

Smart Benefits

Whoo-Hoo!

It's Disruption Baby!

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Dumb Benefits



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I got a call from a young friend and really bright former colleague....

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Bright guy, with an education that probably cost a bazillion dollars  
(big investment in his head)

He wants to tackle the world one roof and integrated  
battery storage system at a time....

(helping customers avoid)

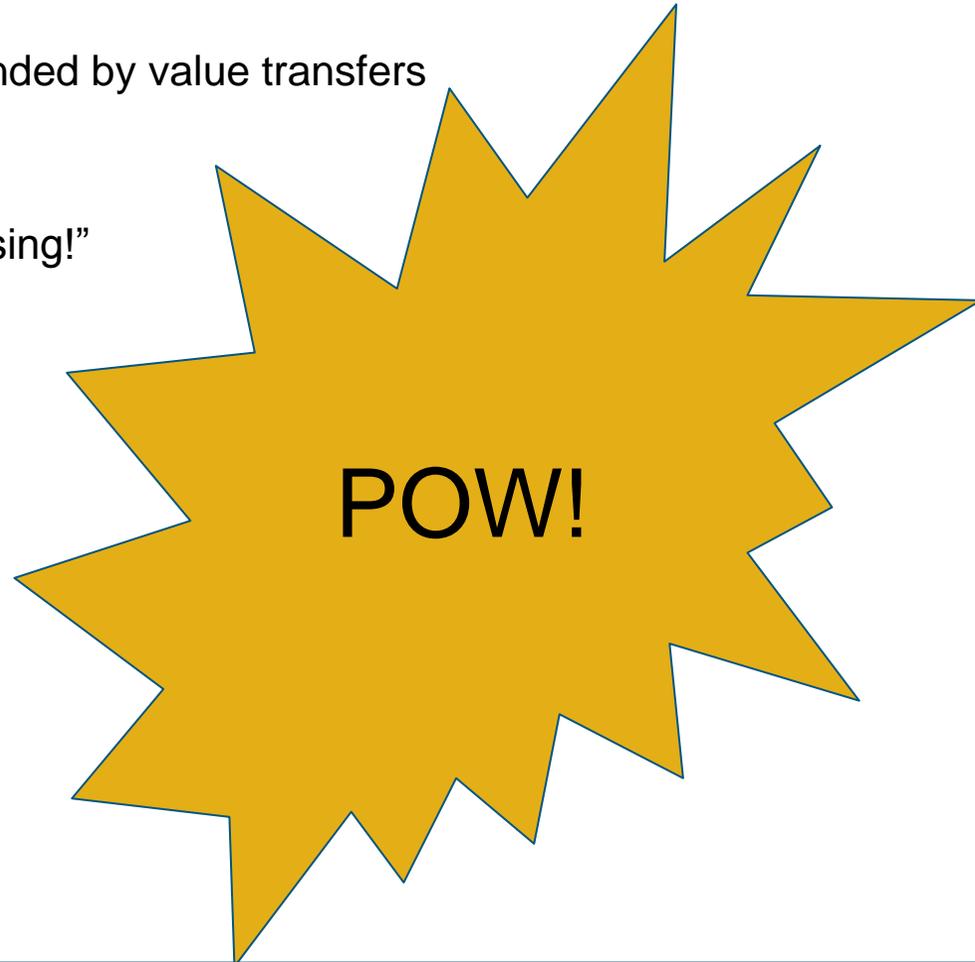
The business case of which derives mainly from network costs....

So is it really smart to take our young bright sparks, fill their heads with really expensive, highly credentialed brain power, and set them loose stealing money from networks?

## He said it was all about DISRUPTION

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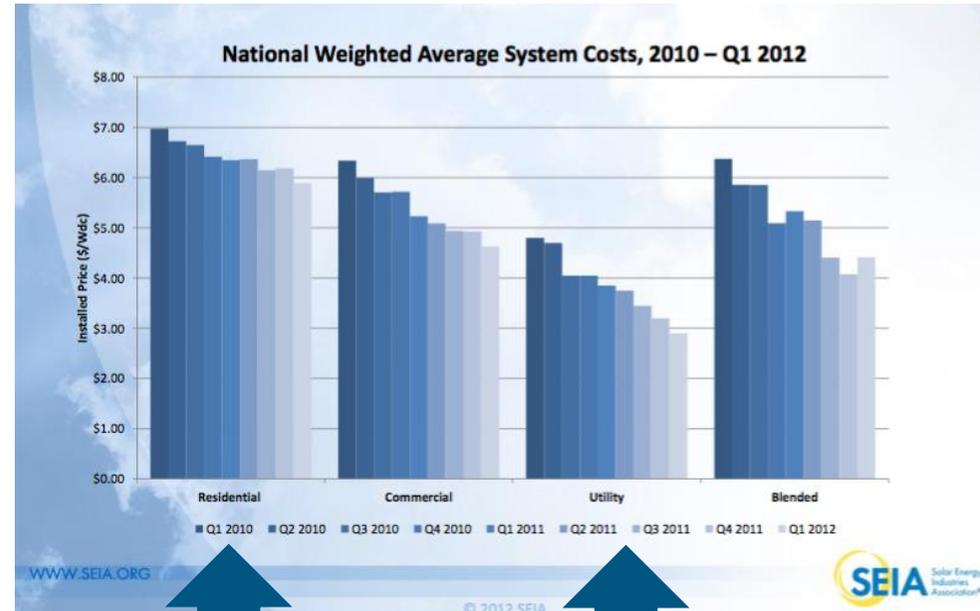
- He knows the business model is substantially funded by value transfers
- But he says – “look at all the technology we’re using!”
- The utility is dead....



