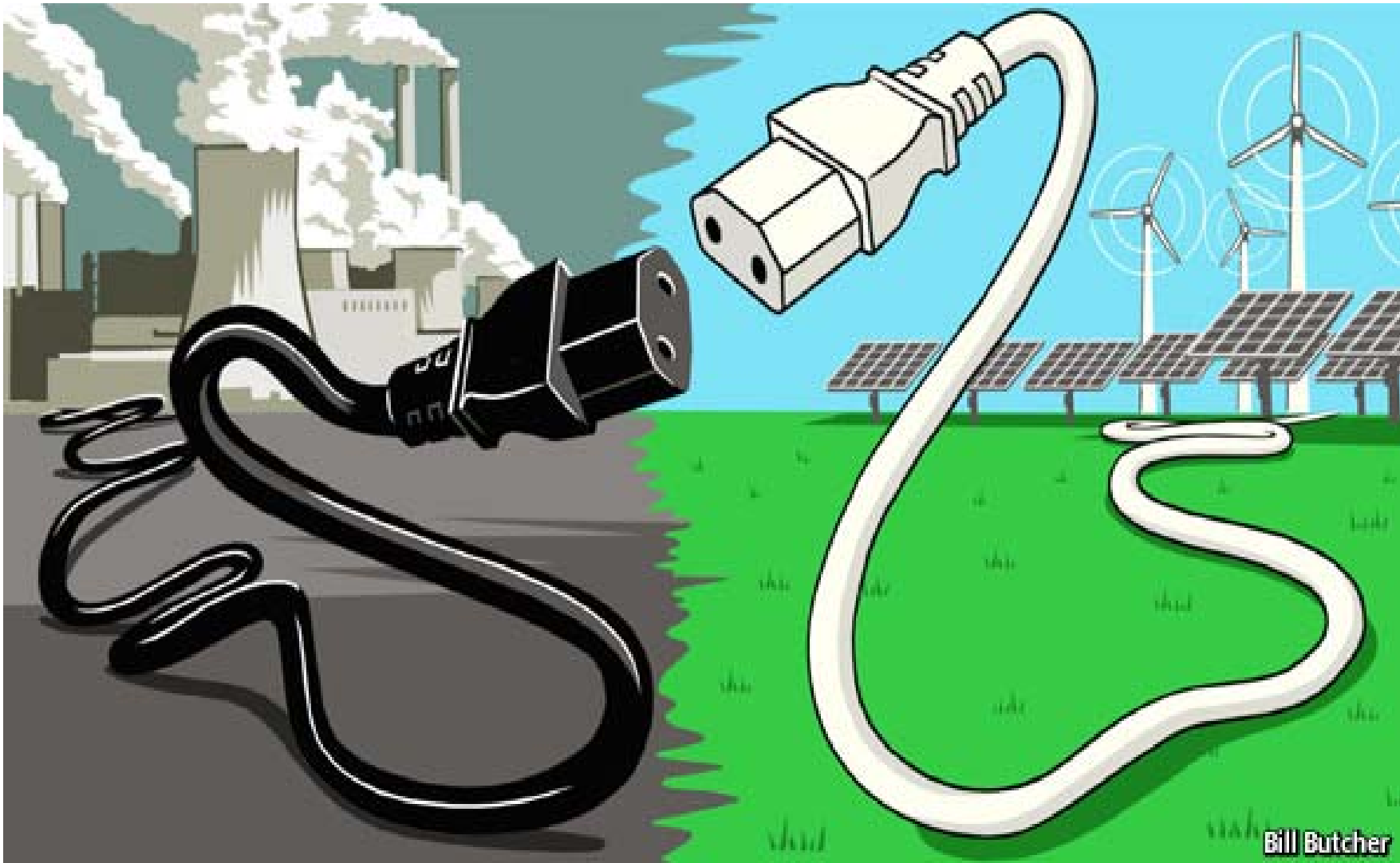


How to lose half a trillion euros



European utilities

How to lose half a trillion euros

Dim and dimmer

MSCI European utilities share price, \$ terms
Jan 2005=100



Source: Thomson Reuters

Cheaper for some

Germany's wholesale electricity price
€ per MWh

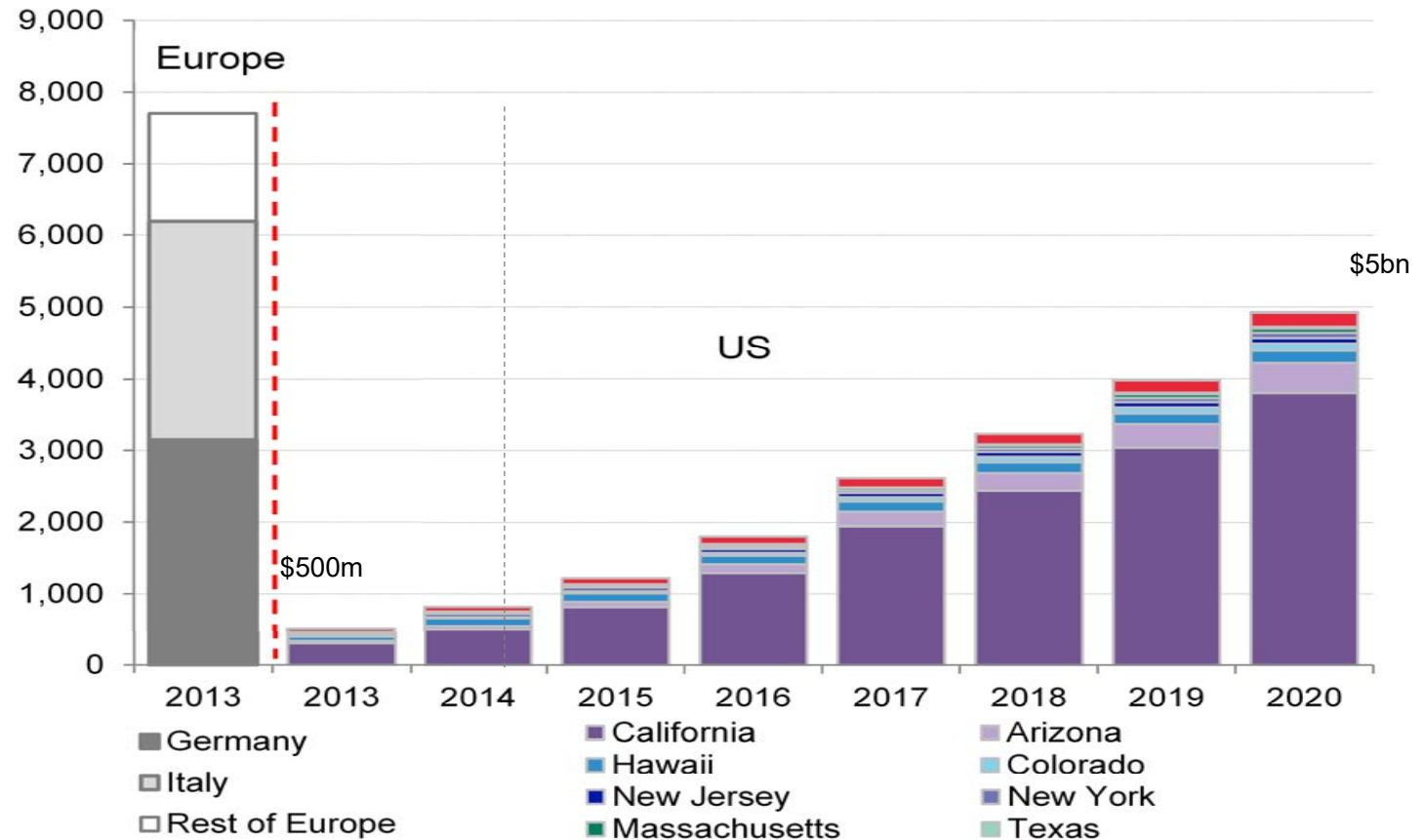


Source: Bloomberg

However, it is heavily impacting Utility's revenue

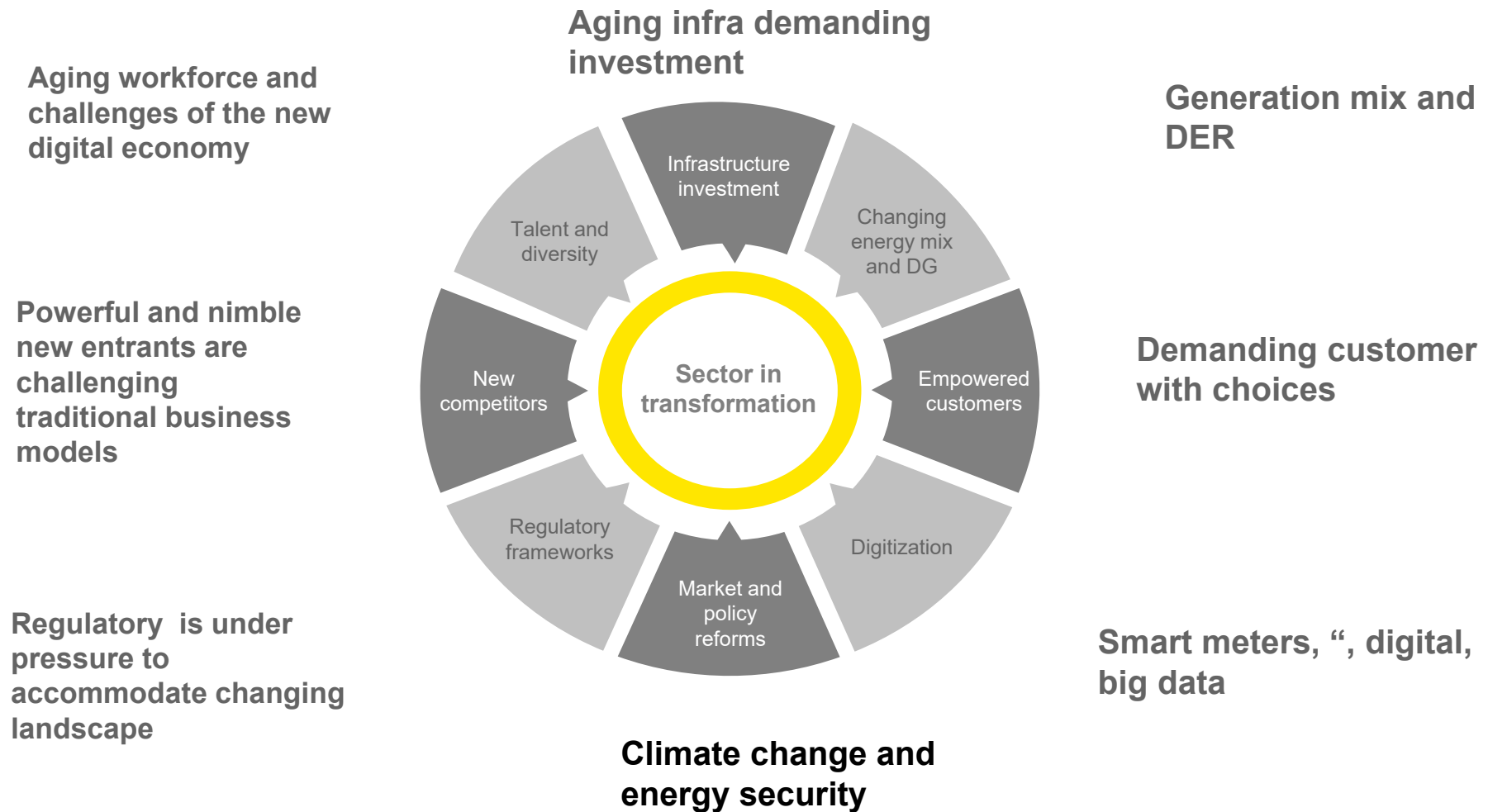
Estimated gross revenue loss to utilities from residential PV (\$m) in Europe and US

- Distributed PV eats into residential electricity sales in Europe and the US.
- European utilities have seen bigger losses.



Source: Bloomberg New Energy Finance

A number of drivers are transforming the P&U sector



Growth opportunities from traditional supply models are limited ...

31%

Drop in energy intensity in the EU28 below 1990 levels

€61b

Expected loss in sales by European utilities by 2025

50%

Loss in market value by the top 20 European utilities from 2008 to 2014

0.8%

Annual growth in electricity demand in the OECD against 2.1% worldwide

20%

EU 2020 energy efficiency, renewables and reduction in GHG emissions target

10%

Market share in generation lost by Germany's big four in 3 years

Sources: Clean Energy Wire, EIA, World Energy Outlook (WEO), Bloomberg, European Environment Agency, Navigant Research.

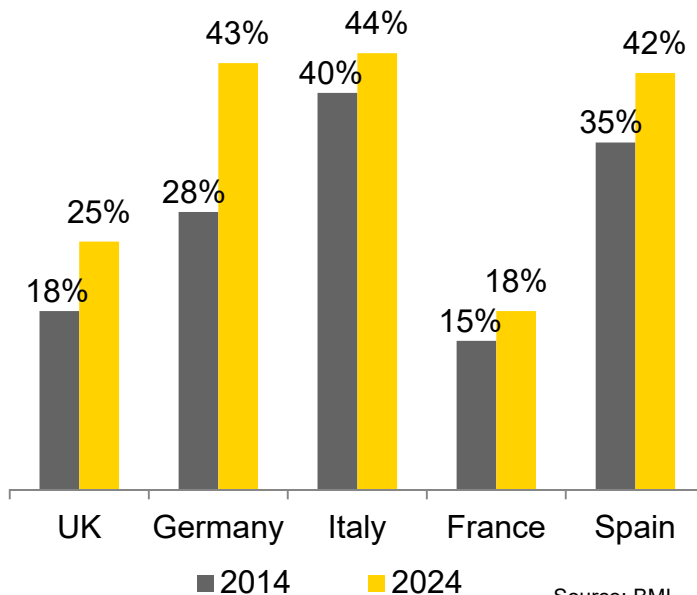
10 Sept. 2015

Changing energy markets: the future for utilities



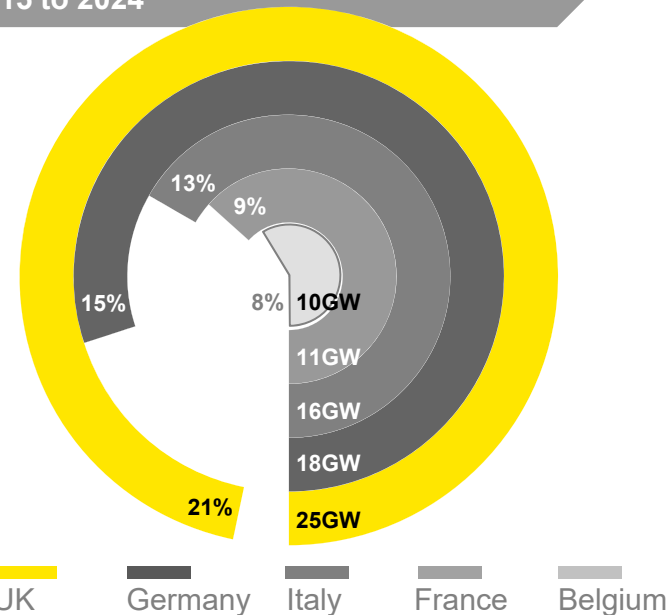
Renewables are disrupting supply models

Share of country's total generation from renewable energy sources



- ▶ Grid operators will increasingly require solutions that address system performance aspects such as voltage, frequency and system inertia.

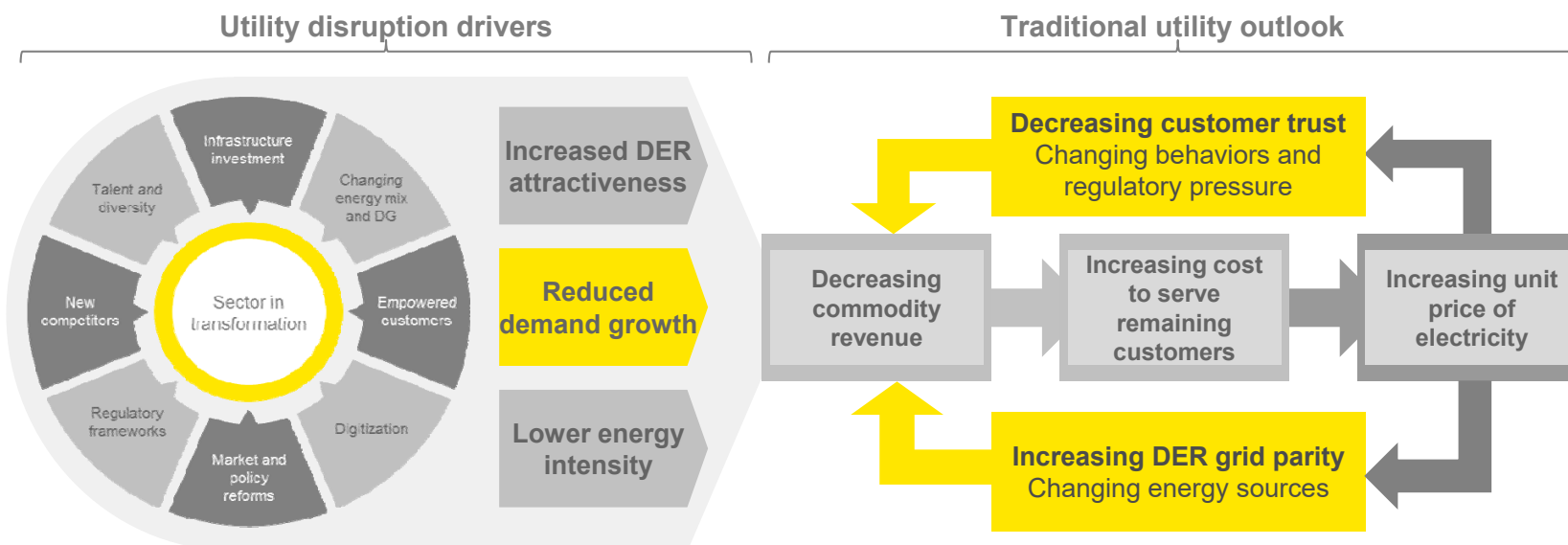
Top 5 markets by share of total installed distributed solar PV capacity in Europe, 2015 to 2024*



- ▶ Over the next 10 years, Europe is expected to install around 153GW of solar PV capacity, of which 118GW, will be distributed solar PV.



Without action, the viability of the utility business model will continue to erode



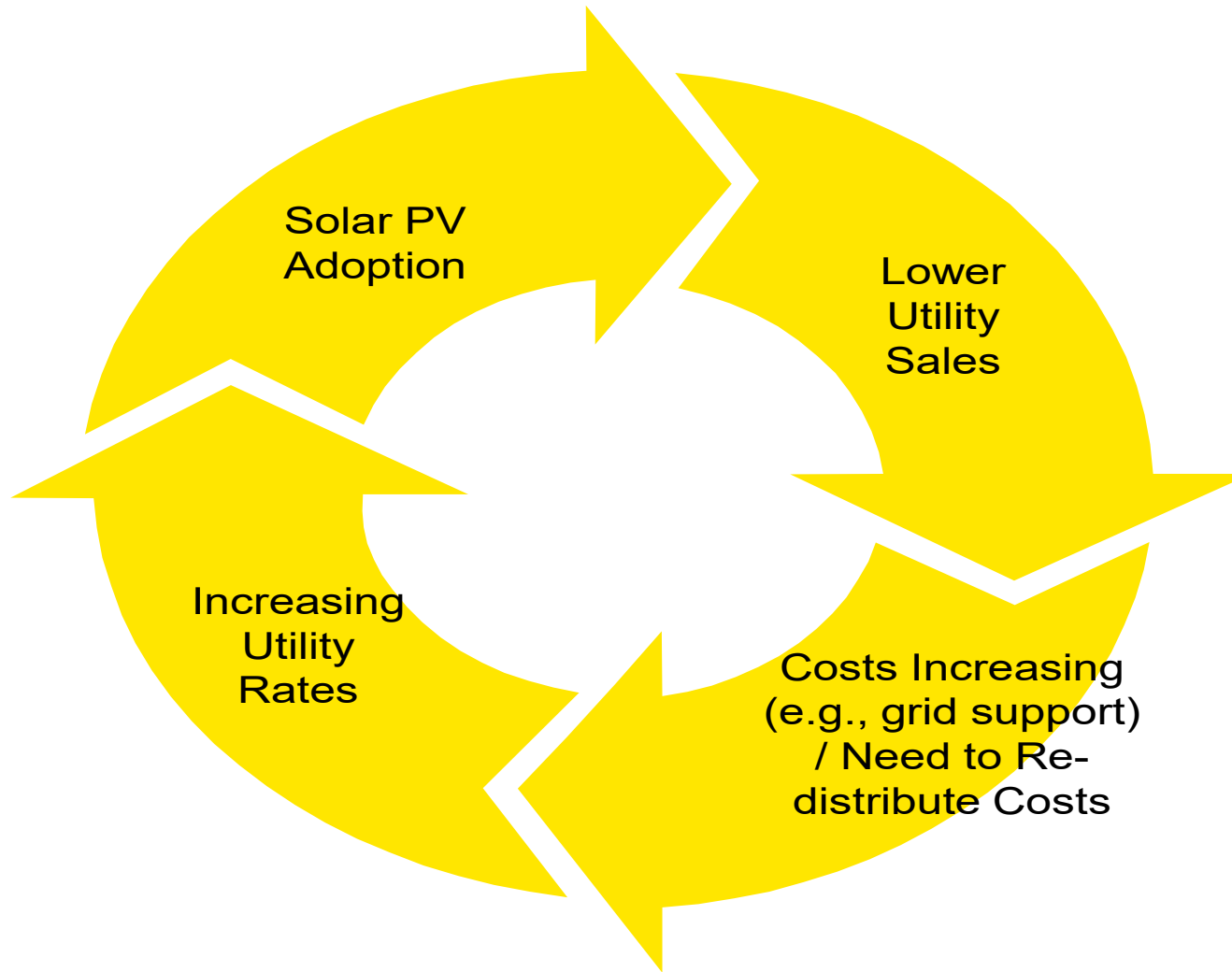
Utility disruption drivers	
▶	Technology innovation decreasing prices of solar, wind and storage strengthening attractiveness of DER.
▶	Slower economic and population growth reducing load and customer base growth.
▶	Sustainability targets and greater energy efficiency decreasing energy intensity and consumption per customer.

