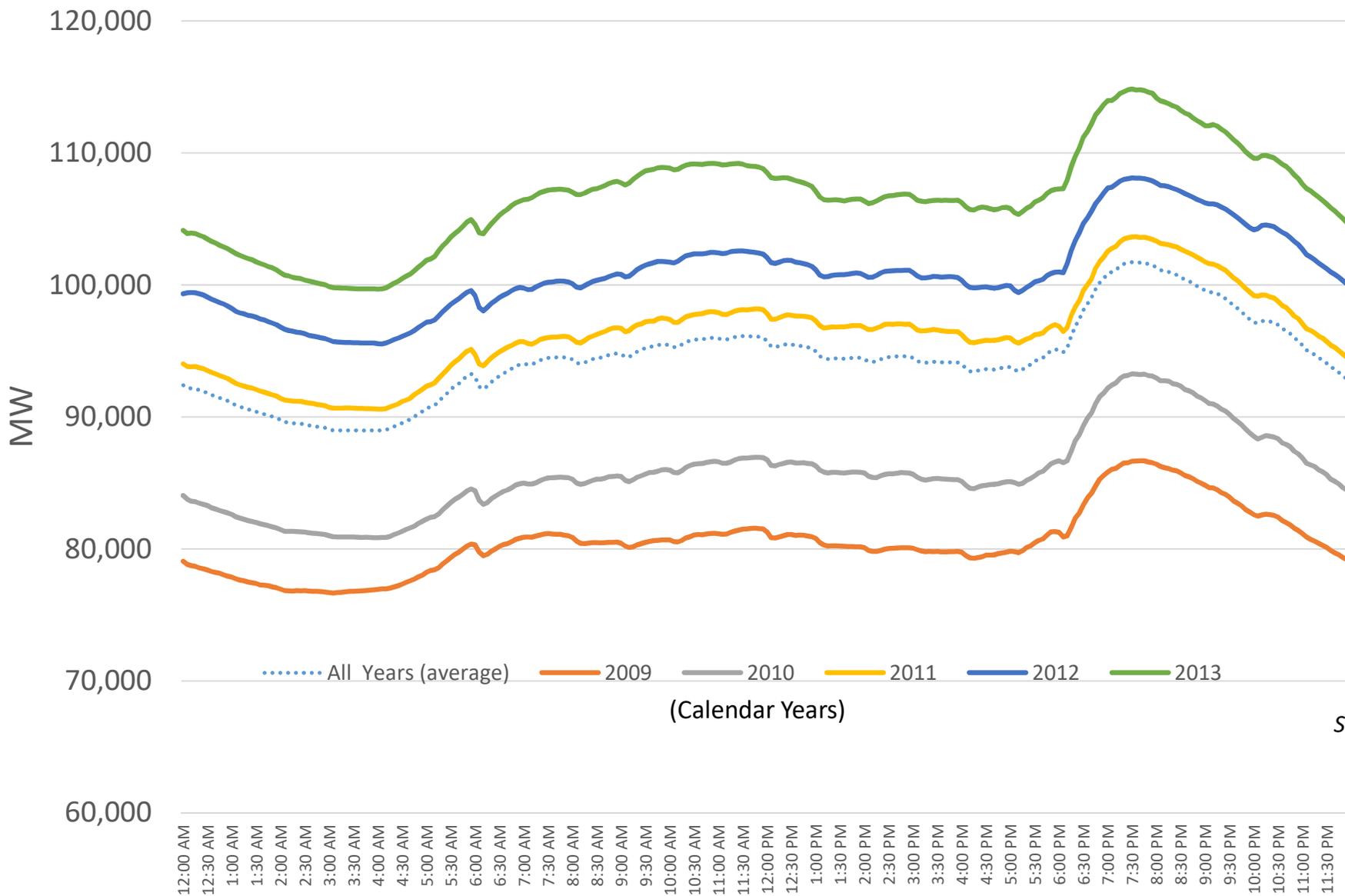
Is a prosumer **ONLY** someone with a Rooftop solar?

- What other modes are there?
 - Thermal storage and time shifting
 - Physical storage and time shifting
 - Other Demand Response
 - EVs
 - A battery?
 - A diesel generator?
- A big chunk of load can be modified
 - Price signal [retail ToD]
 - Control signal
 - Hybrid models (?)

3 Things Consumers Need for “Smart Appliances” and Smart Loads

- Convenience
 - Plug-and-play
 - No lock-in
- Incentives
 - Else, why bother shifting a load
- Control
 - If I want to take a warm shower, I WILL (utility should not control my hot water)