Is this what Joseph Schumpeter meant by “Creative Destruction?”

# No, too often it is about bad markets, bad pricing, or bad policies

- Smarter grid pricing would delay some solar rooftops, but solar would still have happened soon enough
  - Value transfer is a natural part of creative destruction in markets, but when policies induce value transfer, especially when they do so very rapidly, unintended consequences tend to be more severe
- So was cannibalising network revenue necessary or appropriate?
  - Was the rush worth the chaos that has followed in some markets?
  - Has it been worth it creating new stakeholders with vested interests in bad pricing policies?
- Where does it all lead?



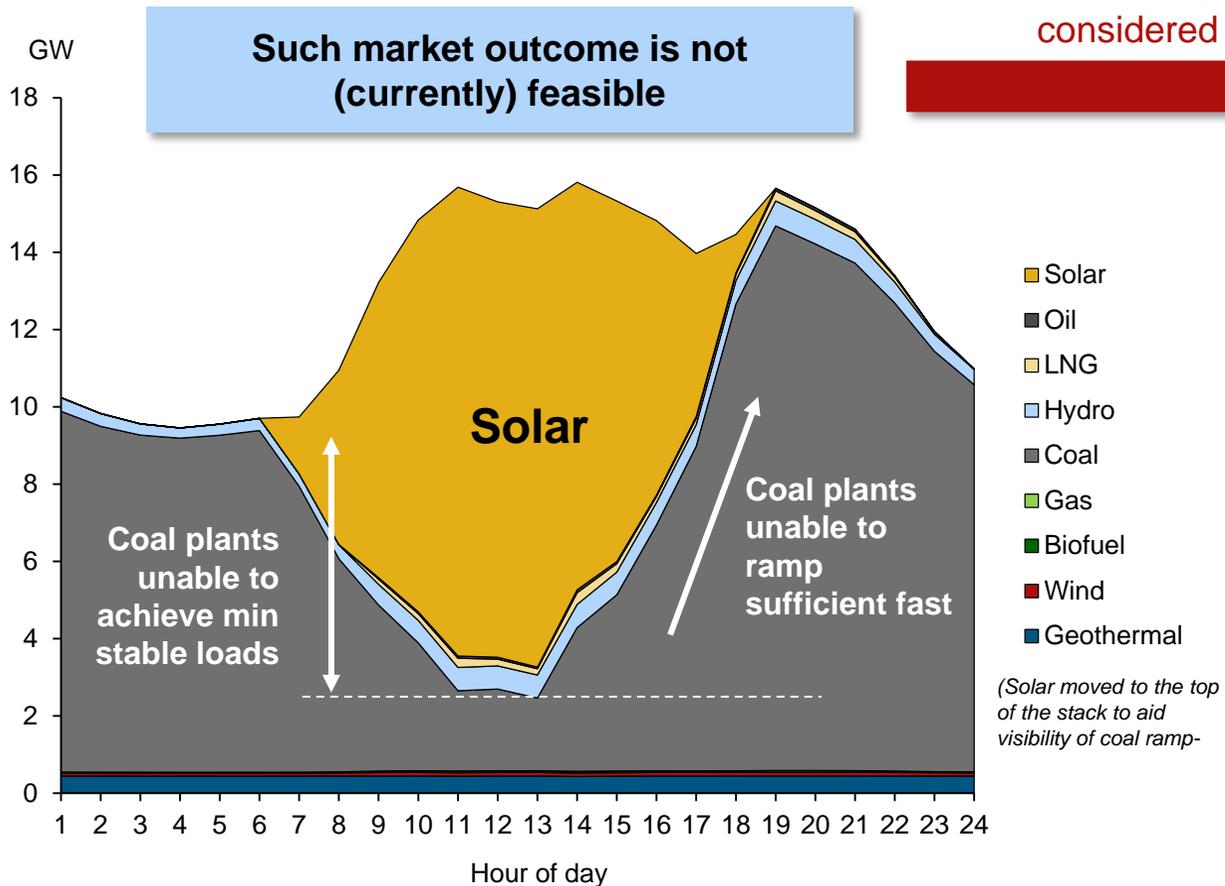
Res. Rooftop Solar

Grid Connected Solar

Dumb spreads dumb

# If policies go too far, the outcomes can *increase* cost or *reduce* security

## Possible Luzon Grid (Philippines) Scenario



## Possible outcomes (less solar will come in)

Demand and value for flexible generation sources will increase (e.g., LNG and/or battery) but also raising costs to consumers