Traditional utility outlook	
▶	Demand for centrally generated energy falling with more customers generating their own electricity.
▶	Cost of building and maintaining depreciating generation and T&D assets increasing as replacement and upgrade fixed costs are spread across less customers.
▶	Utilities seeking continuous rate increases to remain viable, increasing customer distrust and DER grid parity, spurring demand for alternative sources of energy

Sources: EEI, EY Analysis



The death Spiral





Megatrends: disruption in the power and utilities sector - solar plus storage

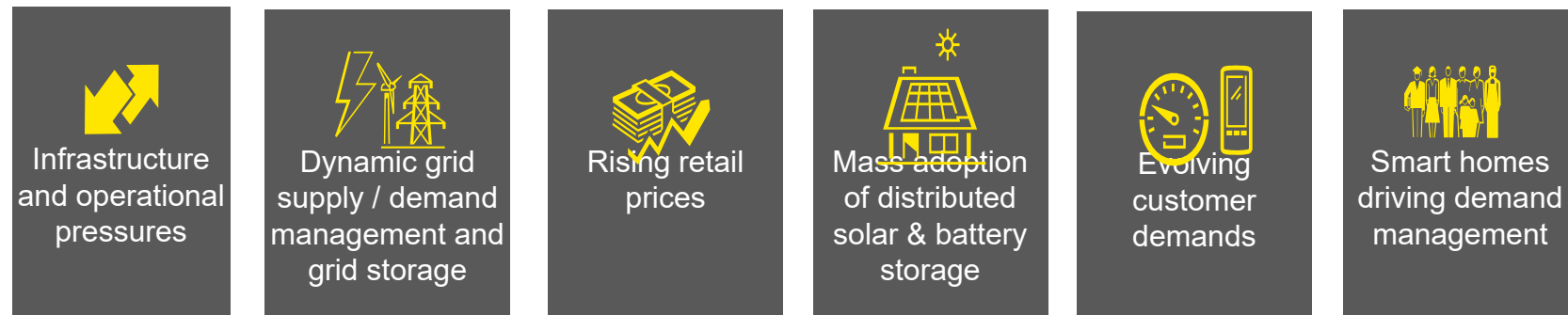
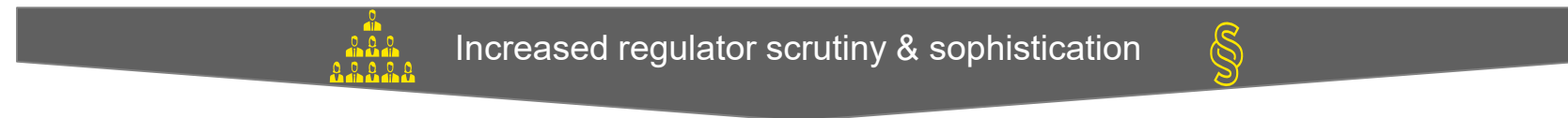
2015 Asia-Pacific Partners' Conference

Transformation is occurring across the P&U value chain with increasing speed

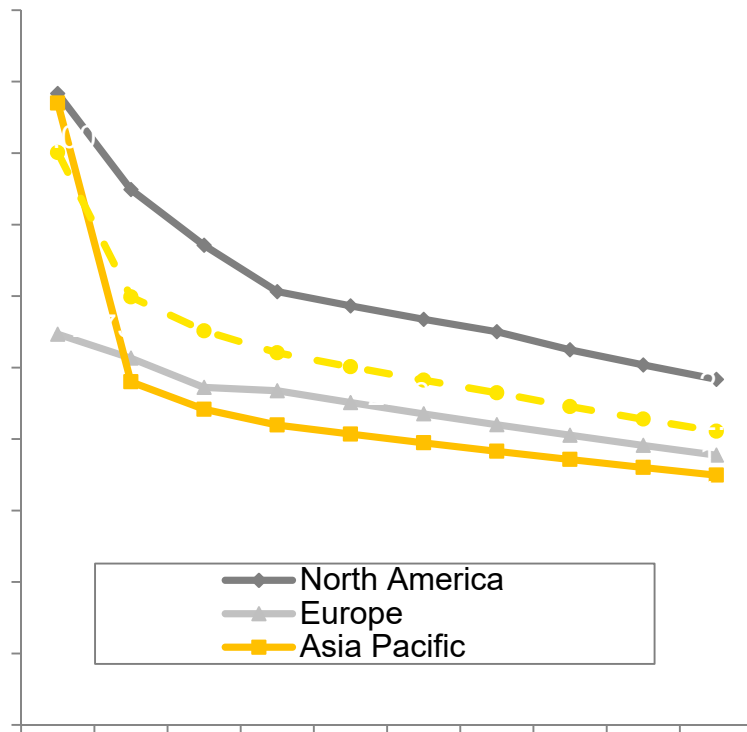
- ▶ Utilities in mature markets will need to manage risk as disruption drives value downstream toward the customer



- ▶ Utilities in emerging markets need to balance affordable and reliable energy access against growing sustainability concerns



The commodification of distributed solar PV is well underway...



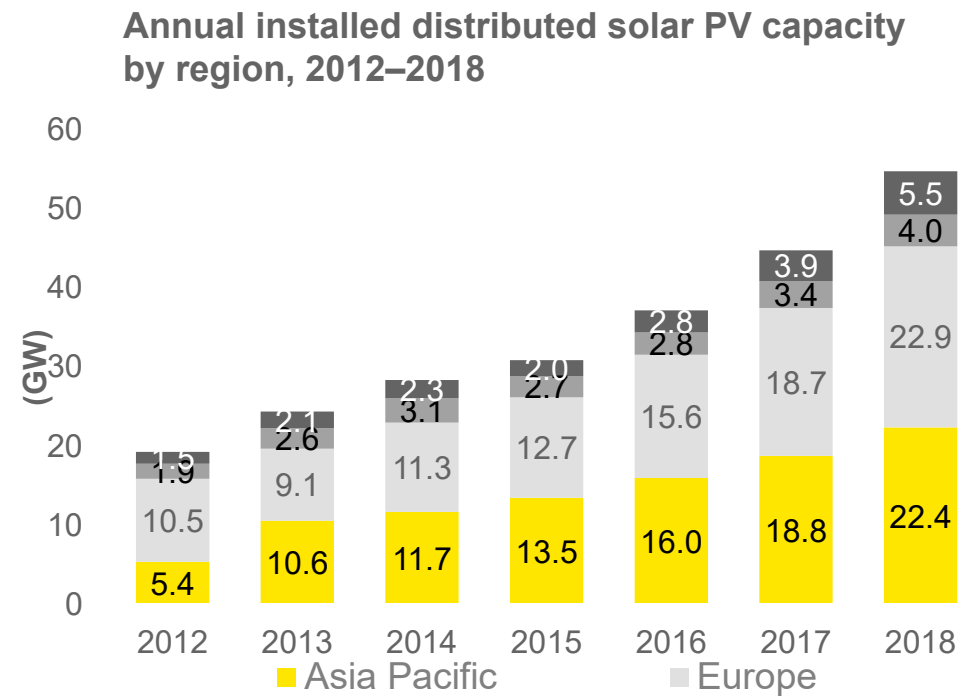
37%: decline in global average PV installation cost since 2011

53%: decline in Asia Pac average PV installation cost since 2011

14%: Expected decline in Asia Pac average PV installation cost over next 5 years

... with continued growth in installations expected globally

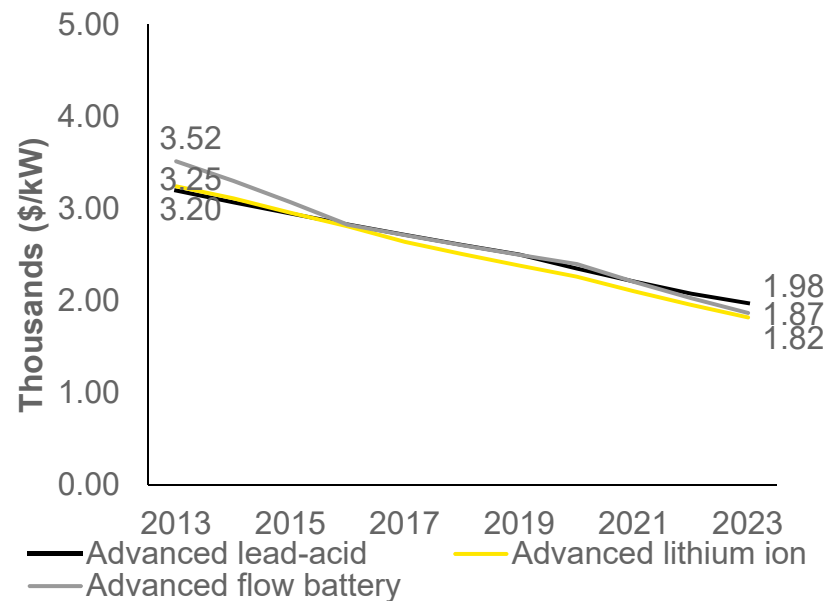
- ▶ Asia Pacific has become the market leader for installed distributed solar PV followed closely by Europe
- ▶ Asia Pacific is experiencing doubling its annual installations of distributed solar PV between 2013 and 2018



Source: Navigant Research

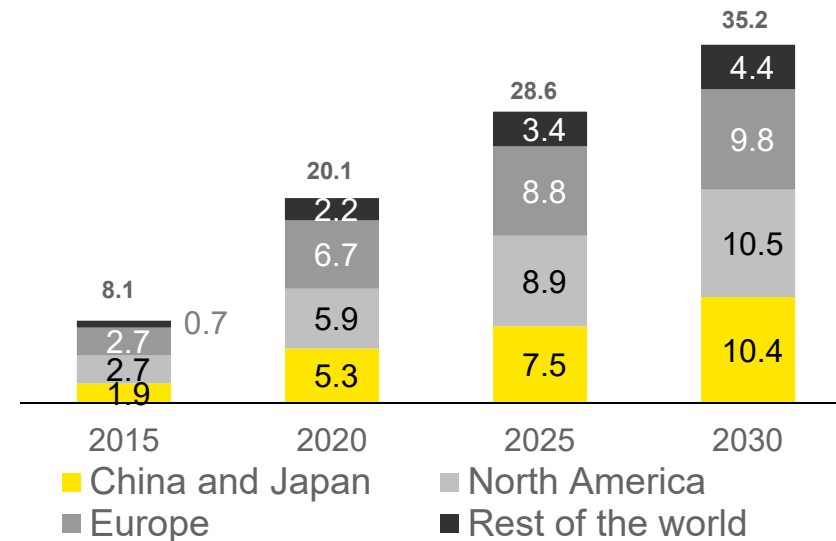
Improving economics for advanced batteries will accelerate energy storage applications ...

Installed energy storage cost for renewable integration, by technology



Source: Navigant Research

Projected annual sales of storage technologies (US\$b)

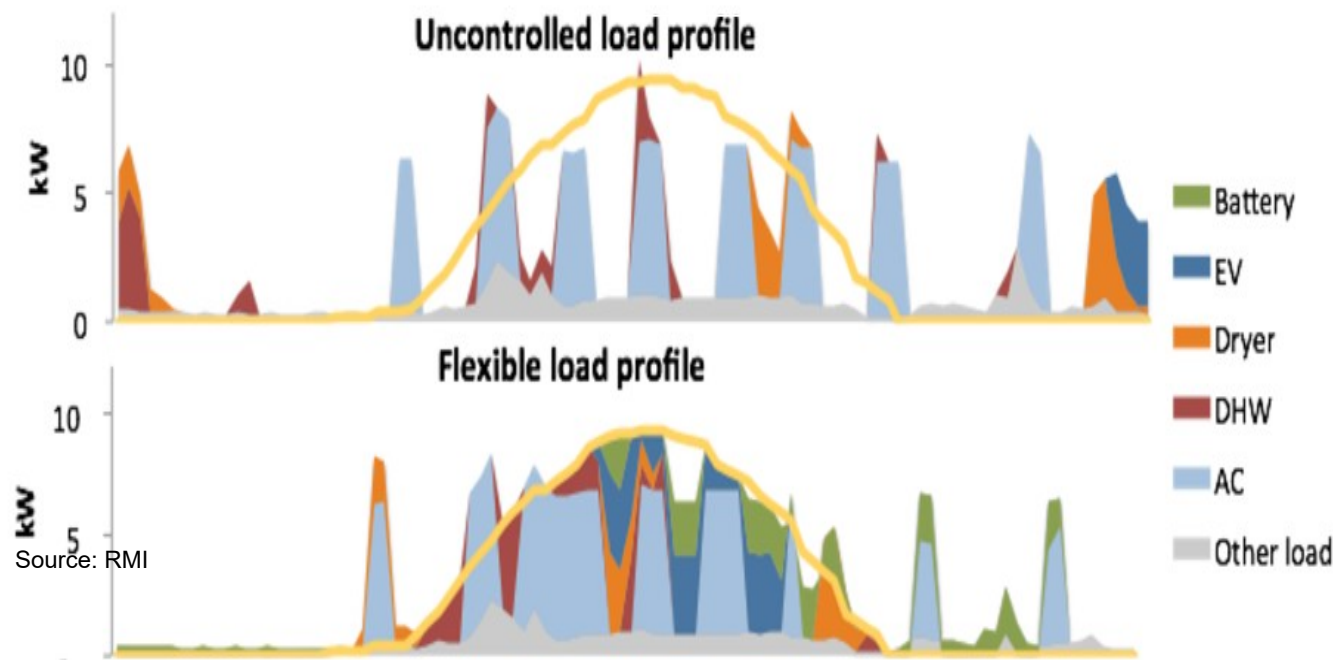


Source: BCG perspective



... which will magnify the value of solar PV in terms of reliability and resilience ...

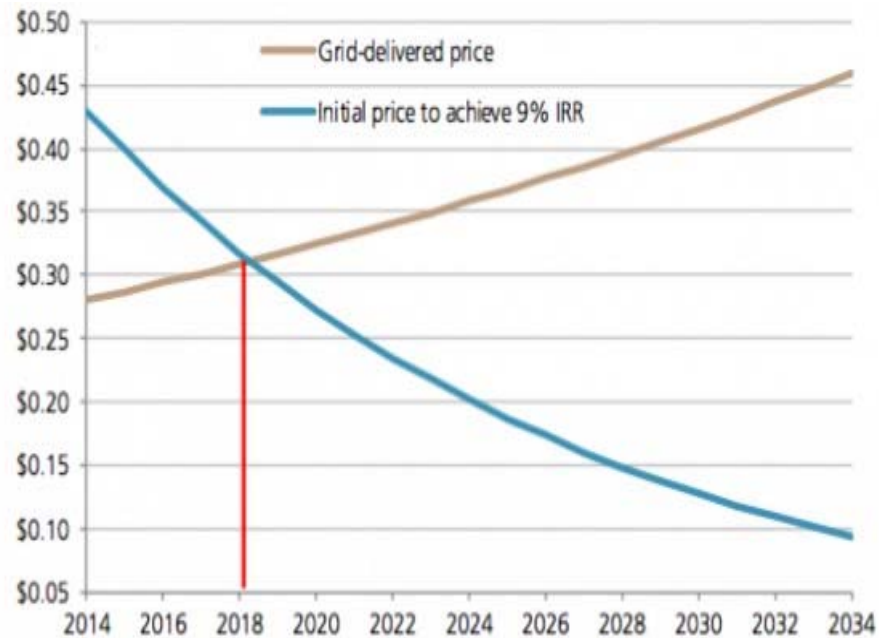
- ▶ When coupled with storage, the value of solar energy is magnified: It can be stored and then discharged during time periods most advantageous to asset owner.
- ▶ These same storage systems can also offer resiliency benefits when the larger grid goes down.



- ▶ In the top chart; only 50% of PV energy is consumed on site.
- ▶ In the bottom chart, 90% of PV energy is consumed on site
 - ▶ loads are orchestrated to operate during hours of PV production.
 - ▶ batteries are used to consume even more of that PV when the sun isn't shining.

... making going 'off grid' an increasingly viable option ...

Australia, cost of off-grid energy supply compared to grid (\$kWh)*



Source: UBS

* Assumes off-grid capex cost falls 5% p.a.

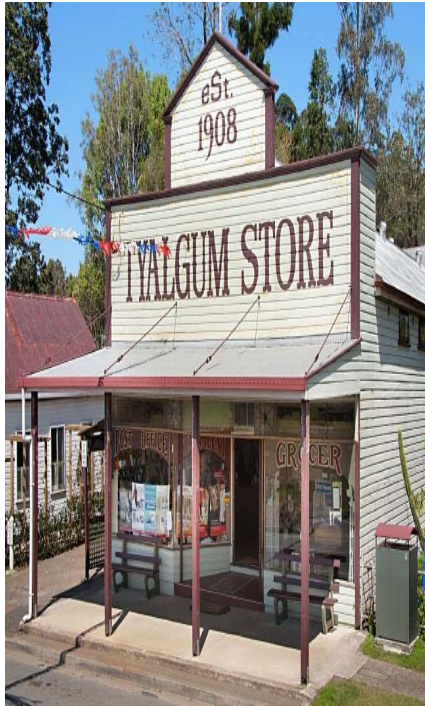
** Source: Rocky Mountain Institute

- ▶ By 2018 the costs of off-grid energy supply from solar PV plus storage will become cost-competitive with Australian households that stay connected to the grid.
- ▶ By 2020, other mature markets including New York and Los Angeles are expected to follow.**
- ▶ Batteries will lead to a further decline in grid demand and make disconnection from the grid feasible for many users.
- ▶ Step change developments in technology (such as aluminium batteries) could accelerate this trend.
- ▶ Regulators will push the adoption of storage to curb network operators spending excess capital on grid infrastructure.
- ▶ Removal of feed-in tariffs will further incentivise customers to go off-grid.



... for both existing utility customers ...

Case study 1: Community off-the-grid renewable energy project, Tyalgum, NSW, Australia



Source: Zen Energy

- ▶ Tyalgum, a small community of about 300 residents in north-east New South Wales wants to become Australia's first village to voluntarily disconnect from the electricity grid.
- ▶ The community is frustrated with rising energy prices and is unsatisfied with service and reliability.
- ▶ Two options the community is considering are:
 - ▶ Installation of solar panels with battery backup on individual houses
 - ▶ Collaboration and cooperation with a local entity that becomes the energy supplier for the town, with a centralized solar plus storage solution



... for both existing utility customers ...

Case study 2: Zen Energy 100% renewable energy utility provider



Source: Zen Energy

- ▶ Zen Energy, a South Australia based company will launch the country's first 100% renewable energy utility company that will use a combination of solar power generation, battery storage, and localised energy grids to create self-sustained off-grid communities.
- ▶ Zen plans to take entire communities off the grid — from social housing stock, to apartment buildings and regional communities that will buy back the power they generate at a fraction of current costs.



... and consumers that had previously represented opportunities for potential demand growth

Case study 3: Aquion Energy hybrid aqueous ion battery storage pack plus solar PV power generation, California, US.



- ▶ A 54 kWh aqueous hybrid ion battery with a 10.8 kW solar PV array at a ranch located outside the area serviced by the local utility.
- ▶ The ranch owner invested in a microgrid operation with the aim to minimize or eliminate diesel generation for daily power supply.
- ▶ The return on investment has proved to be attractive without the need for public funding.



... and consumers that had previously represented opportunities for potential demand growth

Case study 4: AllCell lithium-ion battery storage plus solar PV power generation, Angola



Source: AllCell

- ▶ Remote villages in Angola are miles away from the closest electrical transmission lines and generators are too costly to buy, maintain, and fuel.
- ▶ AllCell designed a solar lighting system composed of a 230W solar panel, 1 kWh lithium-ion battery, and sixteen 13W LED bulbs.
- ▶ The system provides enough light to illuminate four small classrooms for eight hours per night at a cost of less than \$2 per day.



Energy storage is likely to play a bigger role in the utility of the future, but in what form?

- ▶ Will it be rolled out as a merchant resource, helping residential consumers save versus retail tariffs?
- ▶ Will it be larger in scale, used to arbitrage wholesale prices?
- ▶ Or, could it be integrated into the utility grid system to allow for improved resilience and security of supply?

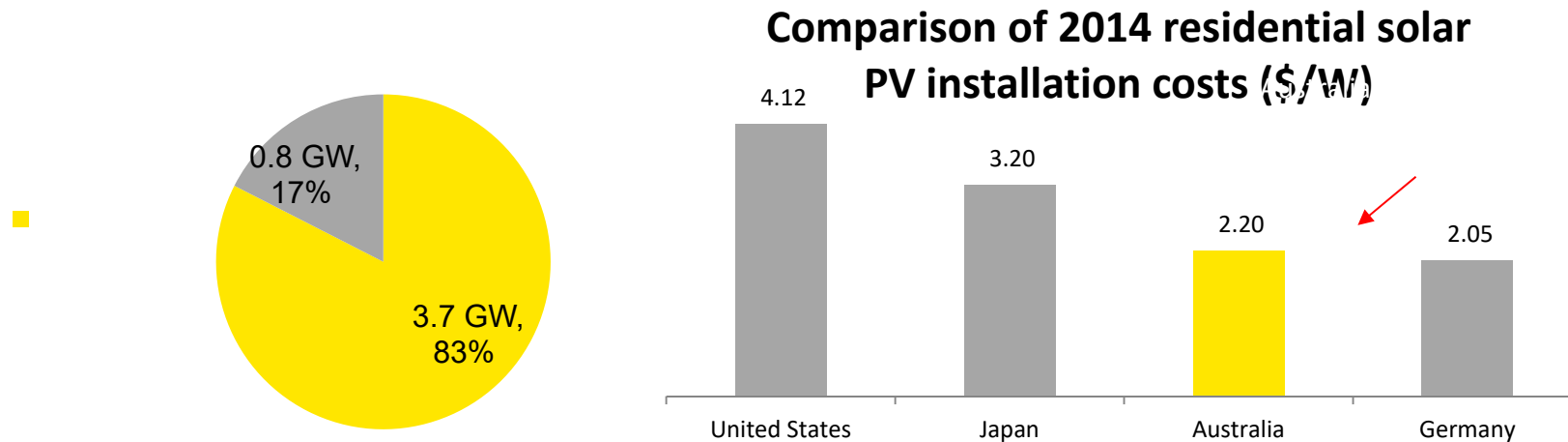




Impact on electricity businesses

Spotlight: Australia has the highest penetration of rooftop solar in the world ...

- ▶ Almost 1.5 million Australian households (around 15% of the total) have installed rooftop solar PV.