Avg. Daily Load Curve: All India Electricity Supply



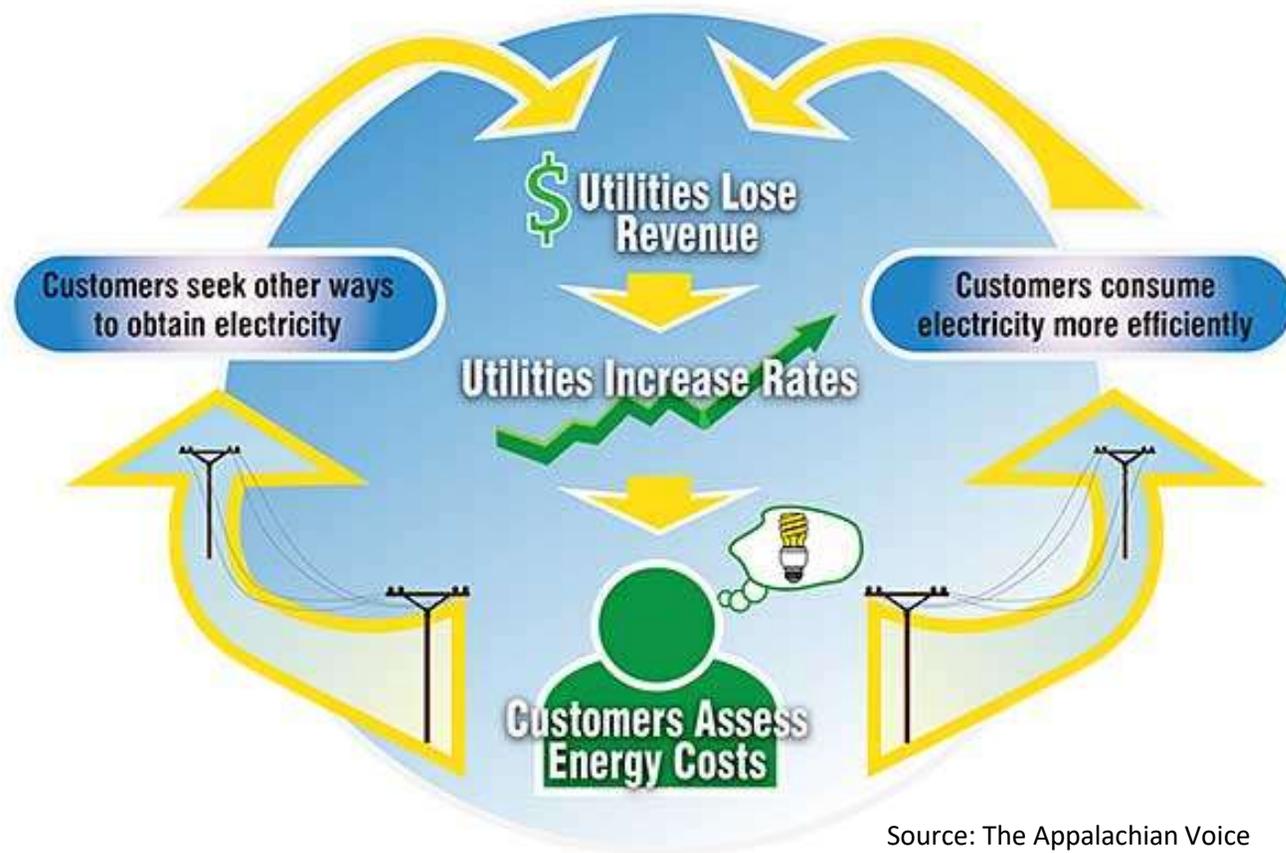
(Calendar Years)

Source: NLDC data

What's one difference between DR and DSM?

- Saving energy vs. saving it at the right time
 - Can we value it differently than “marginal bill” (equiv. to one flavor of net metering)
- Does a utility (discom) benefit if a C&I consumer reduces their off-peak consumption?
- WHO will be the first to go for rooftop PV?

India is (luckily) not YET the West



For India, it's not renewables but theft and tiered slabs (tariffs) that can have similar impacts

Utility Death Spiral

Where are we relating to the Utility Death Spiral?

- Per one study (Prayas) half the units sold in Maharashtra are more expensive than solar
- BUT is it right to compare wholesale with retail?
 - Tariff distortions exacerbate the pressures
- Many policies support RE vis-à-vis other generation
 - CSS waivers, free banking, no wheeling charges, etc.
 - A (new) push to ask thermal to cycle down to 55% out for RE
- *Why would we ever subsidize the rich? (the “paying customers”)*

“Solutions”, rather, Evolution

- Stop treating all power the same (“Basket of Fruit”)
 - Things vary by location, time, ramping, etc.
- Better pricing signals
 - Move from PPAs to markets
 - We don’t have markets for power except a small niche
 - Reduce cross-subsidies – make any subsidies up front instead
 - Move towards marginal cost signaling [granularity is the hallmark of “smart”]
 - Part of ACS and ARR challenges

Don't underestimate the Future

- Disruptors
 - Rise of apps and digital
 - Aggregators (sounds like “uberization”)
 - Storage
 - DER
 - EVs
 - Etc.
- Total bill will not be the only marker
 - Predictability
 - Quality
 - Convenience
 - Choice

Utilities have a choice: *resist* OR *enable*

EA2003 mandated open access; is consumer RE risking similar resistance?

A Smart Future WILL work in India

- Western consumers take power for granted
 - A modified usage pattern *might* save ~\$2/month
 - “Slice of pizza smart grid syndrome” [not worth it]
- Few consumers in India take the grid for granted
- They’re already engaged (sometimes not in the best way)
 - A new system can avoid diesel, darkness, etc.
 - Air pollution is also now a big deal
- Indian consumers are savvy, responsive, and respond to price signals
- Indian IT industry is also leading edge
- *We only need to align utilities, consumers, service providers, etc. — make this a win-win-win situation, not one of tradeoffs*

The future is already here - it's just not evenly distributed

-William Gibson