Solar may be curtailed to ensure system stability if too much is built due to out-of-market policies

Other technologies will be needed and/or costs will increase

# It's not the smartest benefit unless it links to an underlying smart proposition

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- How to improve the use of the physical infrastructure capabilities
  - Reduce safety margins – reduce capacity requirements
  - Increase efficiency (reduce fuel use)
  - Reduce maintenance costs
  - Identify and monetise opportunities for new technologies (storage)
- How to create more value for customers
  - Reduce waste – don't use or pay for what you don't need (buy in vs self-supply vs do-without)
  - Develop pricing and service programmes that match customer needs
  - Easier and faster connect/disconnect/repair transactions
  - Provide enablement technology and capability to integrate customers with the bid data world
- How to enhance environmental outcomes
  - Reduce emissions through smarter dispatch and increased thermal efficiency
  - Provide platform to support emissions markets and more flexible / cost-effective emissions regulations



# Technology and data analytics are enabling *faster recovery from bad policies* – rescuing value or accelerating transformation

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- Creating capability to recover from policy-exacerbated duck curves
  - New opportunities for storage and flexibility
  - Monitoring, predicting, influencing demand / Enabling and supporting faster response supply
- Enabling demand response that reduce the cost of “missing money” problems
  - by supporting more diverse array of resource availability that can be developed and put to use much more quickly than a new power stations or network components can be built
- Improving forecasting and awareness to improve integration of intermittent resources
  - Forecasts closer to real time that can be acted on, are inherently more accurate
- Enhancing the robustness of demand forecasts
  - Would you want to invest on a demand forecast that had huge hidden demand response or energy efficiency conversion potential underneath it?

Key question: how can we make even better use of whatever resources we have?

# The smartest benefits come from the smartest pricing

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- Enabling active or passive response
  - A way to transmit a condition or state to someone or something that can respond to it
- More granular pricing of energy and ancillary services
  - More frequent prices
  - Time of use
  - Co-optimisation of ancillary services
  - Prices for valuable attributes or services
  - Payments to attributes that are growing scarce (and thus have value / cannot be taken for granted)
- More fixed pricing of network access
  - Less avoidability and value-shifting
  - More customisation based on services required
- Prices that can be hedged with financial hedge instruments

# New players finding ways to use data to change behaviors or outcomes

## Energy optimization

## Customer Bill savings



## Operations improvement



## Energy Efficiency



Every year the list of energy “stakeholders” seems to double

**Big** Data is also about making practical use of information previously not available or not able to be processed and interpreted within a useful time frame

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*It needs to be fit for purpose*

Veracity



Volume

*Many sources, Collected frequently*



4 Vs of Big Data

(IBM 2014)

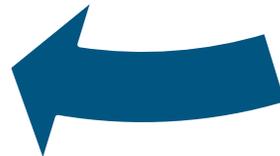


Variety

*We can now mash up Data from different sources to create (even) richer information*

Velocity

*We want to speed up the process of gaining insight or informing decisions*



## I want my (I want my) smart benefits?

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- Network operations
- Customer value propositions
- Operating cost control and asset management

Three areas where we see benefits

# Where are my benefits?

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- Network operations
  - Optimising generation resources in operation (energy and ancillary services)
  - Reducing capacity for a given level of reliability
  - Delivering differentiated power quality based on willingness to pay
  - Fault anticipation and recovery
- Customer value propositions
- Operating cost control and asset management
- Dispatch Engine Capabilities
  - Network and system constraint automation
  - Co-optimisation
  - Dispatch interval
  - Predispach information
  - Gate closure / rebidding
- Ancillary services cost reduction
  - Ability to act on closer-to-real-time information
  - Reduce capacity requirements for same reliability
- Network cost optimisation
  - Reduce safety margins
  - Improve outage anticipation/response/restore
- Forecast enhancement
  - Better integration of intermittent renewables

# Where are my benefits?

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- Network operations

- Customer value propositions

- Energy usage information
- Energy usage reduction/optimisation
- Energy content information / assurance
- Targeted offerings
- Faster response

- Operating cost control and asset management

- Metering

- More sophisticated energy pricing, running up to full real time pricing
- Reduced losses / theft
- Enhanced forecasting

- Sales Targeting

- Integration of customer-side generation, with either off-system sales or storage
- Collation of data sources to enhance targeting

- Usage Targeting

- State monitoring of energy using appliances, enabling passive or intelligent rules-based intervention
- Collation of data sources to enhance forecasting

# Where are my benefits?

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- Network operations
- Customer value propositions
- Operating cost control and asset management
  - Reduced maintenance costs
  - Optimised inventory
  - Anticipate and respond to actual state, rather than schedule
  - Enhanced workforce productivity
- State awareness
  - Enhance accuracy and reduce safety margins, inventory, workforce idling, etc.
- Pattern identification
  - Failure rates / types
  - Performance to specifications
- Enhanced planning
  - Reduce cost through enhanced sourcing, design
  - Reduce requirements from ability to use existing system more efficiently
- Enhanced recovery from failure
  - Actual recovery time reduced
  - Ability to manage situation / report to regulator

# Most disruption “benefits” are being driven by commercial responses to perceived opportunities – but what about the “market itself”

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- How much is it worth – to the market – to know more about:

- What is happening?
- What actions can I / should I take?
- Why did it happen?
- What could happen that I should prepare for?