- ▶ An EY customer experience survey of Australian consumers found that:

50% considered solar but didn't install due to cost

70% installed solar to save money

90% have or would consider solar

... and is one of the world's most attractive markets for energy storage

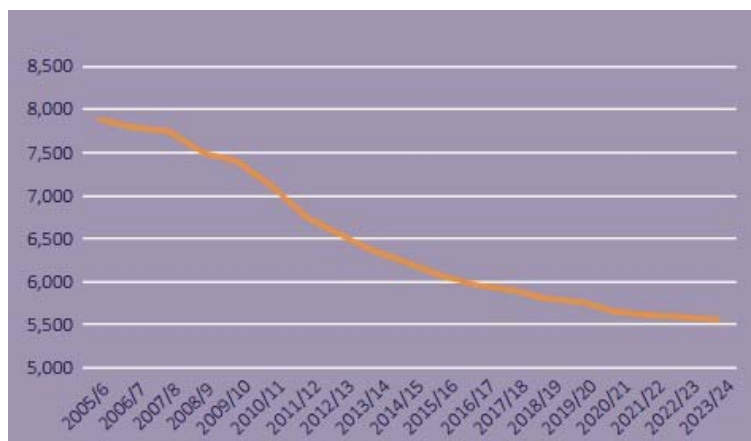
Rise in Solar PV and falling consumption

Focus on energy efficiency

Decrease in heavy industry manufacturing

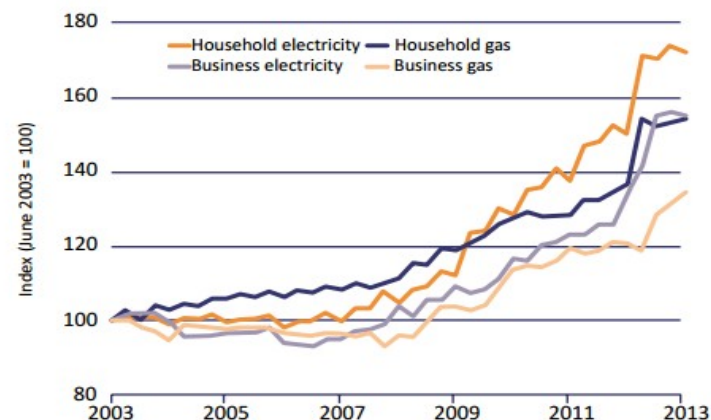
High retail electricity prices

Residential and Commercial consumption per capita NEM (kWh)



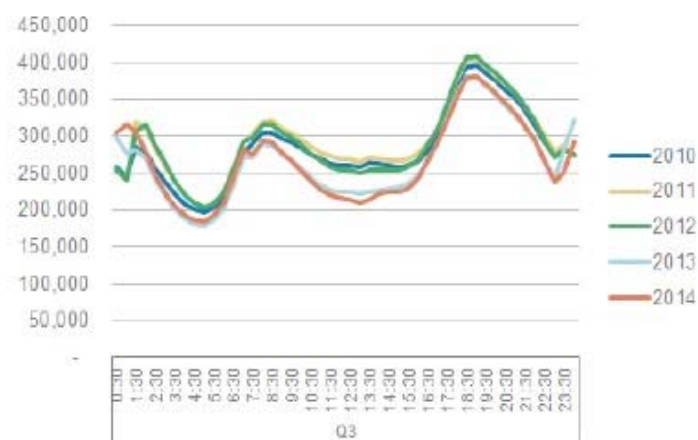
Source: AEMO

Real electricity and gas price increases, 2003 to 2013

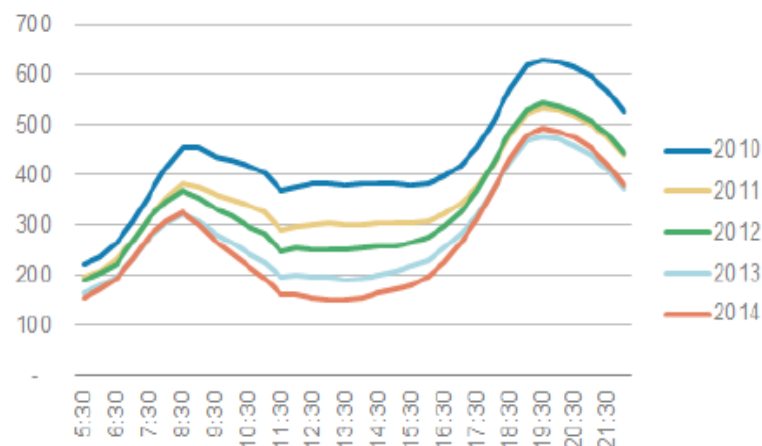


- ▶ The Australian Energy Market Operator estimates that one in four households installing solar PV is also adding energy storage.
- ▶ Australians have a strong incentive to maximize the self-consumption of solar PV generated electricity given the varying compensation received when sending surplus power back to the grid.
- ▶ Growing opposition to solar subsidies and incentives support the business case for solar PV plus energy storage.

The emerging duck: rooftop solar is capturing significant daily electricity demand ...



Ausnet's electricity distribution network in eastern Victoria (ElecD) shows some demand reduction over time due to efficiency and lower industrial activity, however, has limited hollowing out as solar penetration in the network is low at ~10.1%

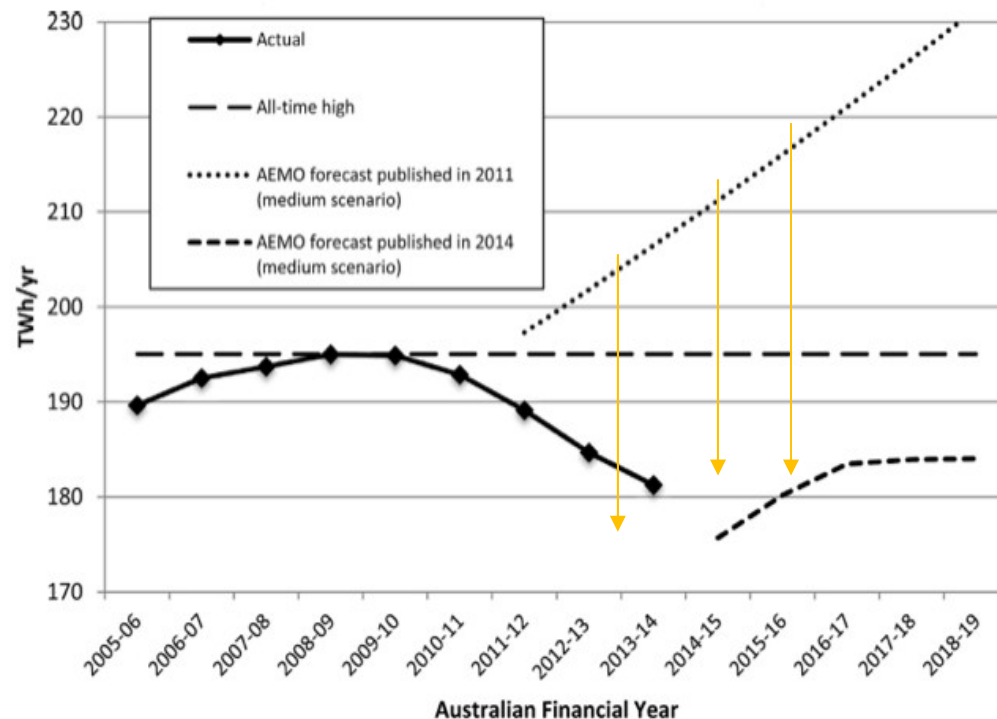


SA Power Networks shows material annual declines in demand, and a pronounced hollowing out. South Australia has ~18.3% solar penetration

- ▶ While rooftop solar has reduced overall network demand, it has not significantly reduced peak demand - battery storage has the potential to reduce peak demand and drive lower replacement and augmentation expenditure, which in turn could lead to lower RABs.
- ▶ Over 2010-2014 ElecD saw 3.2% p.a. peak demand growth and RAB growth of 9.7% p.a., versus 0.4% p.a. peak demand growth and 4.8% p.a. RAB growth for SA Power Network.

... and official forecasts have underestimated its impact on grid-served load ...

Annual consumption of grid-supplied electricity in Eastern Australia versus forecasts

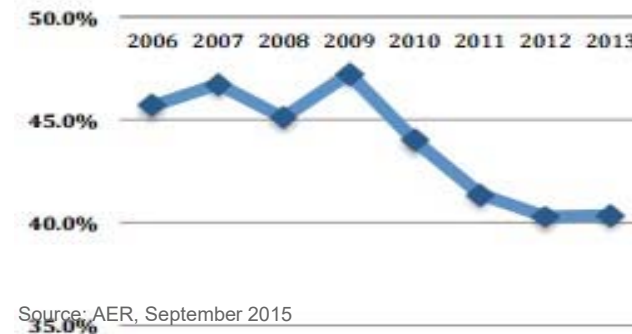
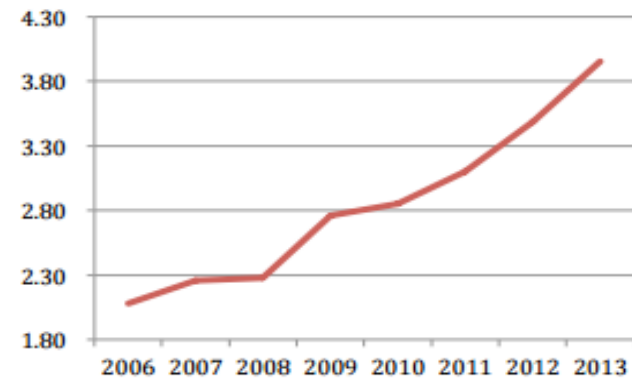


Source: National Electricity Forecast Report, 2014, AEMO, 2011

- ▶ Between 2009 and 2014, annual electricity consumption in eastern Australia declined by 7 per cent, even while the Australian economy grew by 13 per cent.
- ▶ AEMO's 2014 forecast represents a 15%-20% decline in the annual electricity consumption outlook when compared with its 2011 forecast.
- ▶ Such forecasts drive investment planning and have resulted in overcapacity, for which Australian consumers are required to pay through higher rates.

... leading to growing overcapacity in the region

- ▶ The networks' major capex programs over the previous decade have produced significant levels of excess capacity on the network.
- ▶ Higher electricity tariffs and use of energy efficiency measures are further dragging electricity demand down, thus creating significant challenges for network operators.
- ▶ Network capital intensity is declining as technology enables load flattening, reducing the need for network augmentation.
- ▶ SA Power Networks, United Energy Distribution and Powercor are some of the network operators which have the low capacity utilisation of the networks.
- ▶ Regulators are increasing scrutiny of regulatory capex proposals in the next round of resets, aided by more detailed regulatory disclosures, and benchmarking.



Source: AER, September 2015

Australian regulators are thus slashing network spending ...

- ▶ The Australian Energy Regulator (AER) argues that the level spending by networks – which has results in huge increases in bills in recent years is un-necessary and its ruling will result in significant savings by consumers
- ▶ The AER delivered its final decision on networks in NSW, Tasmania and the ACT, and also issued preliminary decisions on network spending in Queensland and South Australia, cutting their proposed budgets by around a third

Network business	Segment	Business revised proposal (\$ million)	AER final decision (\$ m)	Percentage difference	Expected bill reduction for average household 2015-20
Source: Company reports, AER	Distribution	863	591	-32%	\$112 (5.8%)
	Distribution	9,754	6,576	-33%	\$165 (8.0)%
	Distribution	4,441	3,183	-28%	\$106 (5.3%)
	Distribution	4,535	3,838	-15.4%	\$101
	Transmission	2,906	2,189	-25%	\$25 (1.1%) for both TransGrid and Directlink combined
	Distribution	7,874	6,600	-16.2%	\$95
	Distribution	7,798	6,295	-19.3%	\$95



Australian regulators are thus slashing network spending ...

Network business	Segment	Business revised proposal (\$ million)	AER final decision (\$ m)	Percentage difference	Expected bill reduction for average household 2015-20
ActewAGL	Distribution	863	591	-32%	\$112 (5.8%)
Ausgrid	Distribution	9,754	6,576	-33%	\$165 (8.0)%
Endeavour Energy	Distribution	4,441	3,183	-28%	\$106 (5.3%)
SA Power Networks	Distribution	4,535	3,838	-15.4%	\$101
TransGrid	Transmission	2,906	2,189	-25%	\$25 (1.1%) for both TransGrid and Directlink combined
Energex	Distribution	7,874	6,600	-16.2%	\$95
Ergon	Distribution	7,798	6,295	-19.3%	\$95

Source: Company reports, AER

... and encouraging mainstream adoption of battery storage ...

The Australian government has announced to accelerate the deployment of battery storage in households, primarily to:

- ▶ Reduce peak demand, and
- ▶ lower electricity retail tariffs

New entrants in battery storage to trigger adoption:

- ▶ One of the triggers will be the arrival of the first Tesla Powerwall products in Australia in the coming months, although several international manufacturers such as Panasonic, LG, and Kokam already have products in the market.
- ▶ Similarly, Enphase will launch its “plug and play” battery storage product. Like Tesla, Enphase is targeting Australia because of high electricity prices.

Change in tariffs to incentivise adoption:

- ▶ Households in New South Wales (NSW), Victoria and South Australia that used to receive premium tariffs will get little or no payments for exports to the grid, thus incentivising adoption of storage products.

“Australia has the highest rate of household solar in the world. This makes it an ideal place to develop storage and battery technology. Storage is also good for grids and networks – it can smooth out energy supply, reduce peak loads, and mitigate the need for network upgrades. Network operators should recognise that this is part of their responsibility of reducing the costs to rate-payers.”

**Greg Hunt,
Australia
Environment
Minister**

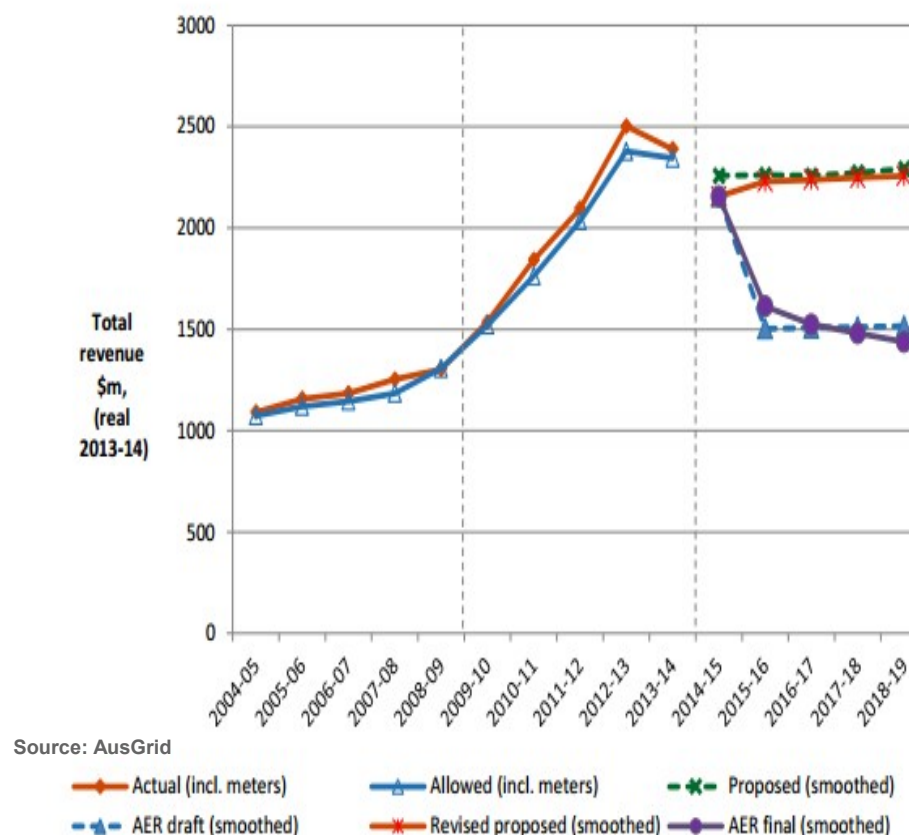


... impacting revenue allowance and valuations of network assets

Key factors impacting Ausgrid's costs in the 2015-19 regulatory period:

- ▶ a lower than expected demand growth in the previous regulatory period, which has led to falling levels of network utilisation across Ausgrid's network
- ▶ forecast demand, which is expected to remain reasonably flat over the 2015–19 regulatory control period
- ▶ an improved investment environment, which translates to lower financing costs
- ▶ Ausgrid's past expenditure that has been higher than necessary to maintain its network safely and reliably

Ausgrid's past total revenue, proposed total revenue and AER total revenue allowance – distribution and transmission (\$ million, 2013–14)



Traditional suppliers are responding by investing in rooftop solar PV ...

- ▶ In February 2015, **AGL Energy** became the first of the major electricity retailers to formally launch a solar power purchase agreement (PPA) plan, branded the Solar Smart Plan, which is being managed by a new division, New Energy.
- ▶ **Origin Energy** has launched a PPA program where it will install and maintain solar systems on residential and small business roofs in Sydney, Adelaide, Brisbane and the Gold Coast.
- ▶ **Ergon Energy** recently contracted with SunPower to offer high efficiency solar PV systems with energy storage technology from Sunverge Energy in a pilot project in Queensland.

“Our view of electricity markets has changed a little bit. We are moving very much to the evolution of solar products, and PPA (power purchase agreement) products.”

– **Origin Energy Managing Director, Grant King**

“There is a lot of talk now in the industry about viewing consumers who want access to distributed energy resources or a rooftop solar power system as lost market share. I don't see it that way. We aren't losing customers, we're just shifting how we need to compete for them and how we serve them: they're the future clients of our distributed power business.”

– **AGL Energy CEO, Andy Vesey**



... and partnering with global battery storage players rather than trying to beat them

- ▶ Australian utilities Red Energy, Ergon Energy and ActewAGL are teaming up with Japan's Panasonic to trial the deployment of household battery storage.
- ▶ In 2015, AGL became the first retailer to announce that it would be introducing a battery storage device into the Australian market.
- ▶ Battery storage companies like Tesla and Panasonic are increasingly targeting the Australian distributed energy market to capitalise on the high penetration of household solar capacity and teaming up with major utilities to deploy its battery technology - rather than selling directly to households.

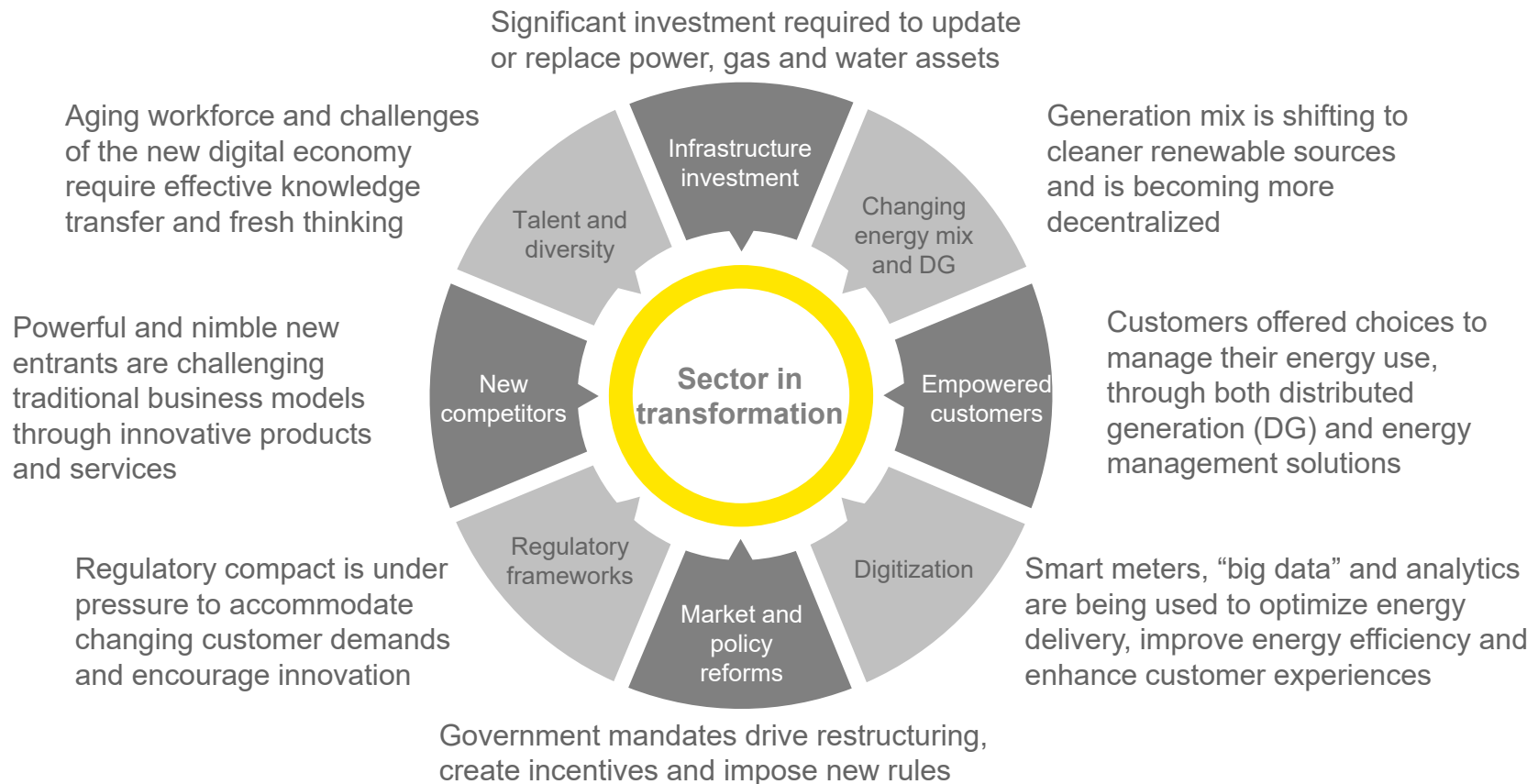
“New emerging technologies are offering exciting opportunities for customers and energy companies. We want to be part of this future and help our customers with ways to control and manage their energy.”
– **ActewAGL CEO, Michael Costello**

“Changing social trends and technological advances, particularly cost reductions in solar PV systems and now battery energy storage systems, will dramatically change – even revolutionise – the way electricity is supplied to and used by our customers.”
– **Ergon Manager Emerging Markets, Glenn Walden**



A number of drivers are transforming the P&U sector

Utilities will play a key role in responding to these challenges and other key factors that are transforming the P&U sector

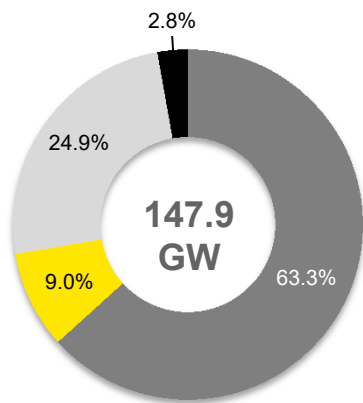


Indian Scenario

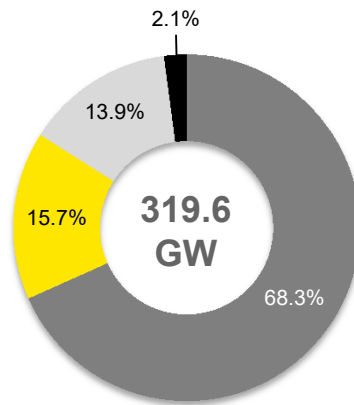
India power sector scenario:

Share of renewables increased from 9% in FY09 to 15.7% in FY17 and is further expected to command 43% by FY27 in the overall generation mix

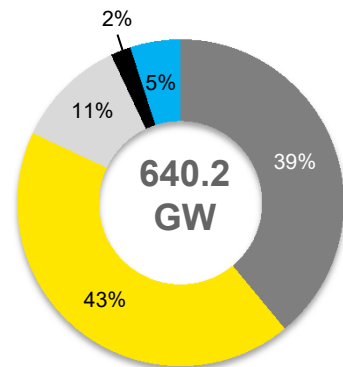
Power generation mix
(as on 31 March 2009)



Power generation mix
(as on 31 March 2017)