IBM (2014)

Is it worth it? – and how do we know?

# Quantifying “benefits” can be difficult until after-the-fact – some faith is required

- Disruptive technologies respond to perceived value, whether real value created or value to be transferred
  - Getting policy analysis right – focusing on policies that don’t feature massive value transfer risk – hard, but important
- But “market improvement” investments often require a cost-benefit “test”
- Four bins

Often Large -- But What Do You Attribute Them To?

Benefits that if known could be achieved in any arrangement without big data

EG:  
Better Capacity Market  
Changes to network pricing  
Market power mitigation

Often Small or Require Information Not Readily Available

Benefits that are achievable with more accurate information, if available

EG:  
Shorter dispatch interval  
Gate Closure Reduction  
Dynamic loss factors  
Co-optimisation of E+AS

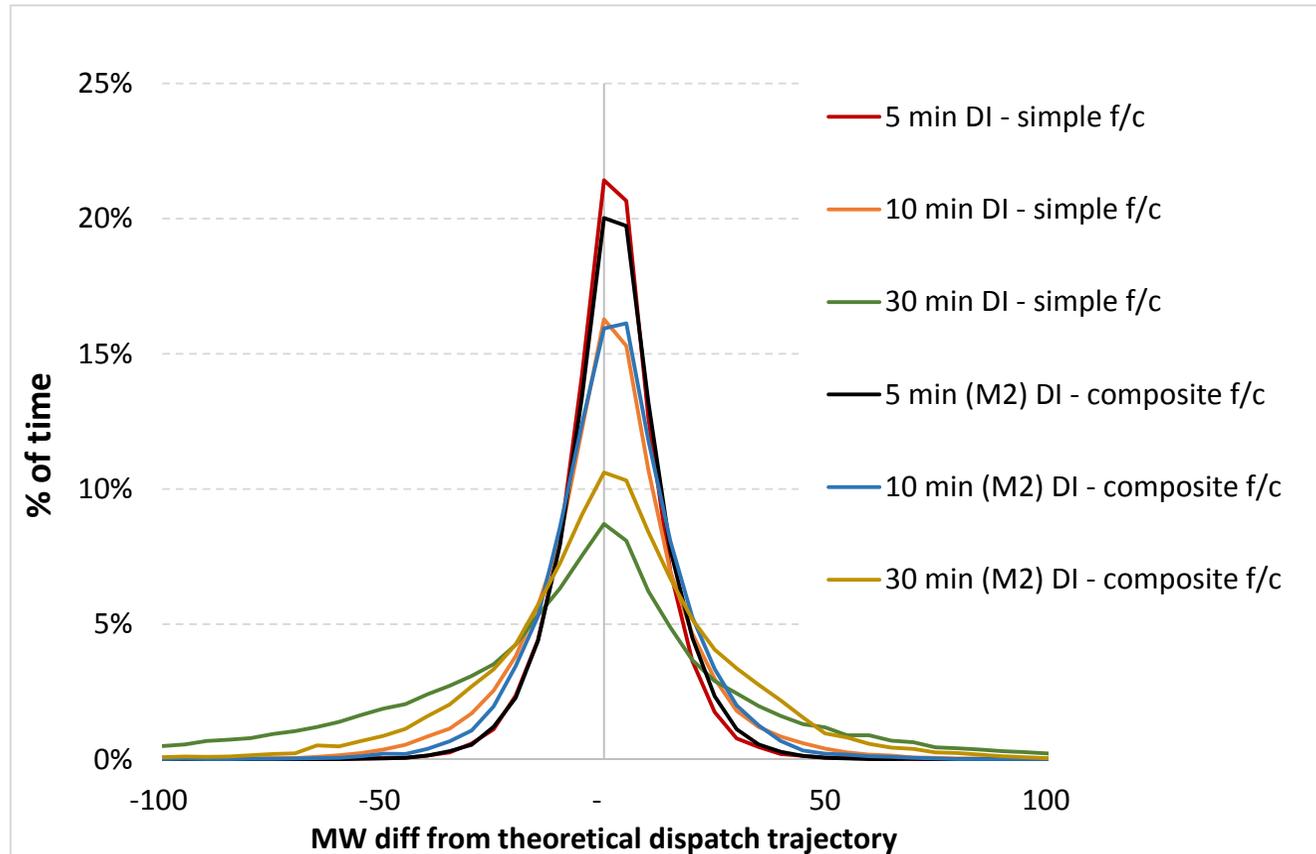
Benefits achievable with faster response if possible

Probably Most Relevant But Most Contentious

Theoretical benefits that make you more future ‘proof’

EG:  
Nodal Pricing

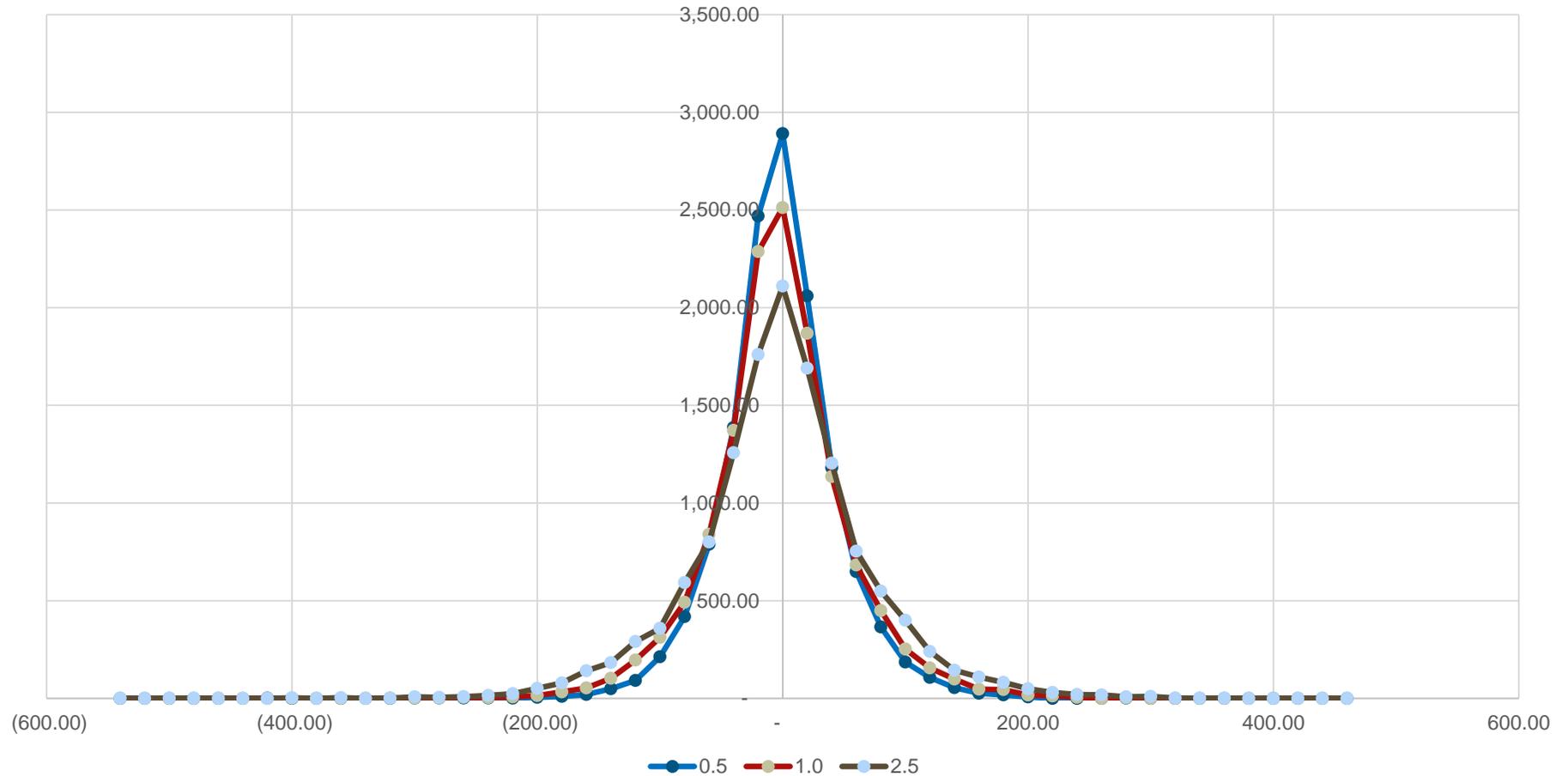
Many opportunities to use more data, faster → reduce ancillary services costs