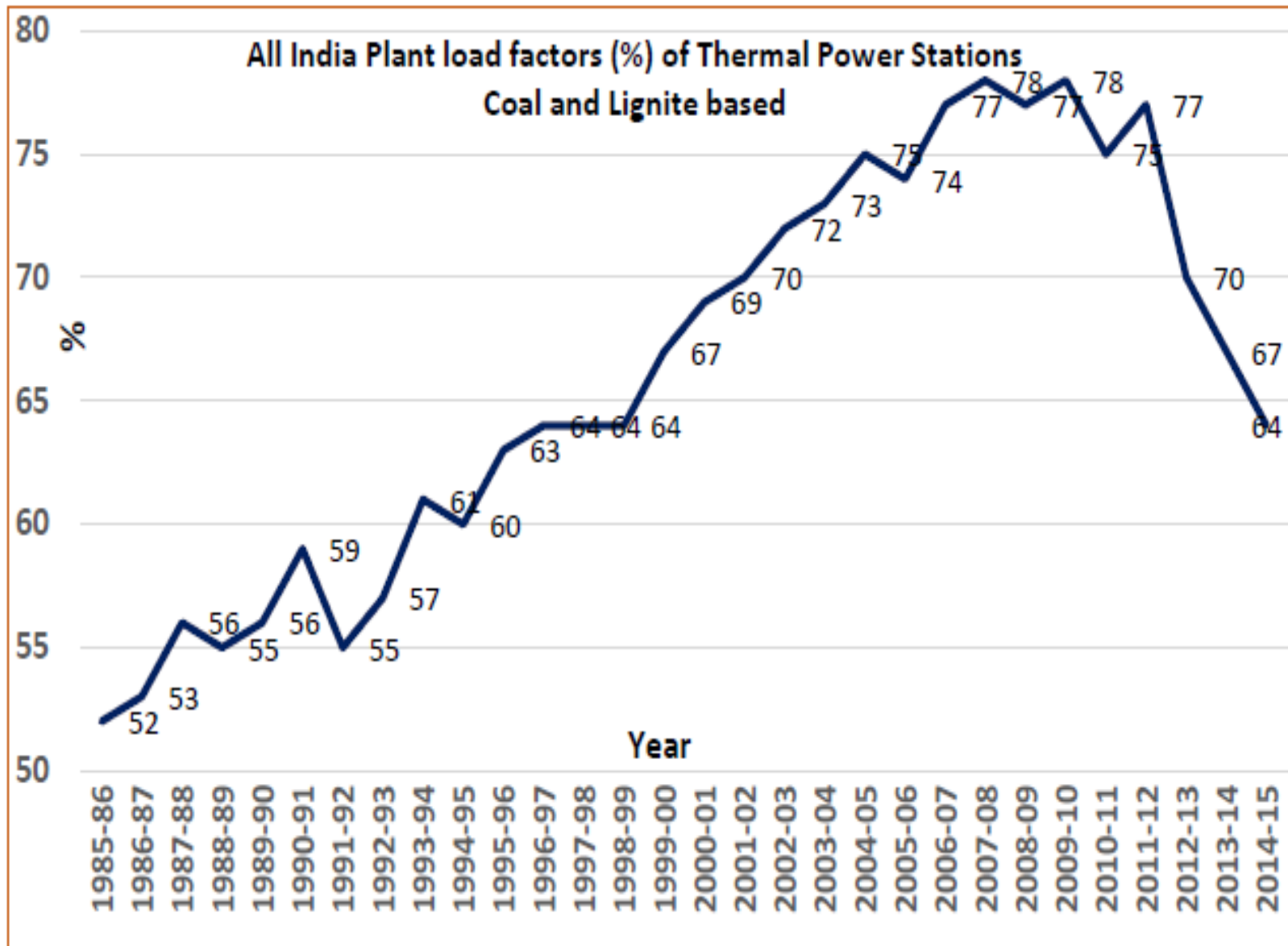


Expected power generation mix
(as on 31 March 2027)

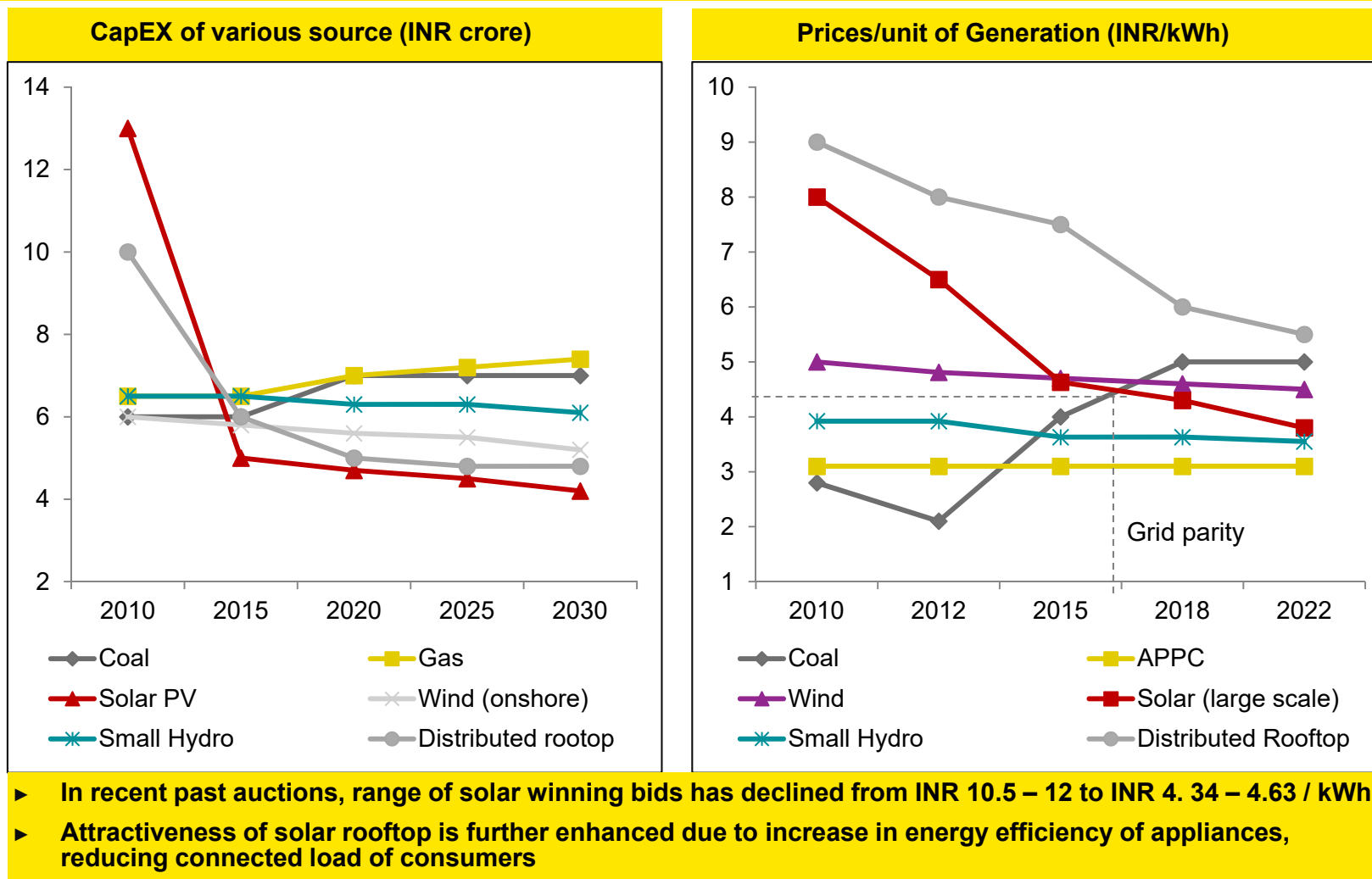


Source: Central Electricity Authority (CEA)





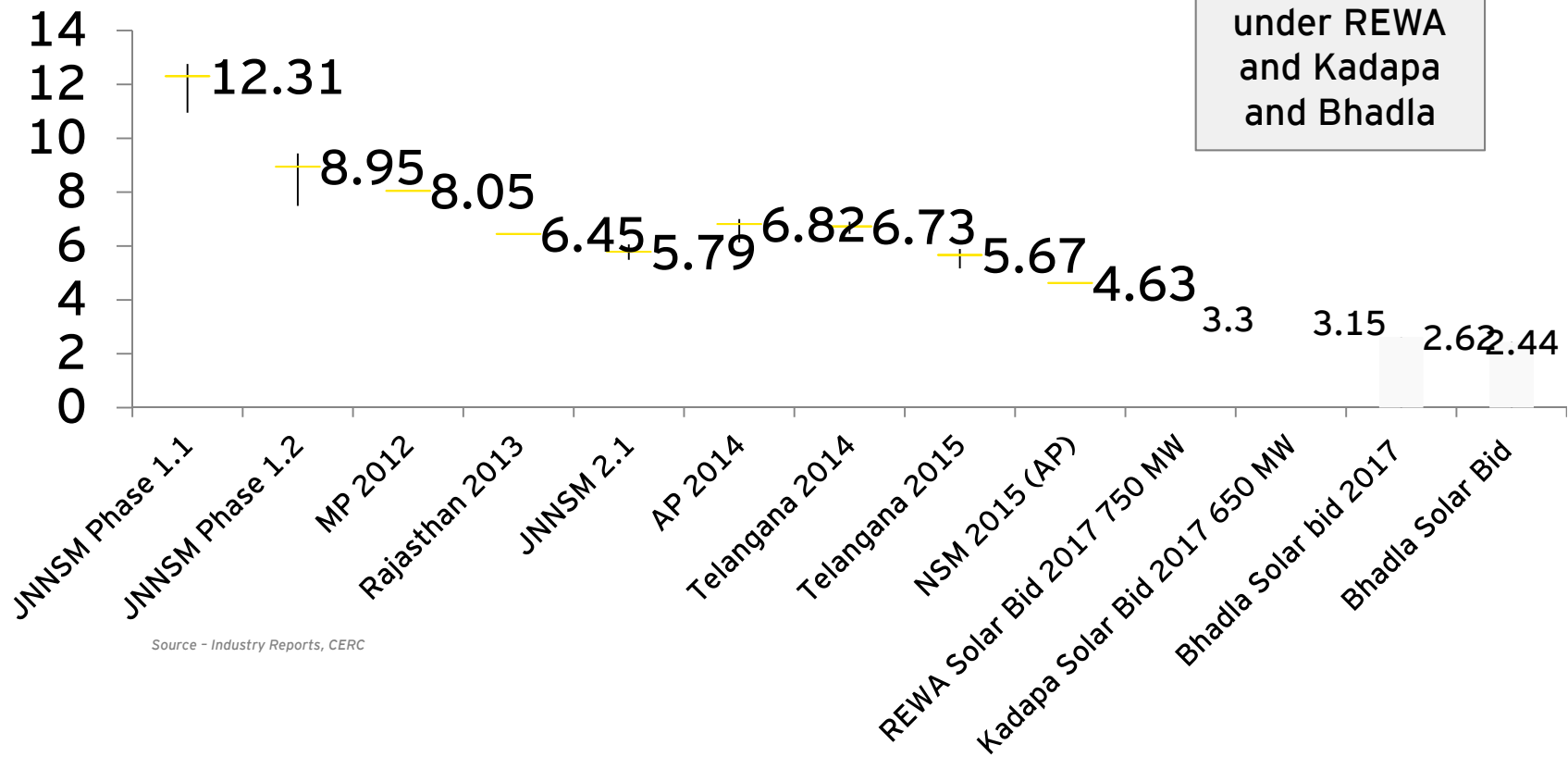
Windfall drop in prices of RE, especially solar, making alternative energy more attractive



Source: MNRE, EY analysis

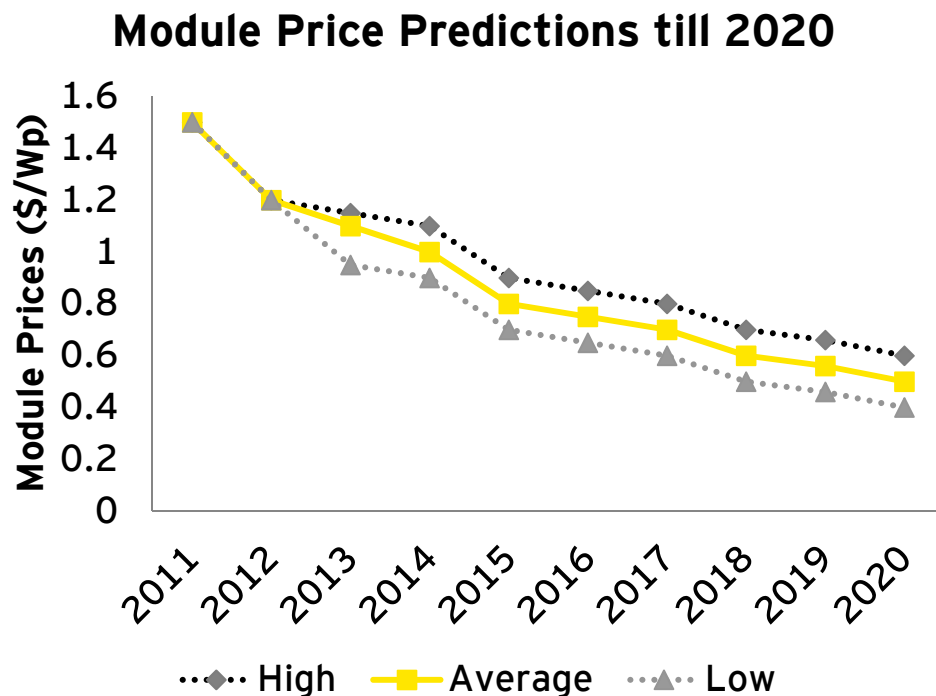
Competitive bidding trends (INR / kWh)

Highly competitive solar bids under REWA and Kadapa and Bhadla

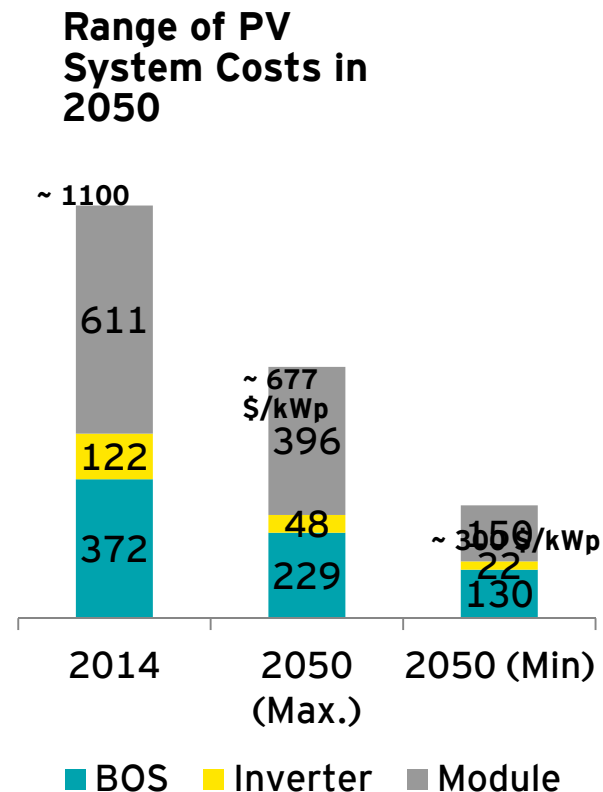


Source - Industry Reports, CERC

Going forward, market expects further compression in module prices, although not at the rate seen historically

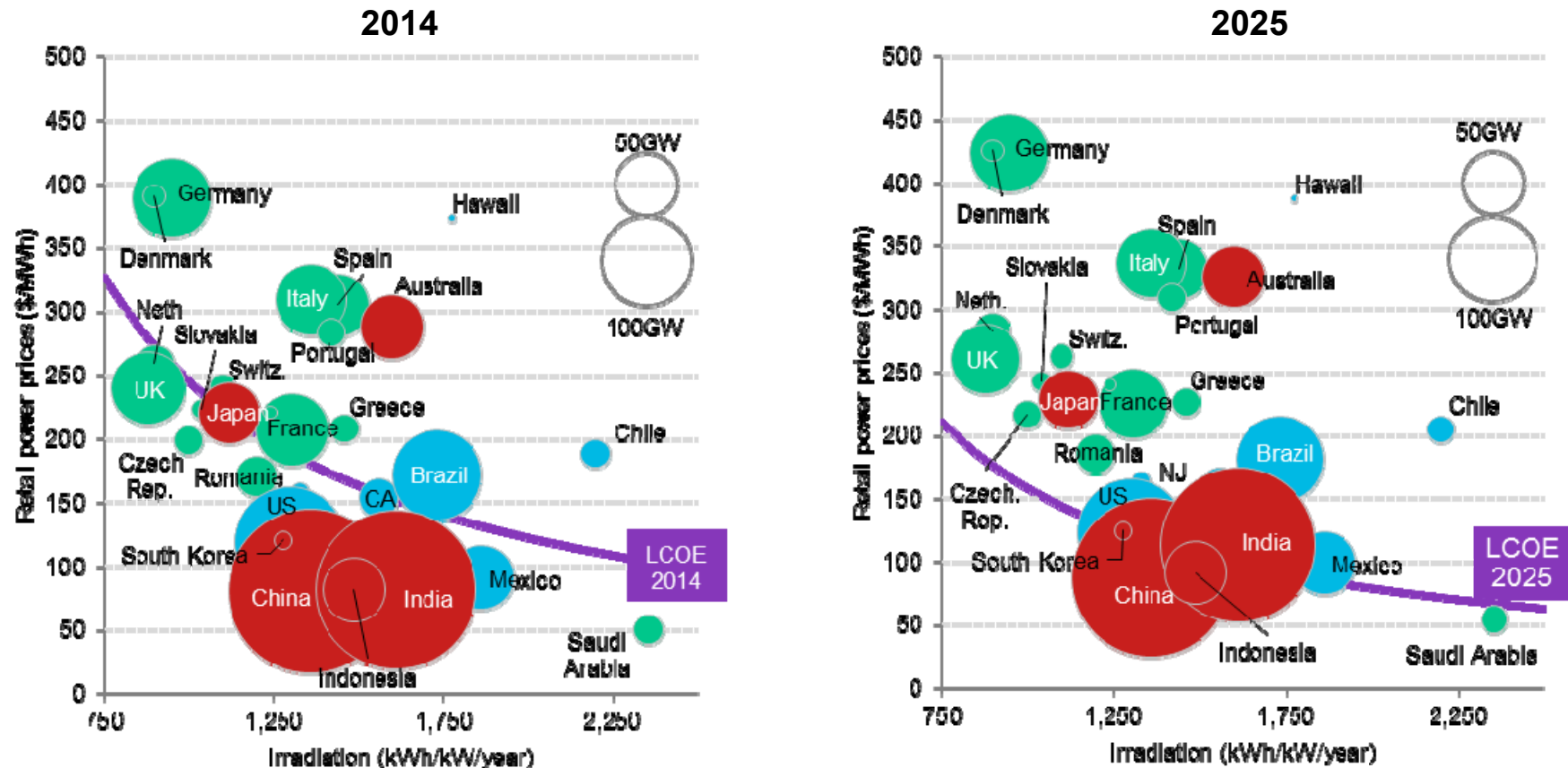


Source: i3 Working paper on What cost for photovoltaic modules in 2020?



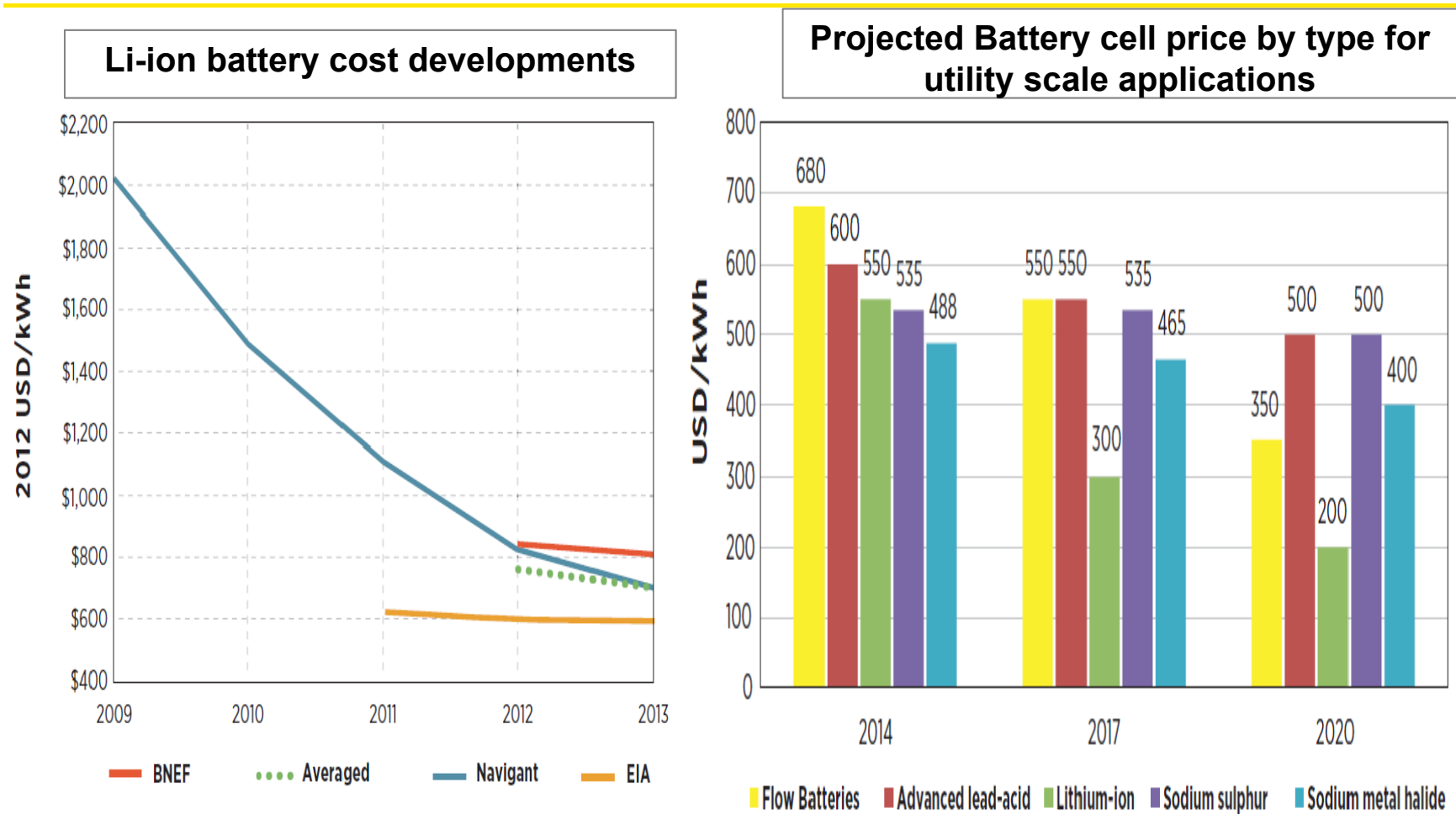
- ▶ Module prices expected to fall to \$0.4-0.5/Wp by 2020 as per industry estimates
- ▶ Gradual improvements in efficiencies to push generation higher, leading to lowering of tariffs

Global residential-scale PV system economics is becoming lucrative steadily lowering LCoE in the next decade



Note: NJ, New Jersey; CA, California. Source: Bloomberg New Energy Finance

What impact will Storage +PV will have on utility's business model?