As systems speed up

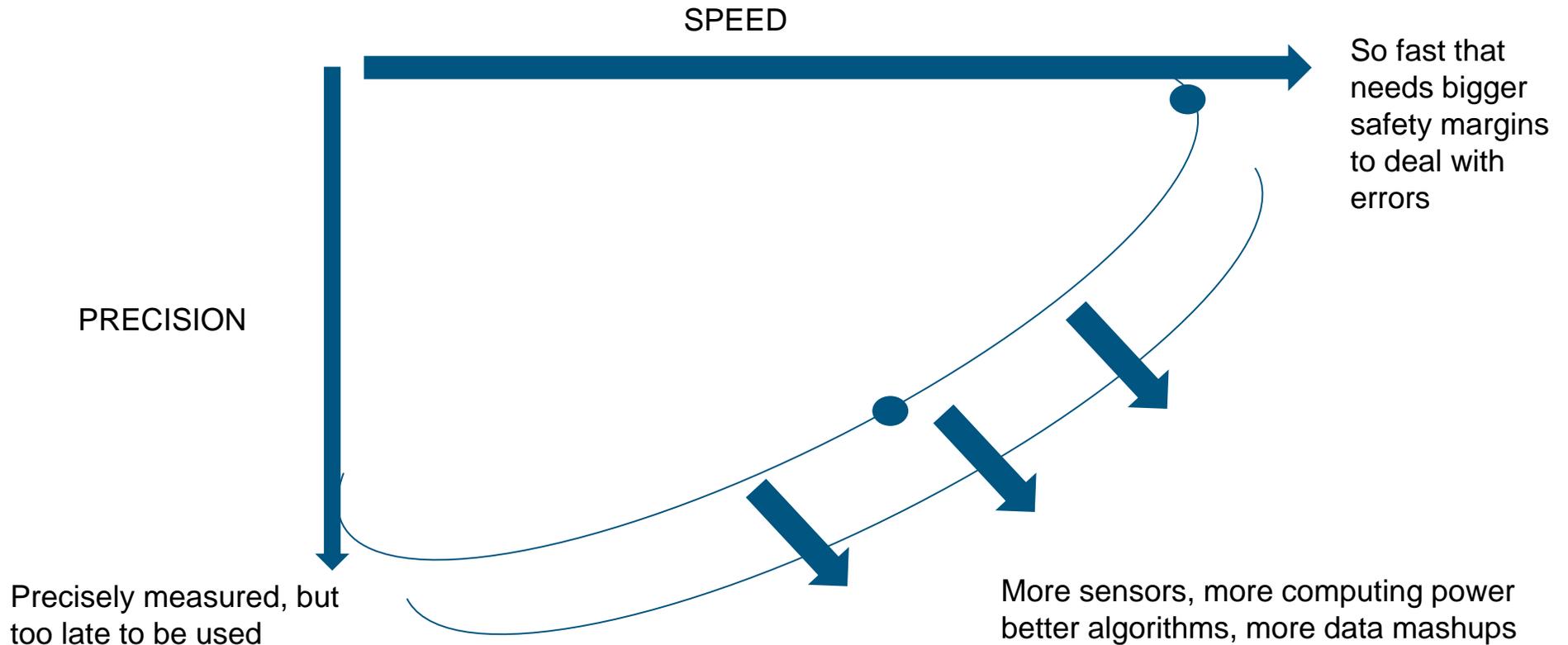
Opportunities to make decisions closer to real time with responsive technologies → take advantage of better forecasts → reduce cost

Demand Forecast Error Improvement 2.5 Hours Out to 0.5 Hours Out



## Challenge: finding the right combination of speed and precision

- At each opportunity, look for opportunities to enhance systems to accommodate greater state awareness, and more frequent and accurate price signaling



# Mash-ups are at the frontier of smart benefits: data gains value in new ways

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- If your car knows you aren't home, you can set rules for power usage at home, depending on whether you are coming or going
  - But whatever knows whether you are coming or going probably knows a lot about many other people
  - How to tap that without privacy problems to enhance usage prediction accuracy?
- Passive
    - You already do whatever it is you need to do to make it work
  - Aware
    - It requires sensor that identifies behaviour, presence, or change
  - Predictive
    - It learns to predict with greater accuracy whatever normally follows from the awareness trigger
  - Responsive
    - You can guide / override it if it learns the wrong thing



## Some place where have we gotten smart “right”

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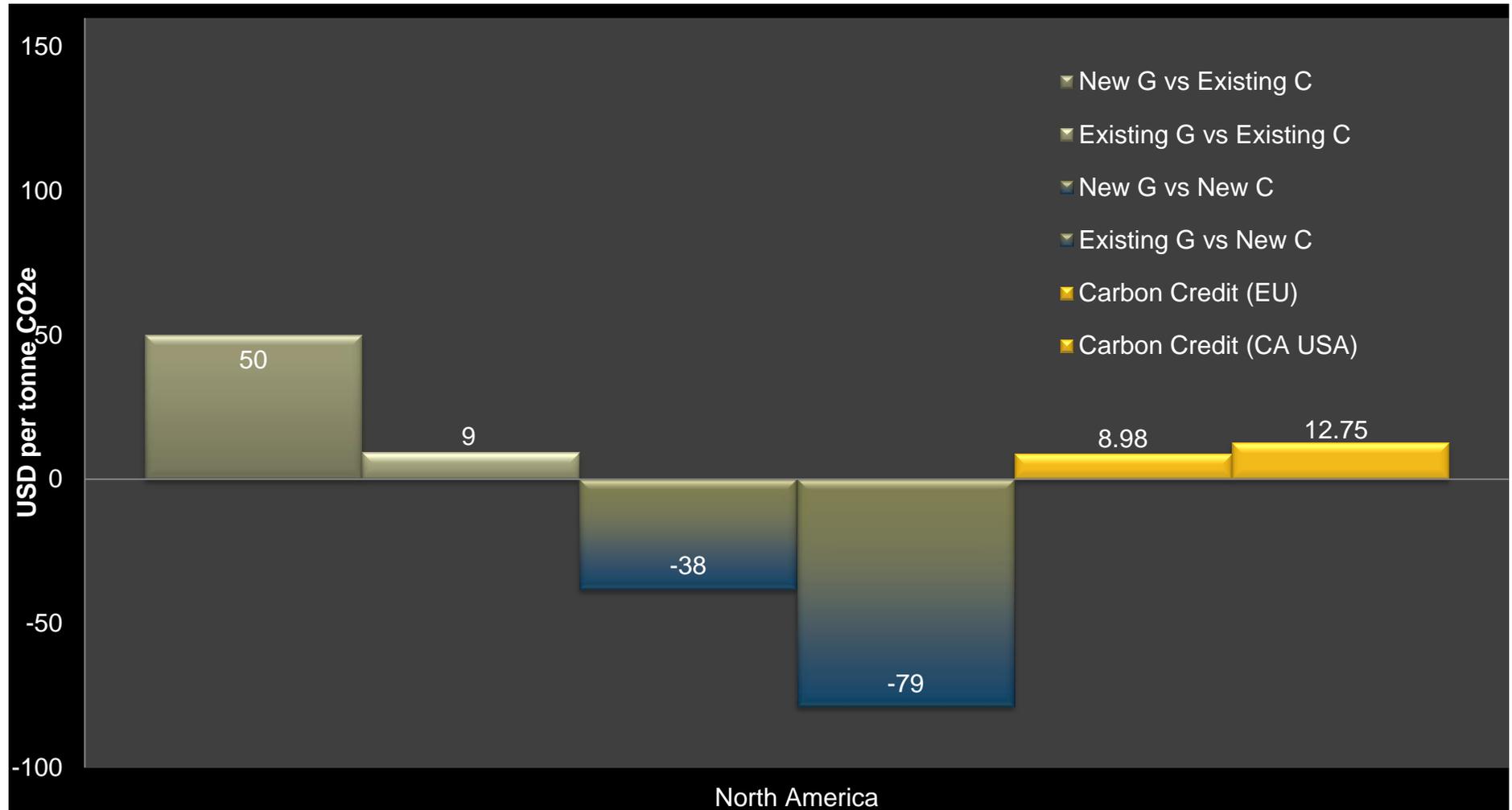
- Boiler optimisation and control systems for emissions compliance (where incentivised)
- Network cost reduction through improved operations and maintenance practices (most places)
- Co-optimisation of energy and ancillary services
- Nodal pricing
- Enhanced state awareness and forecasting / prediction
- Critical peak pricing and other time of use pricing mechanisms that combine information and signals

# Where are we (at risk of) getting smart benefits wrong

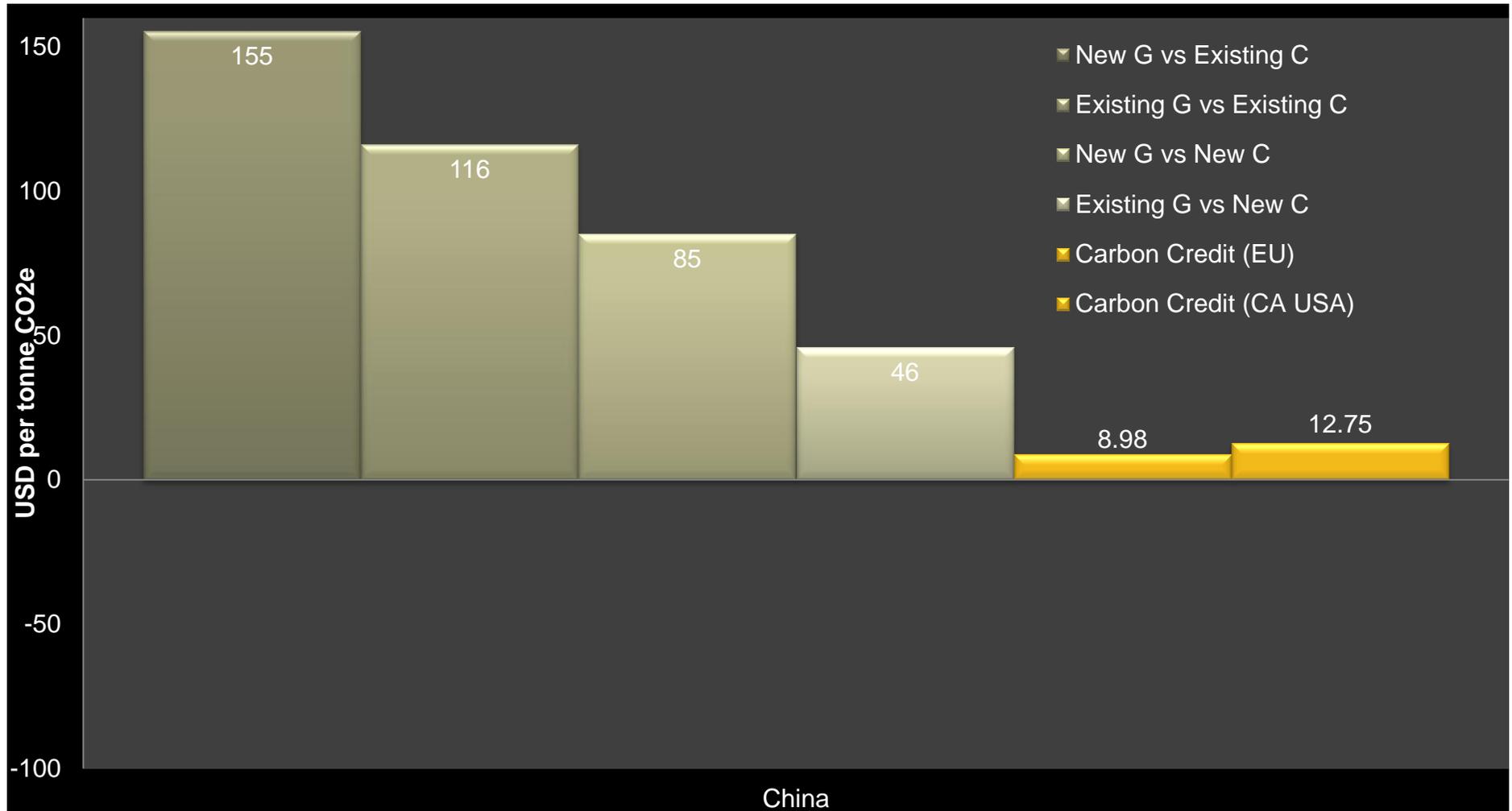
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- Technology incentivisation is a sensitive area – difficult to get right
  - Network tariff avoidance – is that really the prudent way to support technology development?
  - Efficiency benefits of really large new advanced power stations that (elsewhere) impose ancillary services costs on the system which are paid for by other stakeholders
- Environmental regulation (particularly fuel mix targets in Asia)
  - Fuel supply constraints or fuel diversification policies to shift to renewables or natural gas at prices that are much higher than the underlying emissions related opportunity costs
- Reliability of supply
  - Is it worth it to networks to continue providing equivalent reliability to all customers even when the customers are not paying for it?
- Generation / Network boundary
  - What options are available to deal with network constraints and are these efficient
- What is the role / vision of “distribution” in the future?