Source: Navigant Research

Commercial customers who have partially/ fully opted-out from buying power from BESCO hitting revenue significantly

Information technology and communications



Bloomberg
NEW ENERGY FINANCE

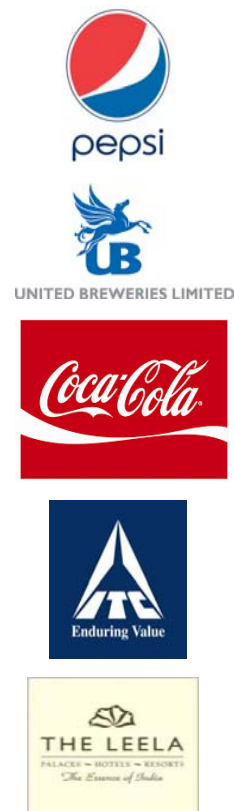
Energy



Industrials and Healthcare

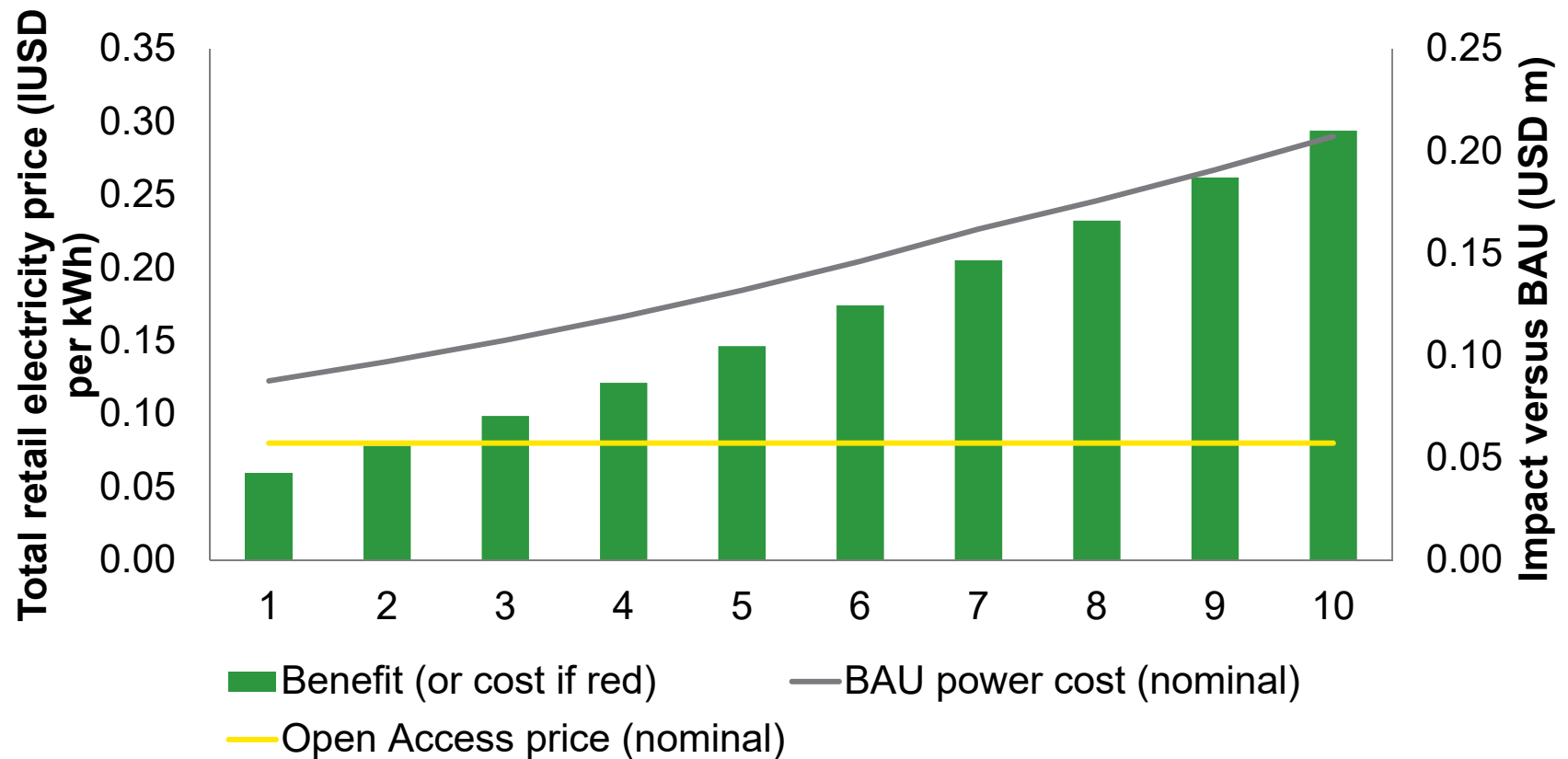


Food & Beverages and Hospitality



Source: Bloomberg New Energy Finance

Impact of renewable over conventional



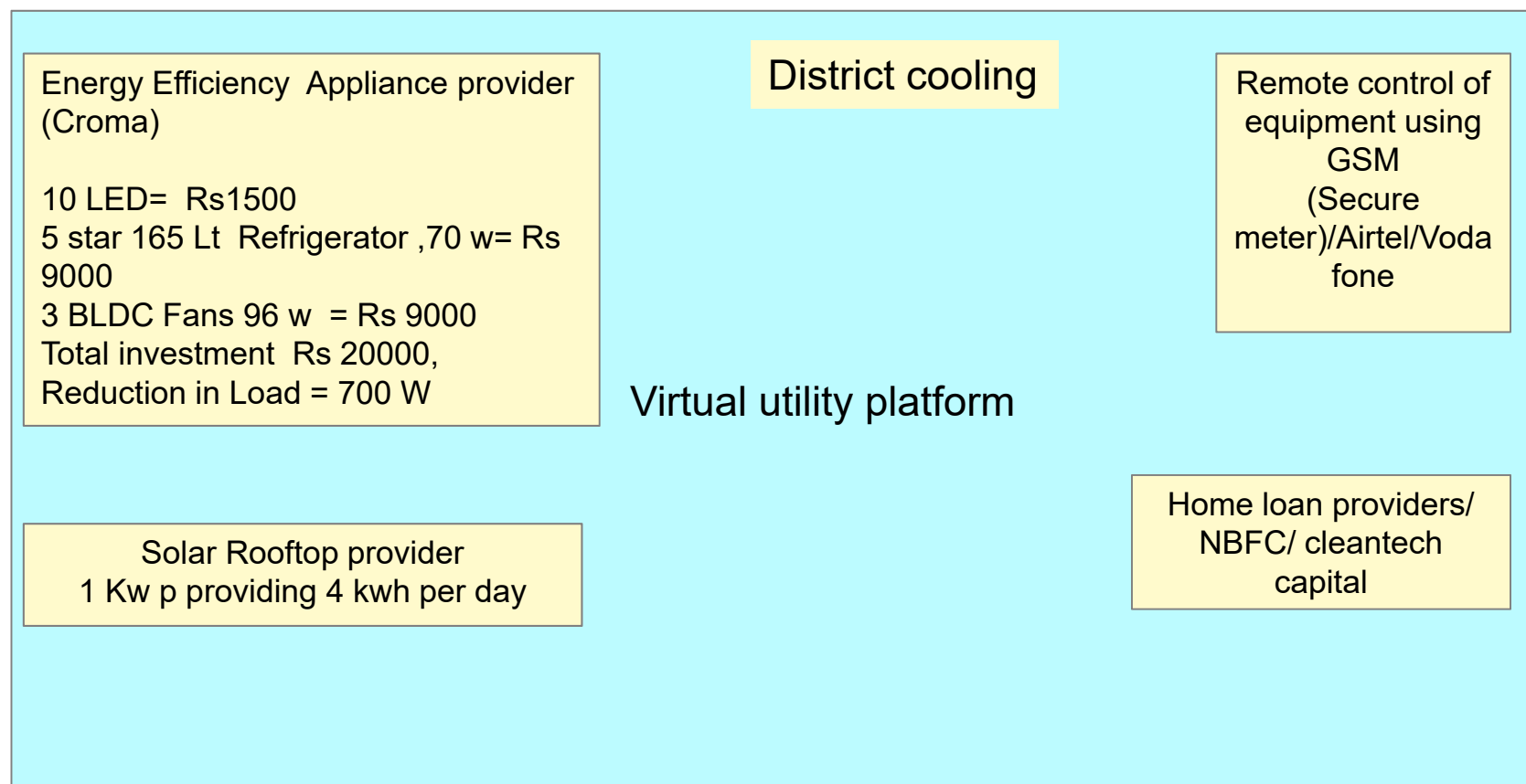
What numbers say

40 year old buildings with		Rooftop space	Available rooftop space 50%	Available rooftop space
ground floor	20%	100%	50.0%	3367000
g+1	25%	50%	25.0%	1052188
g+2	40%	33%	16.7%	748222
>g+3	10%	25%	12.5%	105219
Less than 10 years	10%	50%	25.0%	420875
Others	10%	10%	5.0%	4800
Total available residential rooftop space				5698303
Capacity that can be installed on rooftop (MW)				570
Total power that can be generated (MU's)				848.5913531
% of torrent portfolio in Ahmedabad				11%
				475.2111577
Revenue reduction				10%



**When customers can power
themselves, will they need utilities?**

Platform for DG – disruptive utility model



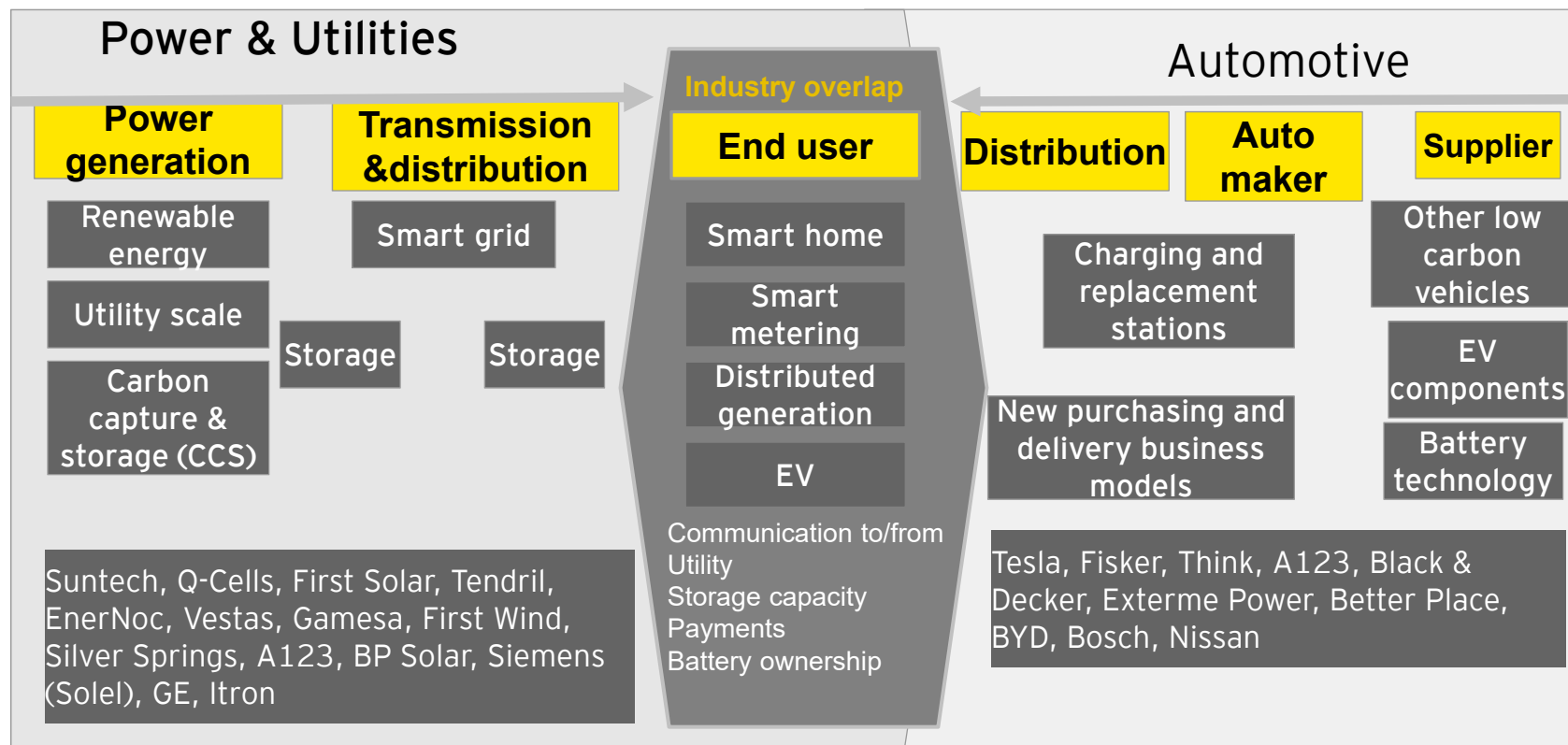
- ▶ No of metered consumer with 1/2/3 storied housing with water connection approx. 6-7 million where this can be applied immediately
- ▶ Additional business can be with District cooling system in societies



The energy company that wasn't there



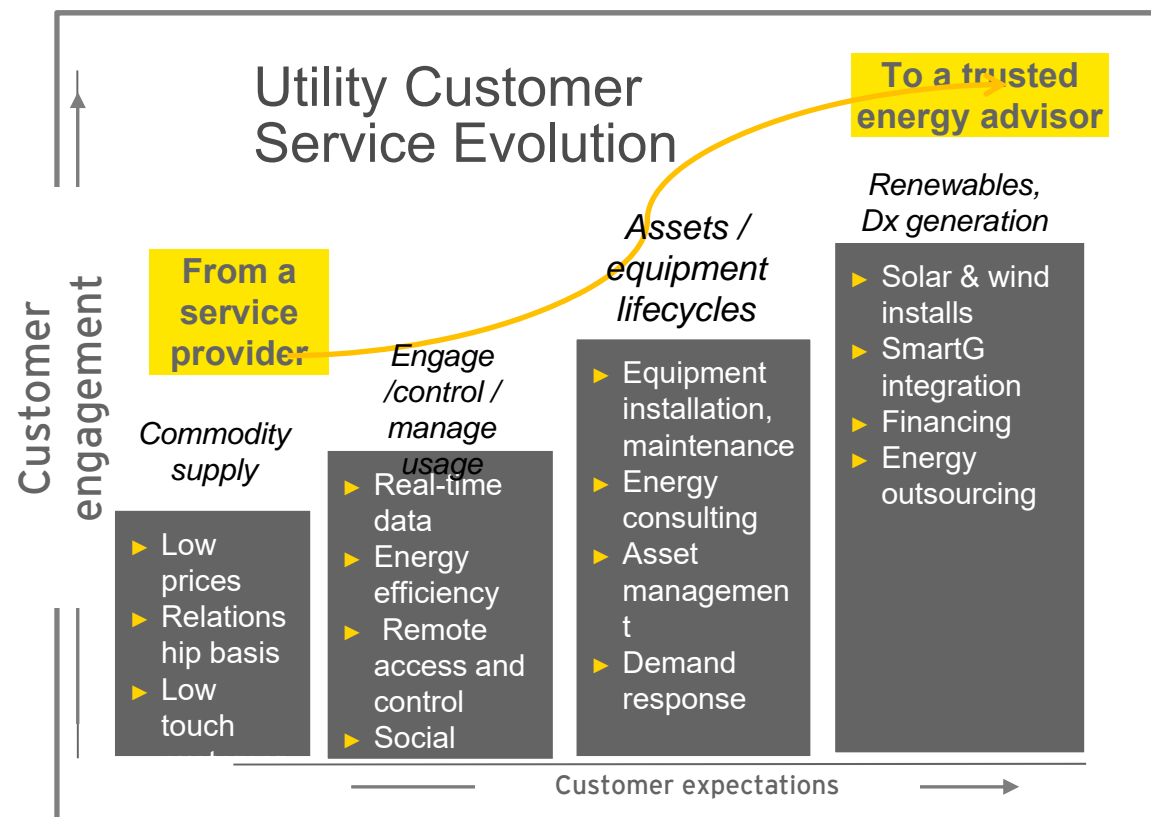
An industry in transformation



Cleantech provides the technological and business model innovation to enable the way energy is generated, distributed, stored, managed and consumed in the Power & Utilities sector and to enable the way low carbon and electric vehicles are manufactured, distributed, purchased, and maintained in the Automotive sector

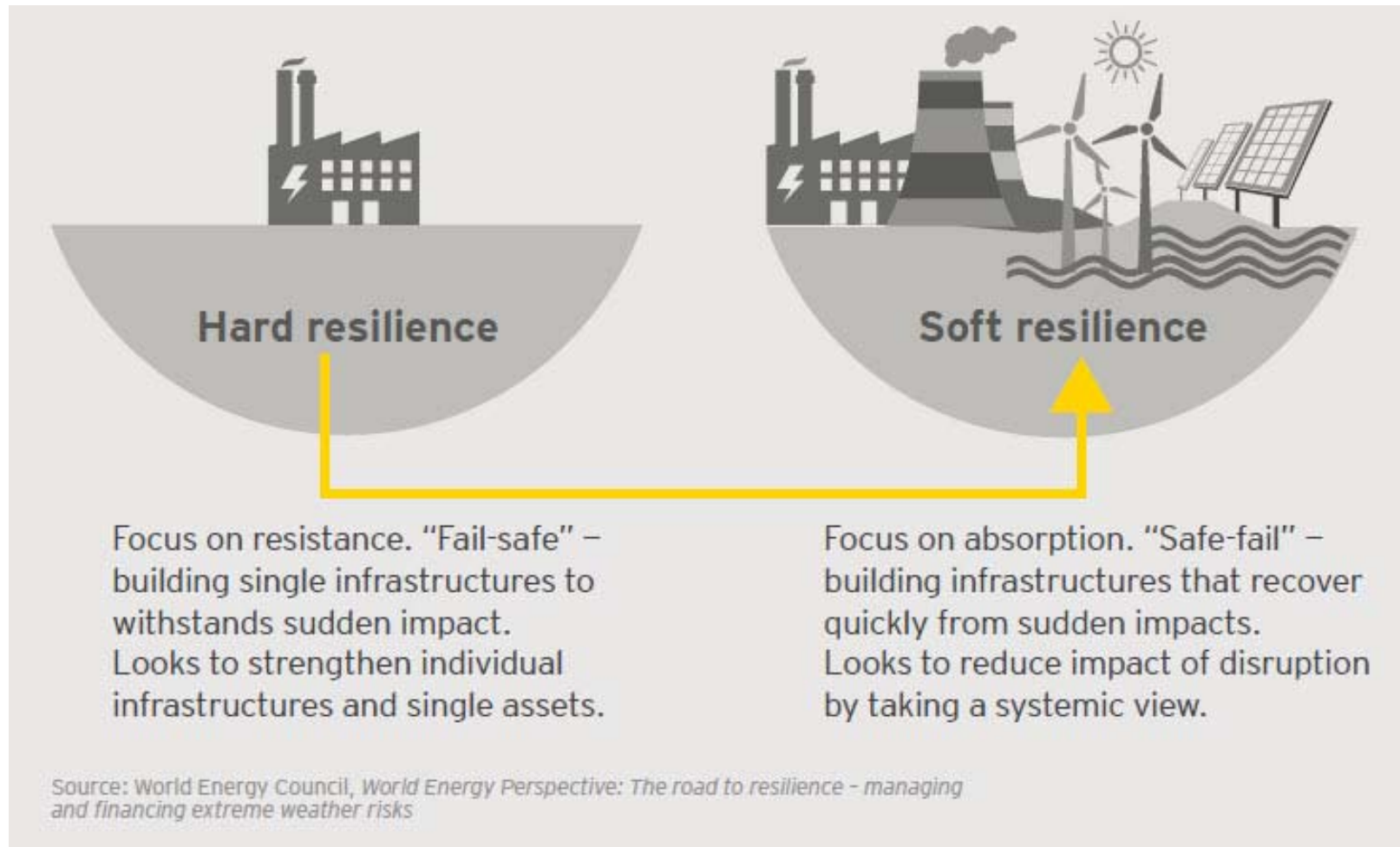


What value & experience today's 'empowered customers' are seeking from power utilities..?

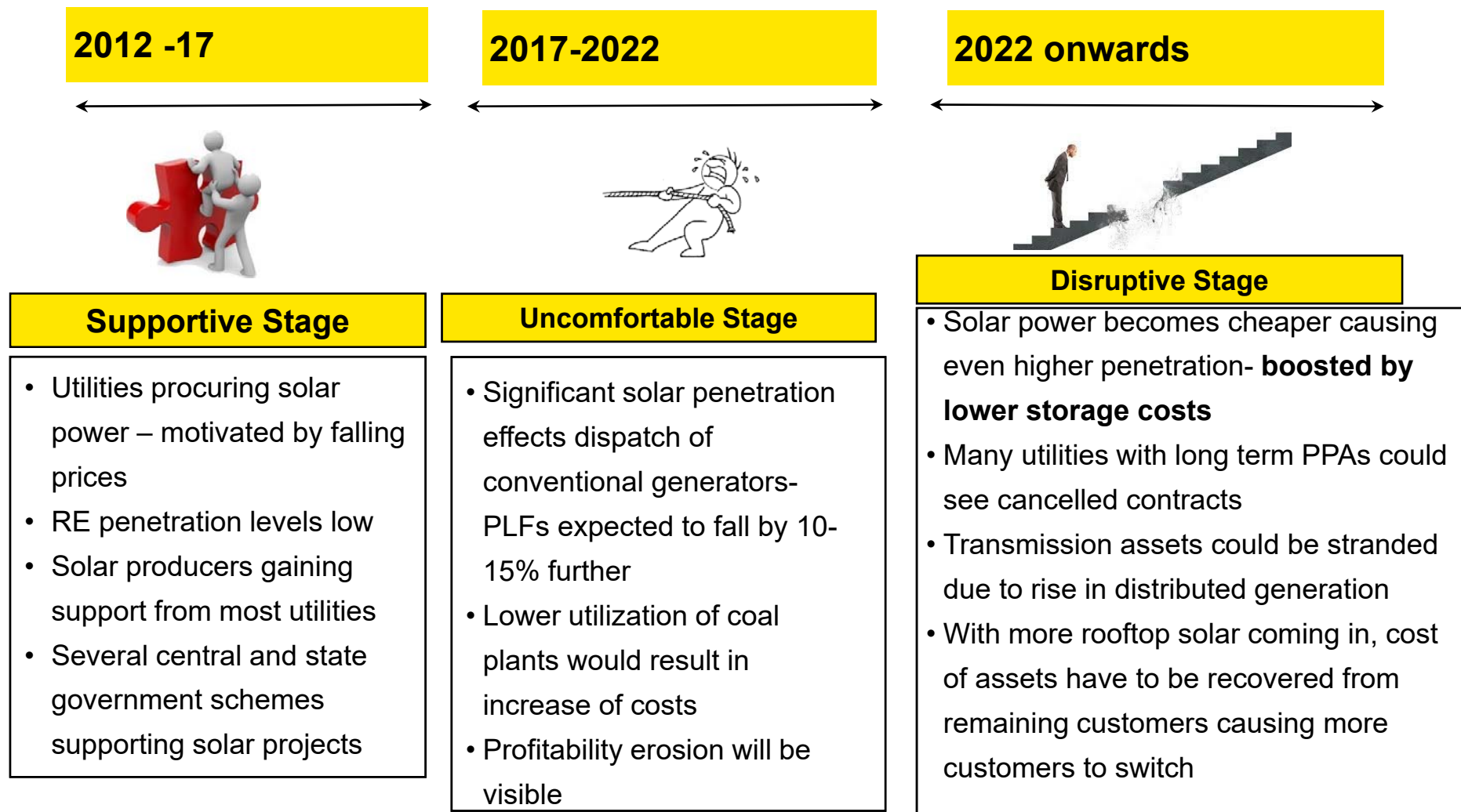


- ▶ **Customer research** - regardless of segment - invariably lands on two key attributes for the trusted advisor role - 'save me money' and 'keep me informed'

Soft resilience approach suits power systems of the future

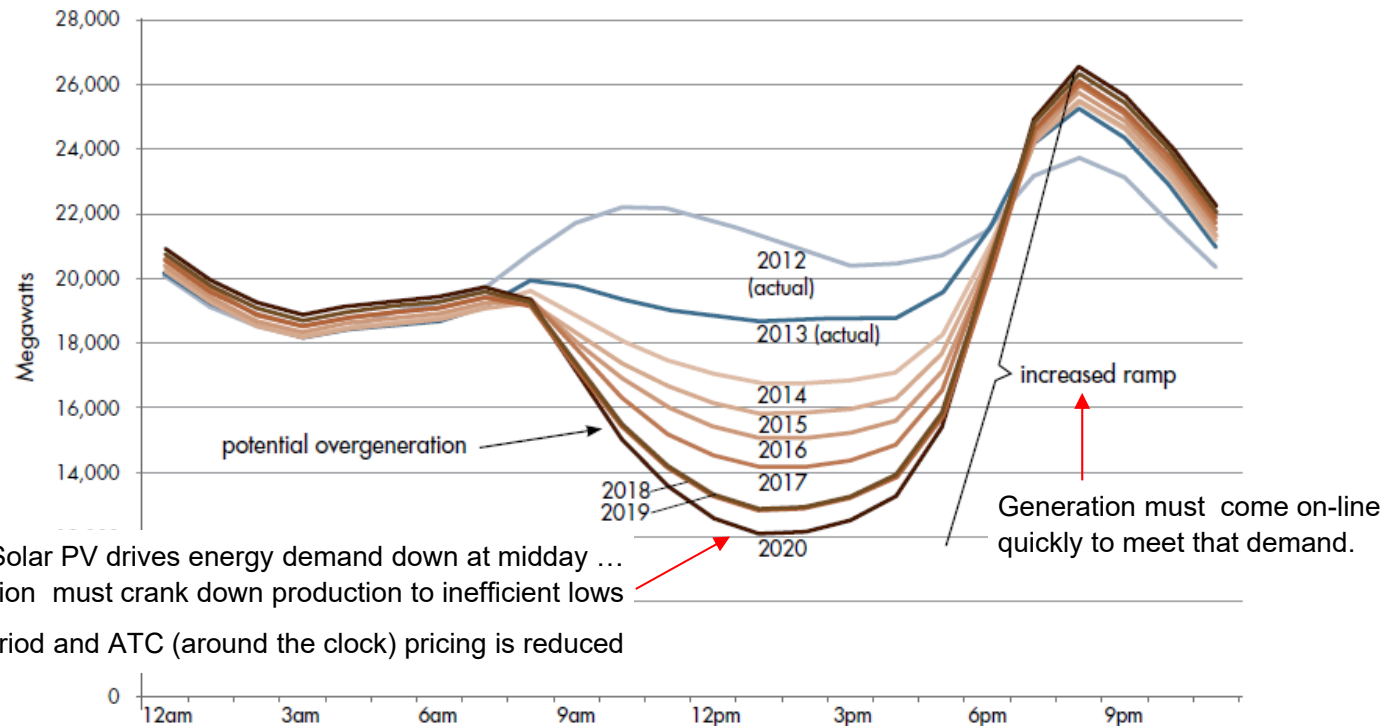


Thus, unless an early-mover, a conventional utility will be left with very few strategic choices...