# North America breakeven CO<sub>2</sub> Prices to Shift from Coal to Natural Gas



# Asia breakeven CO<sub>2</sub> Prices to Shift from Coal to Natural Gas



# In Asia, the smarter benefits (per \$ spent) is new coal vs old coal (for CO<sub>2</sub>)

USD / Tonne CO<sub>2</sub>e

	Efficiency Improvement via Displacement	
\$/kW New Coal	20% less	30% less
2,000	132	65
1,000	50	18
800	34	8

Common in China

Displacing older, sub-critical boilers with ultra-supercritical boiler technology offers significant value (from a CO<sub>2</sub> perspective)

# Summary

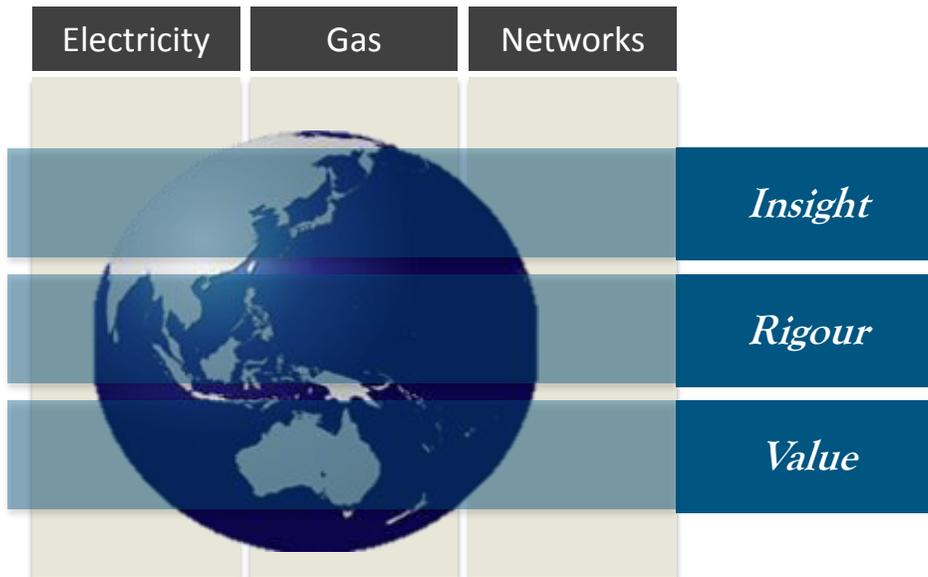
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- Smart benefits create value – not just transfer it
- The disruption to network pricing is inevitable → the question now is what does it mean for reliability of supply versus cost for each customer or class of customer?
- Smart benefits tie to some physical thing – an underlying reality that responds to more accurate signals or that can now be more accurately ascertained
- Smart stuff can provide some solutions to dumb policies – but that's not an excuse to be dumb
- We're really just at the beginning of all of this

Go forth and be disrupted, but, don't forget to get the fundamentals right first

# Thanks

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