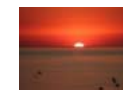
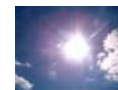
Base load (coal-fired) power plants also face both operational challenges and market risks if solar PV takes off.

California's "Peaking Duck"



Solar PV drives energy demand down at midday ...
baseload generation must crank down production to inefficient lows

Peak period and ATC (around the clock) pricing is reduced



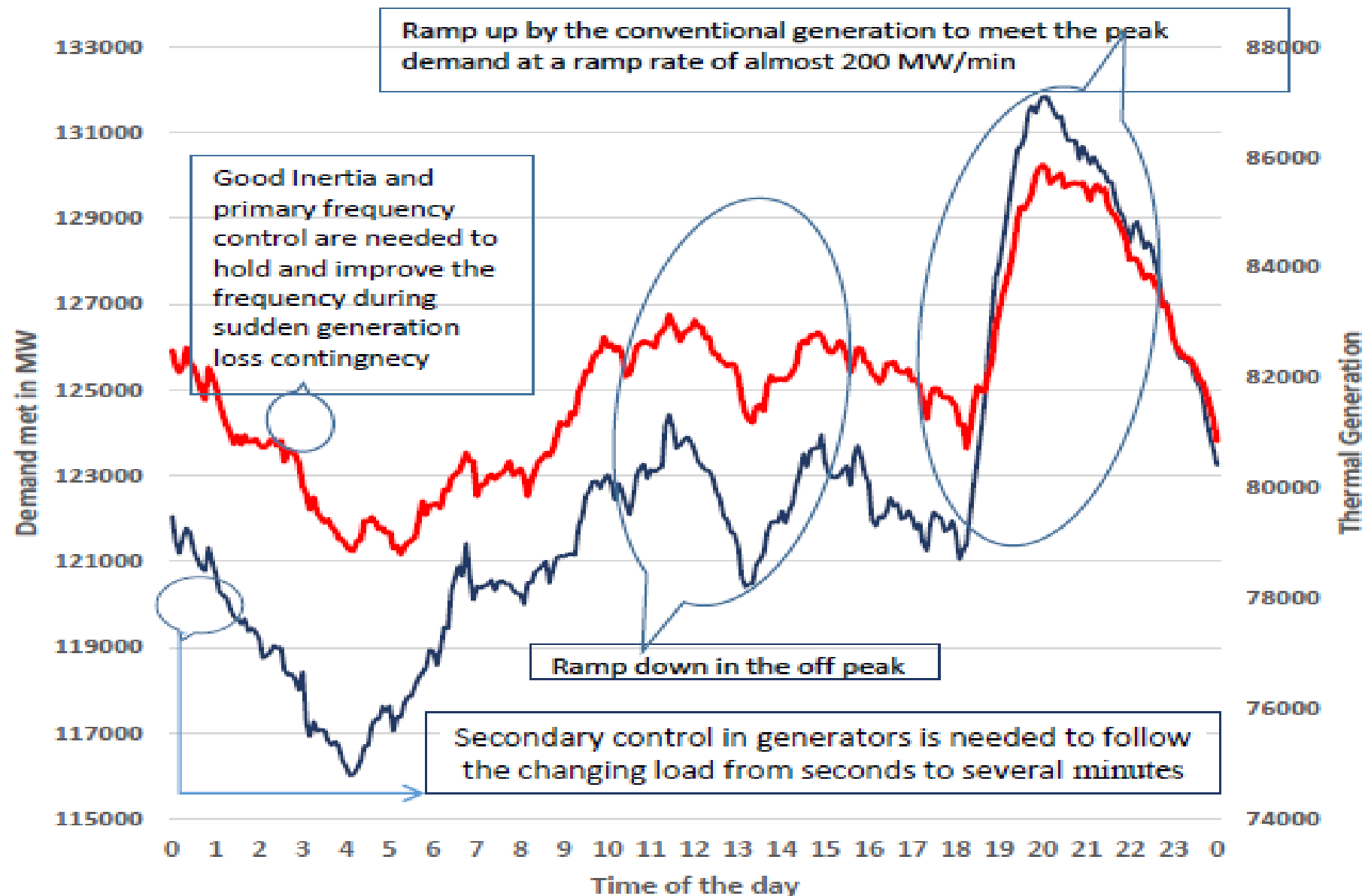
***Longer-term, renewables will change the supply stack
and the competitive positioning of coal baseload generation.***

Expected All India Duck Curve (Sample: 20000 MW of Solar Generation)

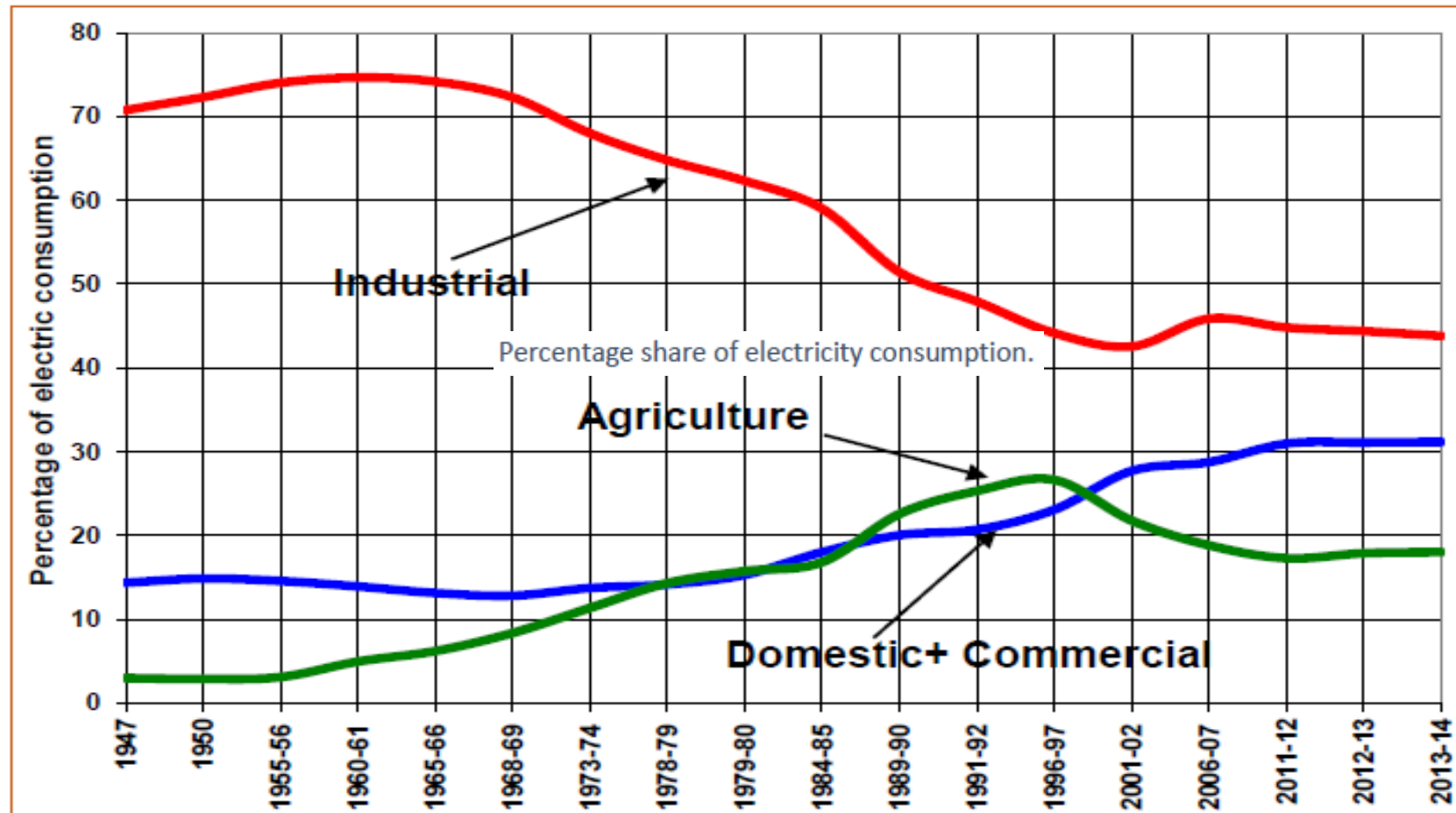


All India Demand Met and Thermal Generation

— All India Demand met — All India thermal generation



Electricity consumption by types



Implications:

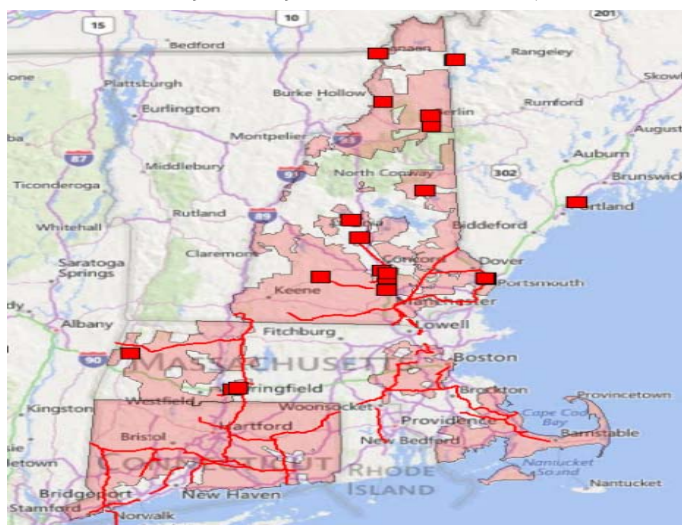
- ▶ Older Units to phase out: 36 GW nameplate capacity – Opportunity – Repowering (22+13)
 - ▶ Traditional players under stress – Divestment in state sector ; - Acquisition and repowering
 - ▶ Distribution privatization: Million + consumers- Behind the meter opportunities
 - ▶ Transmission : Cautious looking at possible redundancy
 - ▶ Flexibility enhancement : invest today, reap benefit tomorrow
 - ▶ Ancillary services: Invest today, benefit tomorrow
 - ▶ Distributed generation: It's the future
 - ▶ PPA- Do not depend on it alone: consider market today
 - ▶ Energy service providers. And prosumers will command the market tomorrow.
 - ▶ Drive regulation before you are driven
-
- ▶ 70% of The top 20 Companies in India were non-existent or nascent 20 years back



Case study 1: Electric distribution evolves

US energy networks are attracting new interests and investment capital

Eversource's growing asset/customer portfolio...



Electric territory Power plant Transmission

PP&E* (\$000)	2010	2011	2012	2013
Electric Dx	\$ 6,197	\$ 6,540	\$ 11,438	\$ 11,950
Electric Tx	\$ 3,378	\$ 3,542	\$ 5,541	\$ 6,413
Gas Dx	\$ 1,127	\$ 1,248	\$ 2,274	\$ 2,426
Total	\$ 10,702	\$ 11,330	\$ 19,254	\$ 20,789
2010-13 CAGR: 25%				
EPS				
\$/Share	\$2.20	\$ 2.39	\$2.27	\$ 2.53

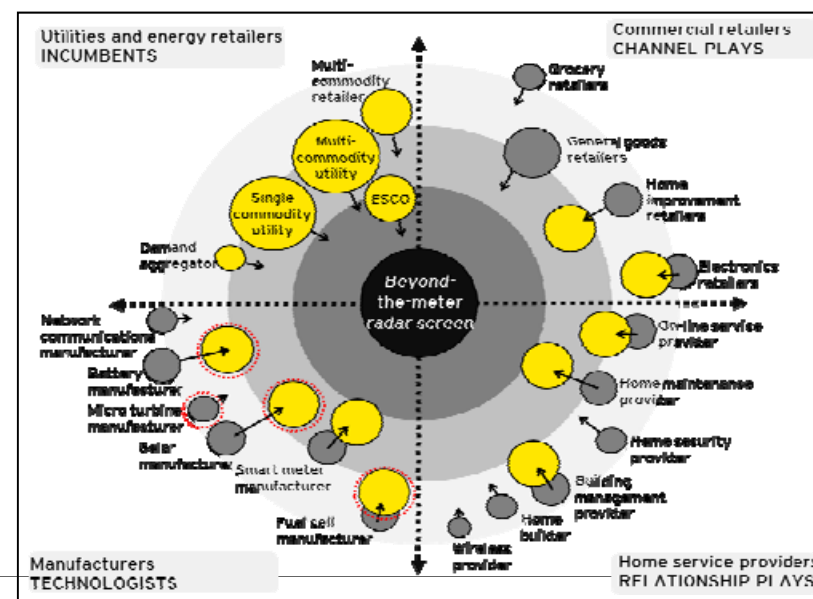
Sources: SNL Financial, Yahoo Finance.

*Note: PP&E = Book value of property, plant & equipment.

...offers superior allowed ROEs...

Allowed Post-Tax ROEs (%)	Electric Dx	Electric Tx	Gas Dx	Gas Tx
France	7.16	7.16	6.03	6.82
Germany	7.62	7.62	7.62	7.62
Netherlands	NA	5.60	NA	NA
Finland	3.00	4.22	3.71	5.03
UK	6.00	NA	NA	NA
Canada	8.32	8.39	9.23	NA
US	10.02	12.38	9.68	NA

...but attracts a growing universe of new entrants:



Situation analysis (1/2): Where ES stands today

ES' power and gas network assets and customers offer a growing set of strategic challenges

A legacy of Eversource success...

- ▶ With New England increasingly needing new generation capacity, transmission, and fuel options; **ES' value lies in its ability to continue to build needed energy infra-structure** for the next decade
- ▶ This need is especially acute given **natural gas pipeline constraints** (exposed over recent winters) with issues poised to worsen after **planned shutdown/retirement** of another 1,400 MWs (including the 620-MW VY nuclear station)
- ▶ ES remains one of the **highest quality, large regulated utilities** with new, positive catalysts on the horizon: Northern Pass and Hydro Quebec's potential CT contract
- ▶ Management has successfully mitigated customer switching risk in NH and **handles a mixed regulatory environment well**
- ▶ In the near-term, **the stock is expected to outperform**

Eversource Energy (ES)

...confronts emerging opportunities/threats...



DG technology is maturing and scaling rapidly worldwide



Significant new financing sources have emerged



Incumbents invest in **new grid technologies to enable disruptions**



Corporate interests seek cleantech opportunities by tapping innovation, crossing sector boundaries



Energy mix optimization through energy efficiency, renewables and DG is a growing focus



Renewables are meeting demand for energy in unforeseen ways

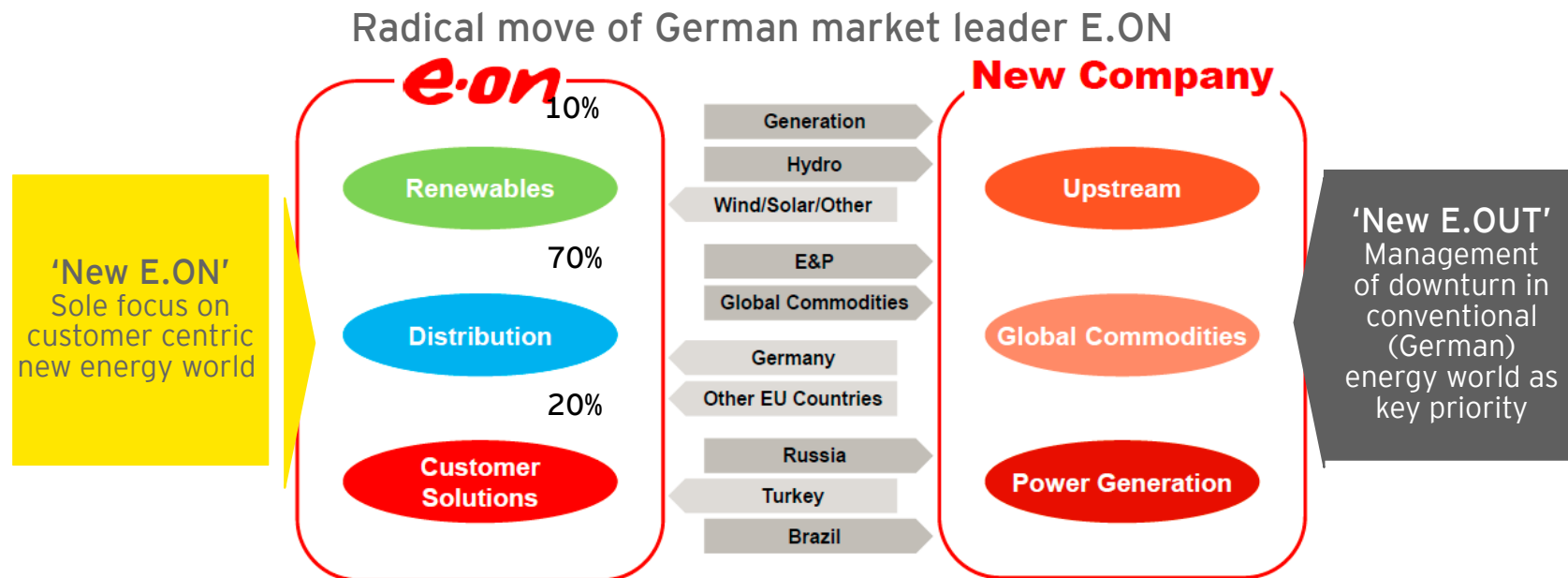


Emerging markets are taking the lead, offering possibilities for greater scale and more rapid innovation

...that require strategic anticipation

- ▶ Widespread DG coupled with batteries, SmartG and other technological, financing, and policy changes have the potential to transform energy networks
- ▶ These changes (or disruptive forces) arise due to a series of converging factors:
 - Accelerating renewable adoption
 - Growing consumer engagement in their energy purchases
 - Falling costs and rising adoption of DG, energy storage, demand response, and energy efficiency
 - Continued political/regulatory interest in global warming, CO₂ reduction, renewables, and DSM
 - Government programs that incentivize select technologies
- ▶ Under certain L-T planning scenarios, a combination of technology gains, improved customer economics and aggressive new business designs offer significant opportunities/ threats to ES' shareholder value

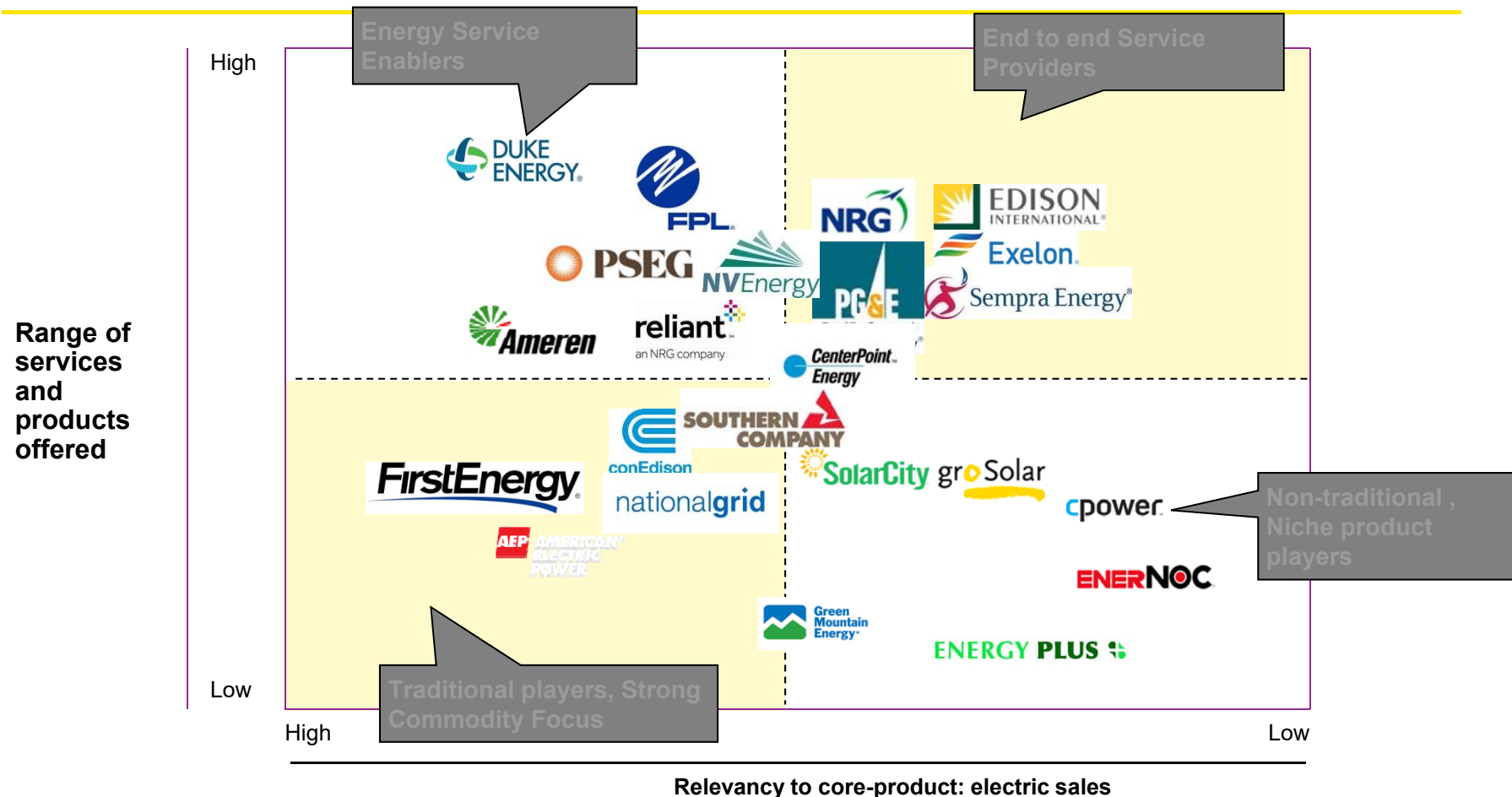
Situation analysis (2/2): P&U companies turn away from traditional business model with Energy Retail as the new core – example E.ON



In Europe, shift in strategic priorities of P&U companies from (bulk) power generation to Energy Retail

Source: E.ON Conference Call on new corporate strategy, December 2014

Peer Companies are adapting a variety of business models to target new growth areas



There is a drive for unregulated energy companies to target end to end services

Ameren



Utility round-up

Ameren Corp. serves 2.4 mil electric and 900,000 natural gas customers in the states of Illinois and Missouri. Ameren is in the process of divesting its generation capabilities to become a transmission and distribution focused utility. The company seeks to lower costs through energy efficiency programs investments and other non-traditional growth strategies –

- Smart meters – Ameren Illinois will install 780,000 AMI electric meters beginning in 2014; Ameren Missouri has already rolled-out AMR electric meters and has no plans for AMI at this point

- Energy efficiency programs – ActOnEnergy® programs in energy efficiency for residential, and C&I customers, will spend \$150M investment in customer EE programs over the next 3 years

- Distributed generation – Ameren Illinois supports distributed gen and net metering upon qualification but requires a one time application fee;

- Demand response – Ameren Missouri has conducted a DSM Market Potential Study with primary data from its service territory to assess the potential for energy and demand savings; Ameren Illinois is conducting a similar assessment

- Home charging stations – End to end support for installation of at home EV charging stations

- Infrastructure upgrade – Illinois legislature approved a grid modernization plan and a 10 year plan to improve its natural gas distribution system; Ameren opened a new \$42M NOC, called Central Substation

- Customer outreach – Ameren Illinois donates energy efficient air conditions to low income families



American Electric Power



Utility round-up

AEP is one of the largest electric utilities in the U.S., serving over 5 million customers in 11 states. With the largest transmission network in the nation and a generating capacity of 38,000 MW of which some supply is sold to deregulated markets, Ameren is positioned to explore non-traditional growth strategies within its seven regionally operating utilities. These initiatives include –

- Renewable generation – An investor in both wind and solar, AEP supports the construction of the extra-high voltage (EHV) transmission grid, which support the transmission of renewable supply from remote areas where wind and solar farms are most efficient to local distribution areas; generating fleet includes 870 MW of hydroelectric capacity

- Smart meters – AEP will install smart meters for all customers by 2015, pending regulatory approvals in states where AEP operates. AEP Texas began its five-year smart meter installation program in late 2009

- Energy efficiency programs – gridSMART® is AEP's smart grid initiative which includes measure to promote energy efficiency for it's customers including high efficiency lighting, weatherization, manufacturing process improvements, and busilder/developer building efficiency programs

- Distributed generation – Some AEP subsidiaries support distributed gen including AEP Ohio which supports solar and wind gen

- Demand response – Programs vary by service territory

- Appliance recycling – Programs in several states with rebate incentive and/or free recycling for old appliances



CenterPoint Energy



Utility round-up

CenterPoint Energy serves several markets in the states of Arkansas, Louisiana, Minnesota, Mississippi, Oklahoma, and Texas, providing electric transmission and distribution and natural gas distribution and services. Known as a leader in Smart Grid technologies, it completed its electric smart meter rollout in 2012.

CenterPoint's many growth strategy initiatives include –

- Smart meters – Electric service territory roll-out finished in 2012, with roughly 5 mil meters installed, CNP has planned to complete the installation of 6 mil AMR gas meters by 2016

- Energy efficiency programs – Launched TrueCost™ website to allow customers to view their usage data and evaluate which retail electric providers (REPs) are best for them; Non-regulated energy services business (IES) for small and medium commercial customers helping them save on energy costs

- Distributed generation – Established protocol for solar PVs and wind turbines to connect to the grid; CNP itself offers no incentives for use of distributed gen since it is not a REP

- Demand response – Smart grid infrastructure supports dynamic pricing and demand response programs for residential and C&I customers (REP controlled); IES plans to help customers participate in ERCOT DR programs

- Natural gas fueling stations – Stations designed to support natural gas vehicles

- Infrastructure acquisition and upgrade – Joined MPL to acquire approximately 11,000 miles of gathering lines, 8,400 miles of interstate pipelines, nearly 2,300 miles of intrastate pipelines and 11 major processing plants; investments in grid automation



Consolidated Edison



Utility round-up

Serving New York City and Westchester county, ConEd is one of the largest investor owned utilities, providing gas, electric, and steam services to over 9 million people. A traditional T&D utility with subsidiaries including a retail electric services company, a wholesale energy supply company, and a generation business. ConEd has pursued non-traditional growth strategies in certain areas–

- Renewable generation – ConEd will consider developing, owning and operating a range of solar, wind, bio-diesel, flywheels and energy storage installations in the Northeast within the next three years

- Smart meters – Exploring AMI possibilities

- Energy efficiency programs – ConEd Green Team features rebates and free programmable thermostats for residential and commercial & industrial customers and tips for saving energy

- Distributed generation – supports distributed generation sources up to 20 MW, including net metering for Solar PV, support for application and installation

- Demand response – Load shedding programs for large C&I customers during peak days, A/C direct load control option for residential customers

- Appliance recycling – Recycling programs, rebates and incentives for energy efficient appliances

- Vehicles – No specific electric vehicle rates yet



Duke Energy



Utility round-up

Duke Energy, headquartered in Charlotte, North Carolina, is the largest electric power holding company in the United States; with assets also in Canada and Latin America. Duke services approximately 7.2 million U.S. customers, with approximately 57,700 megawatts of electric generating capacity in the Carolinas, the Midwest and Florida – and natural gas distribution services in Ohio and Kentucky. It's 2012 merger with Progress Energy has resulted in a multitude of growth strategy initiatives –

- Renewable generation – Heavy investment in solar generation, with purchase agreements with several solar gen facilities, up to 85 MW in one investment, wind investments with up to 5,000 MW in the pipeline

- Smart meters – Roll-outs underway in OH, FL, and NC, in planning stages in other territories, giving customers greater control over their consumption information, DOE and State PUC backing (\$200m Federal funds)

- Energy efficiency programs – energy assessments and incentive rebates for efficient products, engagement with customers around energy analysis, house calls, appliance recycling, and peak usage reduction with state by state variations

- Distributed generation – Solar PV panels for residential and commercial customers, multiple rate options to connect to the grid

- Demand response – DLC and optional load curtailment programs to incentivize customers to reduce their energy consumption at times of peak demand, variations state by state

- Appliance recycling – Programs in several states with rebate incentive and/or free recycling for old appliances



Edison International



EDISON
INTERNATIONAL®

Utility round-up

Edison International, through its subsidiaries including Southern California Edison (SCE) which serves more than 14 million people, is a generator and distributor of electric power and an investor in infrastructure and energy assets, including renewable energy. The operations of Edison Energy are completely independent and unconnected to SCE, and will operate as wholly-owned subsidiaries of Edison Energy, while others will be partially owned by the company along with other investor partners. Edison Int.'s foray into nontraditional growth strategies include –

- Renewable generation – August of 2013, Edison Int. acquired SoCore Energy, a market leader in solar portfolio development and commercial rooftop installation of photovoltaic panels; renewable energy power purchasers; geothermal investments

- Smart meters – SCE completed its AMI rollout in 20XX of XX mil meters, enabling dynamic pricing, demand response, remote control functionality

- Energy efficiency programs – Programs for businesses to upgrade lighting, climate control, office equipment, refrigeration, food-service equipment, and water heating; residential rebates for solar, appliances, pool pumps, water heaters, A/C

- Distributed generation – End to end support for customers, solar PV and wind supported, net metering and credits for residential and C&I

- Demand response – Residential Save Power Days rebate customers for curtailing usage on specific days; C&I Critical Peak Pricing (CPP) and Capacity Bidding Programs, real-time pricing, scheduled load reduction, and direct load control

- Appliance recycling – Established refrigerator recycling program

- EV support – Charging station installation, credits and rebates



Exelon



Exelon, parent company of ComEd, BGE, PECO, and most recently acquired Constellation Energy, with approximately 34,700 MW of owned capacity. Its Constellation business unit provides energy products and services to residential, commercial, and public sector customers. Exelon's utilities deliver electricity and natural gas to more than 6.6 million customers in central Maryland, northern Illinois and southeastern Pennsylvania. Exelon has a strong portfolio of non-traditional growth strategies—

Renewable generation – Owns and operates the largest urban solar power plant, Exelon City Solar in Chicago, and is currently developing 230 MW solar plant in CA

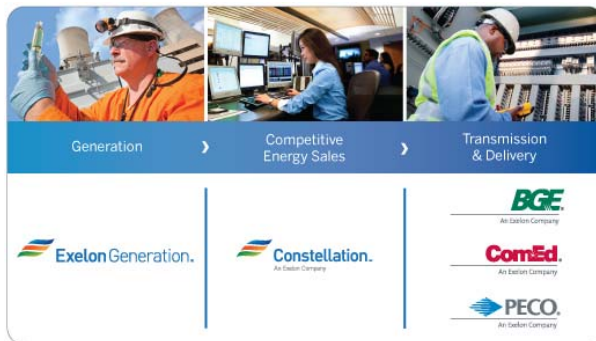
Smart meters – All customers projected to have smart meters by 2015, infrastructure to support dynamic pricing, demand response, remote control functionality; strong customer focus, communications, and offerings around usage analytics

Energy efficiency programs – Subsidiaries offer programs in efficient lighting, efficiency rebates, house calls, thermostat controls, retro commissioning, energy assessments, efficiency programs designed working closely with the state PUCs for meeting local needs

Distributed generation – End to end support for customers, 20 year established solar program in 7 states, supports net metering and buyback, capitalize on state and federal incentives, educated customer base

Demand response – program that uses smart thermostats and DLC switches to control peaks, day ahead notice rebate programs, BGE has 500,000 participants and 40% participation rate, invested strongly in analytics capabilities in load / DR forecasting, M&V and PJM settlement backcasts

Appliance recycling – Established recycling programs in several states





Utility round-up

FirstEnergy includes one of the nation's largest investor-owned electric systems and a diverse generating fleet with a total capacity of more than 20,000 megawatts. Serving 6 million customers in the Midwest and Mid-Atlantic regions, FirstEnergy stretches from the Ohio-Indiana border to the New Jersey shore, touching Pennsylvania, West Virginia, Virginia and Maryland and supplies electricity in Illinois and Michigan through their competitive subsidiary. First Energy's non-traditional growth priorities encompass –

- Renewable generation – Up to 11% of generating fleet is comprised of solar, wind, and hydro facilities, with many long term wind gen purchasing contracts

- Smart meters – Conducted 5,000 smart meter pilot near Cleveland, OH for demand response type events on peak days

- Energy efficiency programs – Energy assessments, HVAC care and incentives, energy audits, lighting and appliance discounts, refrigeration and commercial food service program, traffic signal program, other custom incentive programs

- Distributed generation – Solar PV and other gen, retail versus wholesale connection, varies by service territory

- Demand response – Direct load control of HVACs with programmable thermostat installation for residential and C&I customers

- Appliances – Rebates for high efficiency appliances, appliance recycling programs with rebates



National Grid



Utility round-up

National Grid is a multinational British gas and electric company, with operations in the northeast United States. Operating in New York, New Hampshire, Massachusetts, and Rhode Island, National Grid services 3.4 million customers, including Long Island Power Authority's transmission and distribution network.

National Grid has a strong portfolio of non-traditional growth strategies –

- Renewable generation – National Grid owns no generation in the US, but customer program GreenUp allows you to choose to have all or part of your electricity generated from renewable resources

- Smart meters – Conducting electric meter AMI pilot, roughly 15k meters in Worcester, MA

- Energy efficiency programs – Over 20 years experience in efficiency programs, saving 29 bil KW since 1987; Energy calculator, energy tips for residential and commercial customers, rebates for natural gas heating and home sealing

- Distributed generation – Solar, farm waste, and wind net meter supported throughout US territory

- Demand response – Energy Provider Online™ tool calculates expected load curve, assists customer in selecting proper demand response programs for their needs, conducts demand response audits, programs vary by state PUC

- Appliances – Rebates for high efficiency appliances, appliance recycling programs

- Unregulated business – Includes LNG storage, LNG road transportation, unregulated transmission pipelines, West Virginia gas fields and home energy service activities that were acquired as part of the KeySpan acquisition

- EV support – Plug-in electric vehicle partnership programs with local and national organizations



NextEra Energy (FPL)



Utility round-up

NextEra Energy, parent company of Florida Power & Light as well as NextEra Energy Resources, LLC, services over 4.5 million customers as a rate-regulated utility. NextEra Energy has taken several steps to grow strategically beyond the customary rate case initiatives –

- Renewable generation – Largest solar and wind generation portfolio in North America

- Clean generation fleet – Low emission generation with 97% of capacity from renewables, nuclear, and gas-fired plants.

- Grid modernization – Infrastructure improvement and Installation of automated switches, smart meter installations providing improved reliability and shortening outage times

- Energy efficiency programs – Energy surveys/audits, lighting, insulation, roofs, equipment maintenance and on-call services. efficiency rebates for customers resulting in a 1,855 MW summer peak reduction, 3rd party profit sharing model

- Distributed generation – Residential and commercial solar installations support, rebate program from \$1000 - \$50,000 for solar water heaters and PV system, grid connectivity and net metering available

- Demand response – Pays customers for direct load control program for AC and water heaters, established, 8 year program with 820,000 customers



NV Energy



Utility round-up

NV Energy, headquartered in Las Vegas, Nevada, provides electricity to 2.4 million customers throughout the state, and natural gas to another 145,000 in the Reno area. NV Energy generates electricity at its own power plants in southern Nevada and augments its resources with renewable energy and other power supplies. The utility was recently purchased by Berkshire Hathaway's MidAmerica Energy and is already engaged in several non-traditional growth strategy initiatives –

- Renewable generation – Requirement that at least 25% of the company's retail energy sales be derived from renewable energy resources by 2025, over 1 GW of renewable gen currently in the mix

- Smart meters – NV Energize project deployed smart meters and communications infrastructure for all residential and commercial customers and pilot programs for time-based rates, advanced customer service options, and electric vehicle monitoring

- Energy efficiency programs – Energy analysis, mPowered online energy management tool helps manage household energy use through analytics, lighting, pool pump rebates, solar wind, and hydro rebates, energy saving tips

- Distributed generation – Solar, wind, and hydro gen support, end to end assistance, net metering support,

- Demand response – Bill credits and rebates to residential customers who reduce load on event days in the CoolShare™ DR program, 50,000 enrolled this summer, 140 MW reduction in 2012

- Appliance recycling – Refrigerator recycling, appliance rebates, A/C rebates





Utility round-up

Pacific Gas and Electric Company provides natural gas and electric service transmission and distribution to roughly 15 million customers in northern and central California. It's parent company, PG&E Corp., owns some generation and procures contracts to expand its renewable gen mix. PG&E had been at the forefront of non-traditional growth strategies—

- Renewable generation – 19% of its generation fleet is comprised of renewables including, solar, wind, eligible hydro, geothermal, and biomass and waste facilities; goal of 33% renewables by 2020

- Smart meters – One of the first AMI smart meter deployments in the country, but encountered issues with customer adoption, communication issues, and lack of customer education; 90% of PG&E customers have smart meters

- Energy efficiency programs – Home Money Saver end to end program includes home assessment and upgrades to appliances, insulation, lighting, with monetary incentives, energy management analytics for large C&I customers, Energy Savings Assistance program for low income residents

- Distributed generation – End to end support for residential and C&I customers, supports net metering and buyback, supports the California Solar Initiative program for residential and C&I

- Demand response – SmartAC™ direct load control through a programmable thermostat, dynamic pricing including TOU programs, Automated and Semi-Automated Demand Response program for non-residential customers

- Appliance recycling – Established recycling programs, rebates and incentives for energy efficient appliances

- Vehicles – Electric and natural gas fleet, with more than 80 charging stations around its service territory, electric vehicle support and specific rates for charging





Utility round-up

Composed of the Public Service Electric and Gas Company (PSE&G), PSEG Power, PSEG Energy Holdings and PSEG Services Corporation, PSEG is one of the ten largest electric provider companies in the country. Headquartered in Newark, NJ, PSE&G is the largest provider of gas and electric service in New Jersey, servicing 1.8 million gas customers and 2.2 million electric customers. Beginning in 2014, PSEG will begin operating the transmission and distribution system of LIPA, replacing National Grid. PSEG has explored or implemented several non-traditional growth strategies, including –

- Renewable generation – Garden State Offshore Energy (a joint venture of PSEG Renewable Generation and Deepwater Wind) will be a 350-megawatt wind farm off the coast of New Jersey; Solar 4 All™ program will install, own and operate 80 MW of PV panels; biomass and hydro generation plants

- Smart meters – Pilots have been conducted to explore the efficacy of smart meters

- Energy efficiency programs – Online energy analysis, home energy toolkit, natural gas conversion, solar PV installation support

- Distributed generation – Solar PV panel loan program, supports net metering for residential and C&I customers

- Demand response – Cool Customer Program provides direct load control to A/C units on peak days through a free programmable thermostat provided at sign-up plus \$50 credit upon thermostat installation, or a \$4 credit for each summer month plus \$1 per event

- Appliance services – Offers heating system and appliance repair service for all customers, rebates for energy efficient appliances, established refrigerator and freezer recycling program

- EV support – Tips for installation, electric vehicle service rates



Sempra Energy



Utility round-up



Sempra Energy's utilities, San Diego Gas & Electric Co. (SDG&E) and Southern California Gas Co. (SCG), serve more than 20 million consumers. Sempra U.S. Gas & Power and Sempra International, develop and operate critical energy infrastructure and provide gas and electricity services in North America and South America. Sempra Energy's non-traditional growth strategies include –

- Renewable generation – Strong portfolio of renewable gen with record solar pV capacity growth; hydrogenation and wind generation facilities with co-investor Edison International

- Smart meters – SDG&E completed its AMI deployment in 2011, installing 2.3 mil meters; SCG is in the process of installing their 5.8 meters to be completed in 2017

- Energy efficiency programs – Energy consultations, incentives and rebates, support for industry C&I

- Demand response – Capacity bidding, critical peak pricing, A/C direct load control for Summer Saver program

- Appliance services – Rent or own, authorized contractors may provide free efficient lighting, insulation and weatherization, appliance replacement, window treatments

- Infrastructure upgrades – Natural gas pipeline developments and safety initiatives, midstream expansion in pipeline and storage,

- EV & NGV support – Time-of-use rates for EV owners, support for new customers, support for businesses for EV charging stations, NGV support, incentive and rebate support



Southern Company



Utility round-up

Southern Company and its subsidiaries provide electricity to 4.4 million customers, with a generating capacity of nearly 46,000 MW, including the operation of three nuclear generating plants. One of the earliest adopters of AMI technology, Southern Company has been creative in its growth strategy initiatives. These initiatives include –

- Renewable generation – Operating one of nation's largest wood biomass plants, in TX, several solar and wind generating facilities, multiple hydro and nuclear facilities, one of the leaders in carbon capture technologies

- Smart meters – Southern completed its AMI deployment in 2012 of 4.4 mil meters, enabling dynamic pricing, demand response, remote control functionality

- Energy efficiency programs – Initiatives for upgrading lighting, building materials, energy audits, weatherization, smart thermostats, supports ENERGY STAR®,

- Distributed generation – Ongoing projects to research and promote distributed generation, solar applications on billboards and headquarter buildings

- Demand response – Residential direct load control of heating and A/C, real-time pricing and interruptible load initiatives for C&I customers

- Appliance sales – Some subsidiaries own and operate appliance stores that sell high efficiency appliances to customers

- Infrastructure Upgrade – Smart Grid Investment Grant recipient automating transmission and distribution line devices enabled with SCADA technology, remote monitoring devices and electronic relays in substations, and integrated Distribution Management System, which includes automatic fault isolation and service restoration

- EV support – Helping to establish charging and energy use standards



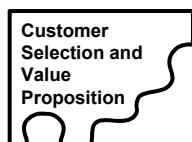
Product and service design framework – Demand response

Overview of business design elements



Business Design Elements

Description

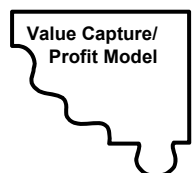


Customer Selection/ Value Proposition

Companies are targeting customers who could significantly reduce their electric costs from shifting usage from peak hours. Focus is on customers who are involved daily in their usage control and are receptive to changing their usage behavior

Enables providing customers with multiple rates and retail products that include demand response – e.g. TOU, CPP, demand bidding, capacity bidding and Ancillary services

Demand response is often being packaged with other offerings like energy efficiency and energy management services and in some cases projected as a good environmental solution



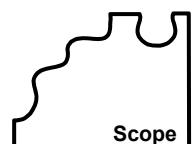
Value Capture/ Profit Model

In markets with higher demand for wholesale load reduction, peak demand reduction, on-peak / off-peak differential, companies are profiting from demand response returns

It has become another way to enhance customer 'stickiness' – specifically with C&I customers

Revenues from capacity markets, load as resources, emergency programs

Cost reduction and supply hedging through peak reduction, on- peak to off-peak shifts and weather sensitive programs



Scope

Majority of programs geared towards peak reduction and other areas include emergency, capacity and peak shifting

More than 66,000MW under DR programs currently with around 30,000 MW in C&I and more than 8,000MW in residential programs. 9M residential customers currently enrolled

PA, MI, MN, IL, OH, FL and CA have the most DR program participation and PA, CA and FL have strong residential programs

Key players are electric companies, aggregators / CSPs and large self participants



Strategic Success Factors

Favorable regulatory and market conditions that result in sustainable demand response prices and returns. Several regions are 'on the fence' with decisions on DR program implementation

For large scale residential participation – customer education and awareness is key

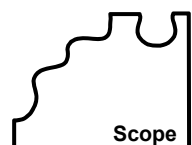
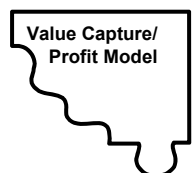
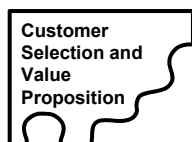
New technology developments are supporting higher amount of load aggregation in to DR programs

Companies are working closely with their ISOs to obtain favorable market protocols for demand response



Product and service design framework – Demand response

Examples of key competitors



Traditional players			Non-traditional players	
<i>Top companies by number of DR customers</i>				
FPL	AEP - OH	BGE	EnerNOC	Comverge
<p>Company offers Incentive based demand response program</p> <p>Pays customers for DLC of AC and water heater</p>	<p>Time of use based DR program</p> <p>Summer peak reduction credit to customers</p> <p>Emergency and capacity program based payments</p>	<p>PeakSaver program that uses smart thermostats and load control switches to control peaks</p> <p>Rebate opportunities for reducing usage with one day ahead notice</p>	<p>Underserved medium-sized C&I customers</p> <p>Advanced aggregation and dispatch process software applications</p> <p>Highly automated, minimal internal resource impacts</p>	<p>Developed DR offerings and solutions based on smart grid investments and platforms</p> <p>Custom DR program by electric company (e.g. TXU iThermostat)</p>
<p>Avoided new generation / supply costs</p> <p>Lower hedging costs</p> <p>State incentives and funding</p>	<p>PJM demand response revenue payments</p> <p>Control weather sensitive load and avoid high summer supply costs</p> <p>State energy efficiency program</p>	<p>Lower supply costs</p> <p>Avoided peaks during summer</p> <p>DR as a controllable load</p>	<p>Partnership with electric companies for CSP services and Direct end user demand services</p> <p>Application flexibility based on customer specific demands</p>	<p>Partnerships with traditional energy companies</p> <p>Direct sales</p> <p>Targeting residential</p>
<p>820,000 customers</p> <p>Has evolved for more than 8 years</p>	<p>700,000 customers</p> <p>Program design based on ISOs demand response products and own supply portfolio</p>	<p>500,000 customers</p> <p>40% participation rate</p> <p>500 MW of peak load control</p>	<p>More than 700,000 sites under control and 13,700 C&I customers</p>	<p>Around 2100 customers</p>
<p>Big customer education and awareness campaign</p> <p>FL PUC support</p> <p>Non-intrusive DR program design</p>	<p>Strong support from PJM</p> <p>Favorable market prices</p> <p>gridSmart program – favorable outlook from FERC, Fed</p>	<p>Customer education, testimonials and marketing campaigns</p> <p>Invested strongly in analytics capabilities in load / DR forecasting, M&V and PJM settlements backcasts</p>	<p>National corporate-level agreements</p> <p>Targeted presence in favorable DR markets</p> <p>Emphasis on customer education and non-intrusive services (residential)</p>	<p>National corporate-level agreements</p> <p>Involvement with ISOs and partnership opportunities with large energy efficiency programs</p>

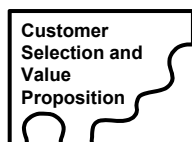


Product and service design framework – Solar / Distributed Generation Overview of business design elements



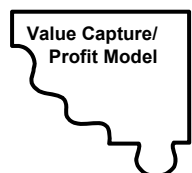
Business Design Elements

Description



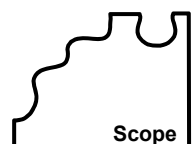
Customer Selection/ Value Proposition

Significant focus is on customers in states with strong solar incentive programs (State and Federal incentives) and for customers inclined towards generating their own power. Marketing and messaging around the renewable appeal to customers, carbon off-sets and RECs
Companies are marketing programs for solar leasing, natural gas generators, co-ownership models for wind and buy-back programs for excess electricity generated. Energy efficiency incentives are included. Customer value is driven from ability to use own power and lower monthly electric company costs . For larger customers cheaper natural gas costs and lowering solar PV costs are appealing.



Value Capture/ Profit Model

Longer term vision around distributed generation / renewables based business models
Ability to capture a new market segment that was previously served by engineering companies and 3rd parties. Installation, maintenance, service and integration of electric output to the grid
Establish long term contractual relationships with customers (for e.g. solar leasing)
Reduce supply needs to balance load by switching to distributed generation. Solar installations have proven successful to take off weather sensitive loads during peak periods
Optimization of own RECs / RPS requirements
Partnerships with 3rd parties to expand customer bases, service capabilities and increase revenues



Scope

EIA estimates between 28 – 61 Billion KWh of distributed generation by 2025
The renewable distributed generation market is projected to be around 15 GW of capacity by 2015
Significant growth in solar – NJ, AZ, CA, NV, MA, HI and MD. TX seeing strong demand for NG generators



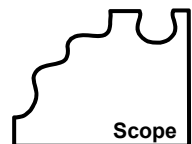
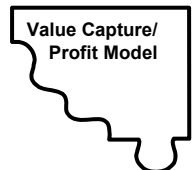
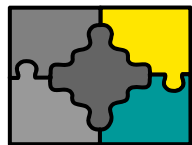
Strategic Success Factors

Favorable state incentives for Solar and Wind distributed generation installations
Lower solar panel and natural gas costs
Ability to support longer term financing / cheaper capital costs
Favorable regulatory commission and ISO protocols and incentives for integrating distributed generation into the grids



Product and service design framework – Solar / Distributed generation

Examples of key competitors



Traditional players			Non-traditional players	
FPL	Duke	Exelon	Honeywell	Johnson Controls
<i>Top national electric companies by retail customers</i>				
Residential and commercial solar installations support Rebate program from \$1000 - \$50,000 for solar water heaters and PV systems Net metering and grid connectivity	Started focusing on solar for residential and commercial customers recently Multiple rate options for grid inter connections State incentives and tax credits	Provides end to end services for customers - planning, permits, installation, maintenance of solar (through home services) Solar leasing program in 7 states (20 years)	Residential solar focus (hot water/load reduction) Strong networks of independent local installation contractors C&I engineering, design, project mgmt, energy market experience	Leveraging existing customers Single partner for design, financing, operations and maintenance
Peak demand reduction and reduced electric distribution upgrades Funds from state energy efficiency incentives, PUC approvals, Federal credits	Selective support to solar / DG programs on a region by region basis Customer engagement and partnership opportunities Large scale solar farm installations	Excess buy back through net metering Multiple Utility scale solar generation farms Customer engagement and lock in opportunities SREC market	Governmental energy/renewable rebates/incentives Installation and monitoring services	Integration into the building energy management systems
Primary focus on Solar water heaters and PV systems Commercial and residential	Customer own power generation with interconnectivity to the grid Commercial and residential	Solar and DG programs in all 3 Utility territories with BGE leading with a wide variety of solar services	Usage optimization based on solar production	Solar, wind, geothermal, biomass, biogas
PUC support for rate recovery / rebates for solar Favorable net metering program based on regulatory rulings	State and federal programs for renewables and solar installations	Strong support in MD, IL and PA State and federal incentives for solar Strong customer education and renewable awareness	Innovative business structures and financing	Dominant position in the building automation space Early entrants Emphasis on customer analytics and equipment control



Product and service design framework – Energy Efficiency

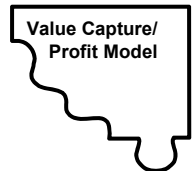
Overview of business design elements



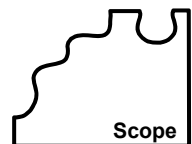
Business Design Elements



Customer Selection/ Value Proposition



Value Capture/ Profit Model



Scope



Strategic Success Factors

Description

Customers are increasingly viewing electric companies in energy advisor roles as compared to just supplying energy. Both customers and electric companies are recognizing energy efficiency as a source of power generation.

Energy efficiency programs are targeting optimization of energy use, quality / reliability improvement, equipment monitoring and maintenance, benchmarking and asset management services for customers. Customer value is driven by the optimization of the entire energy usage cycle.. For larger customers energy efficiency programs range from building energy management systems (BEMS) to energy equipment management. For residential customers, focus has been on optimizing customer usage behavior and appliance efficiency improvement.

Better customer engagement and long term energy advisor relationship
Summer peak reduction and lower maintenance and upgrade costs for T&D services
New market revenue opportunities for services like benchmarking, usage monitoring and equipment lifecycle management
Leverage full value of technology investments (e.g. SmartGrid) and consumption data availability
Partnerships with 3rd parties to expand customer bases, service capabilities and increase revenues
Increased customer satisfaction

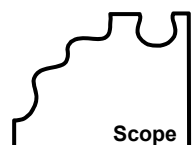
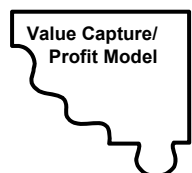
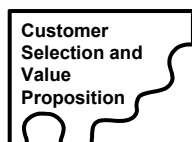
Estimates for energy efficiency contribute to 35 - 82GW of peak capacity reduction by 2020 and reduce annual growth rate of electricity consumption between 22 – 30% till 2030
Projected energy savings of 400 TWh by 2030 of which around 190TWh would be from the South region

Technology development and smart meter based data availability has unleashed a wide range of efficiency solutions at lower costs. Big data based remote assessment of energy usage is being utilized
State level and Federal level incentive programs exist
Higher commodity cost cycles and customer perceptions on energy usage are driving demand for solutions



Product and service design framework – Energy Efficiency

Examples of key competitors

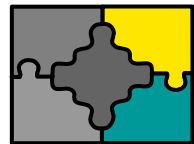


Traditional players			Non-traditional players	
FPL	Duke	Exelon	Honeywell	Johnson Controls
Top national electric companies by retail customers				
FPL Energy services offers a variety of energy efficiency programs- energy surveys / audits,, AC, insulation, roofs, equipment maintenance and on-call services. Efficiency rebates for customers	Full engagement with customers around energy analysis, house calls, appliance recycling, peak usage reduction and incentives for energy efficient equipment installation	PECO, BG&E, ComEd offer extensive Energy efficiency programs – efficient lighting, appliance recycling, efficiency rebates, house calls, thermostat controls, retro commissioning, analysis	Large/medium sized C&I and residential focus Customized customer focused program Targeted programs based on market requirements	Large/medium sized C&I and residential focus Control systems, products, energy efficient equipment and implementation knowledge
Company benefits from additional revenue through new services. Ability to reduce summer peaks – 1,865 MW Third party subscription model – profit share	Better manage peak loads through the Smart Saver and demand response program Non meter services revenue Energy efficiency funds	Delay new generation build (reduce IL usage by 2% - 2015) Energy services business segments projected as growth areas for the companies	Management of energy efficiency programs Guaranteed performance contracts	Energy performance contracts Revenue share based on savings
Programs for both residential and commercial customers – Rebates based energy efficiency installation programs	State by state programs by residential, business and large industrial customers Rate case support	Efficiency programs are designed working closely with the state PUCs for meeting local needs Additional customer segment focus (e.g. transportation industry)	Managing DR/efficiency programs for over 100 utilities 150M home controls, 10M building controls, 1,000's of industrial sites	2,500 performance contracts w/ guarantees of more than \$4.6B Manages 1.5B square feet of commercial real estate
FL PUC support for summer peak reduction programs Customer education and a strong 3 rd party partnership and promotions model	Favorable regulatory support Long term alternative for new generation / T&D upgrades Customer satisfaction	Strong backing of local PUCs of each Utility 3 rd party partnership network Brand awareness	Technology integrated solutions (utility and facility control systems) Experience and proven energy efficient programs	Combination of process, technology, people and accountability Aggregated (Energy, water, technology, & behaviors) approach to building efficiency



Product and service design framework – Smart Meters / Intelligent Grid

Overview of business design elements



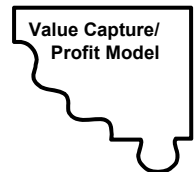
Business Design Elements

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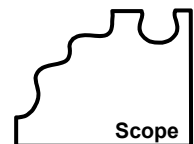
Customer Selection/ Value Proposition

Smartmeters have been positioned as the foundation for an intelligent grids that can support a variety of customer engagement functions around 'smart' electric consumption
More than 33% penetration rate by 2012
Real time energy usage monitoring, control, TOU and CPP types of products and demand response are enabled through these meters.



Value Capture/ Profit Model

Customer value is through energy savings, two way supply opportunities, better engagement, effective and cheaper reliability and maintenance programs and close to real time usage data access
Smart meters enabled offering new types of retail products to customers based on usage
Companies are reporting better operational efficiencies and cost reductions in areas like customer communications, maintenance services (T&D), outages and billing
Technology now exists to make the grid 'two-way' flexible and enable demand side management and DR programs
Higher customer satisfaction
Federal funding and rate recovery for smart meters / AMI installations
Big data based analysis services



Scope

Companies are offering a variety of functions utilizing the smart grid infrastructure – Direct load control, asset monitoring, dynamic usage based pricing plans, remote thermostat access, networking, theft protection, demand response, distributed generation metering, energy usage displays, benchmarking, remote surveys and load forecasting



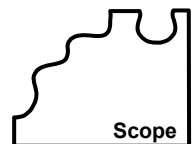
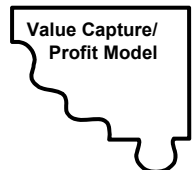
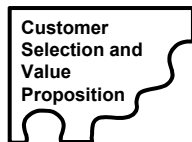
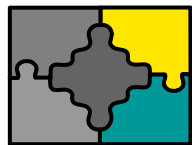
Strategic Success Factors

Strong federal and state PUC level support and rate recovery for smart meter roll-outs
Favorable 'opt-out' programs and regulations
Customer awareness and education
Innovation - vendor and 3rd party company collaboration to develop new products and services



Product and service design framework – Smart meters / Intelligent grid

Examples of key competitors



Traditional players			Non-traditional players	
FPL	Duke	Exelon	Honeywell	Johnson Controls
<i>Top national electric companies by retail customers</i>				
<p>Enable better control and real time information for customers</p> <p>Enhanced customer service, outage prevention / faster restoration, lower long term service costs</p> <p>Customer data analytics</p>	<p>Better control over energy usage</p> <p>Lower costs for Utility operations</p> <p>Cheaper and environmental alternatives to generation</p>	<p>Through its Utility companies Exelon offers full scale customer services on its smart grid platform – energy efficiency / conservation, demand response, load shifting, usage based prices and monitoring</p>	<p>Leveraging existing customers</p> <p>Integration of various C&I systems with utility installed system</p> <p>Automated efficiency /energy mgmt decisions</p>	<p>Large to mid-size C&I and institutional</p> <p>Intuitive integrated product suite</p> <p>At-a-glance visibility into actionable information</p>
<p>Lower operational costs and increased response times</p> <p>Big data backed customer analytics and roll-out of various customer programs</p>	<p>Enhance traditional Utility operations, better customer communications / satisfaction</p> <p>Reduce operational costs and improve response times</p>	<p>Ability to enable peak reduction, load management, home energy reports , online monitoring services, remote communications, dynamic pricing and operations cost savings</p>	<p>Linking installed Honeywell energy efficiency products with smart meter pricing</p>	<p>Leveraging available grants, rebates and incentives</p>
<p>More than 4.5M customers on smart meters</p> <p>\$800M smart meter / AMI program with \$200M of DOE grant</p>	<p>More than a \$1Bn program – started in OH and Carolinas. In regulatory discussions in IN, KY and North, South Carolina</p>	<p>All customers projected to have smart meters by 2015 (with opt-out exceptions)</p>	<p>Big data analysis and remote quality monitoring services</p>	<p>Biggest player in the building automation and BEMS space</p>
<p>Federal- DOE and FL PUC backing</p> <p>Technology innovations and addressing customer engagement</p>	<p>Federal- DOE and State PUC backing (\$200m Federal funds)</p> <p>Customer education initiatives and comprehensive regulatory strategies</p>	<p>Recipient of Federal funding and rate case based recovery of costs</p> <p>Customer messaging around cost savings</p>	<p>Customer control and convenience</p> <p>Smart grid value delivery</p> <p>Customer engaging solutions</p>	<p>Strong network of partnerships and collaborations</p>



Product and service design framework – Other Customer Services

Overview of business design elements



Business Design Elements

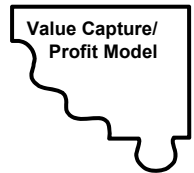
Description



Customer Selection/ Value Proposition

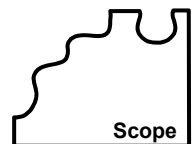
As customers are becoming more receptive and comfortable with new technology and service models, companies have come up with a variety of non-core value add services –

- Usage and control – Real time access over smartphones, thermostat and lighting, usage triggers
- Appliances – Installation, maintenance services, warranties, rebate management
- Home improvements – lighting, insulation, roofs, window glazing, rewiring and electrical contracting
- DG, PGEV – Charging stations, solar leasing, installations and maintenance, batteries, energy storage, permits, local contractors, state and federal incentives
- Loyalty and Rewards – Bundling services, rewards partnerships



Value Capture/ Profit Model

Position as a 'one stop shop' for providing all energy related customer services and products
Incremental revenues that support complementary products and services
Low customer attrition - Industry surveys and research shows a high level of customer stickiness when multiple products / services are procured
Better future positioning to address new market, technology and customer behavior changes



Scope

Majority of the big electric and gas companies are providing multiple non-core products and services
Certain services are in pilot stages OR very regionally focuses (e.g. distributed generation and PGEV)
Significant participation from non-traditional players integrating backwards (e.g. cable, telecom, engg services, appliance manufacturers and finance companies)



Strategic Success Factors

Strong third party and vendor network and collaboration models
Customer messaging and marketing around end to end energy services
Technology and product innovation and market support
Targeted growth areas and gradual ramp-up compared to large scale investments



How should Utilities respond to these emerging opportunities?

Rather than allowing distributed generation to erode revenues, utilities can embrace this new reality – become “A project enabler and operator, and a system integrator of RE” based on a “Prosumer” business model





Solar policies in India



Understanding grid hosting capacity

A common apprehension that remains with Distribution utilities is the lack of awareness on grid hosting capacity of distribution grid for connecting rooftop solar PV with the system and how to enhance it to meet the ambitious rooftop targets. Though different states have come up with separate limits on consumption or capacity of rooftop based on distribution capacity (transformer ratings/line capacity), such limits are not based on any sound technical assessment. Very soon the question of equality and right to generate and trade would come up and hosting capacity would need to be enhanced.



Understanding Impact on DISCOM

1. Investment Recovery
2. Grid Connection Charges and Distribution Network Tariffs
3. Rules Forbidding RES Energy Curtailment Except For Security Issues
(e.g. Curtailment of power feed-in at PCC ; Active power control by PV inverter P(U); SCADA + PV inverter control (Q and P) ; Wide area voltage control)
4. Insufficient Self-consumption Framework
5. Insufficient DSO access to advanced PV Inverter Capabilities
6. Storage Solutions
7. Insufficient Framework for Demand Response
8. Incoherent Metering Framework



Understanding Technology impact

DSO solutions: network reinforcement, on load tap changers, advanced voltage control, static VAr control, DSO storage, booster transformers, network reconfiguration, advanced closed-loop operation;

Prosumer solutions: prosumer storage, self-consumption by tariff incentives, curtailment of power-feed in at PCC, active power control by PV inverter, reactive power control by PV inverter;

Interactive solutions: demand response by local price signals, demand response by market price signals, SCADA & load control, SCADA & PV inverter control, and wide area voltage control



DSO Solution

Grid reinforcement: A cost intensive and the most traditional solution of enhancing the grid hosting capacity. To overcome the thermal and voltage limitations, upgradation of existing distribution lines and transformers is performed. This increases the capacity of the grid to host additional capacities of installed rooftop solar plants.

On-load tap changer transformers: Tap changer transformers allow the flexibility to alter the turn ratio and the voltage on the secondary side. This can be utilised to increase the voltage on the secondary side (during increased solar generation) and to decrease the voltage on the secondary side (during decreased solar generation). On-load tap changer transformers will allow altering the turn ratio while the transformer is live.

VAr control: VAr compensators can be utilised to provide instantaneous reactive power under various network conditions. This is necessary to maintain voltage in the grid.

DSO storage: Storage systems can be installed at the DSO level for various applications such as peak shaving, power shifting and provision of ancillary services in the distribution grid. The storage systems can be utilised for solving various problems in the distribution grid.

Booster transformers: Storage systems can be installed at the DSO level for various applications such as peak shaving, power shifting and provision of ancillary services in the distribution grid. The storage systems can be utilised for solving various problems in the distribution grid



Prosumer Solution

Prosumer storage: Storage systems can be installed at the prosumer level for reducing the value of injected power into the grid. The intermittent generation from the rooftop solar plants is absorbed by the storage systems thereby mitigating local congestion and voltage problems.

Tariff incentives: Direct or indirect incentives provided for self-consumption of power from rooftop solar plants reduce the load in the distribution grid. This can be achieved by the prosumer by optimising the consumption in relation to the production by the rooftop solar plant. A fixed tariff system in which the feed-in price is lower than the consumption price of the power generated by the rooftop solar system incentivises the prosumer to shift the electricity consumption thereby decreasing the power injected into the grid.

Curtailement of power feed-in: The solution controls the power fed-in by the rooftop solar plant into the grid below a fixed contracted value. 70% of the installed PV capacity has been mandated as the maximum contracted power injection in the German Renewable Energy Act. The solution powers down the PV power produced or activates a dump load for absorption of power produced. This way a significant drop of power will result in only a small loss of energy production since the real production of the rooftop solar plant seldom reaches values close to the installed capacity.



Interactive Solutions

Demand response by local price signals: Demand response is triggered by the local price signals available to customers connected to the feeders that experience congestion problems. The price signals can be set directly by the DSO based on the estimated grid situation. Different consumer electricity prices are defined within the DSO network according to grid loading. The solution requires a smart energy interface which is able to receive variable price signals, a smart network and SCADA on the DSO side.

Demand response by market price signals: Demand response can be triggered by electricity market price signals which are identical for consumers wherever they are located.

SCADA + direct load control: DSOs are allowed to curtail consumer demands based on an agreed contract. A capacity payment is made to the consumers who allow third parties to make use of their flexibility in emergency cases.

Wide area voltage control: The solution includes all voltage and VAr control technologies available in the distribution grid, combined to efficiently monitor and regulate power, voltage and reactive power. Equipment like OLTC, capacitor banks etc. are coordinated to optimize voltage and power factor in the complete DSO area.



Possible aspects to be considered for FoR

- 1) Appropriate institutional reform for accommodating distributed generation, market competition, efficient grid operation, resilient and smart grid and finally framework for investment recovery in all sector. Still very low level of liquidity in the market with bulk of the generation locked up in 20-25 year PPAs,
- 2) Overall market restructuring and strengthening market with new products
- 3) Development of processes and policies for segregation of wire and supply
- 4) Bundled power dispatch (with RE in other states) and thereby ensuring sale
- 5) Appropriate DR and DSM measures to ensure grid stability
- 6) Optimizing asset value, appropriate planning and investment
- 7) Appropriate design of accounting framework and rollout plan
- 8) Enhanced regional market and bilateral cooperation. Participation of regional players in Indian power market.
- 9) Institutional reconfiguration considering aggregator (Karnataka regulation) or balancing groups ensuring commercial and physical settlement



Shuvendu Bose

Clean Energy Services , Power and
Utilities, Ernst & Young

India

