

The energy sector is being disrupted, but the drivers form a complex mix of innovation, market-dynamics, and legacy regulatory and policy factors. The result can be a mix of desirable and undesirable impacts that introduce change but not *necessarily* progress.

Energy transformation and disruption in electricity markets

Mike Thomas

About The Lantau Group

Consultants to the Energy Sector

Competition, Markets, Regulation, Policy

Decisions Support Analysis

Disputes

Market Analysis

Asset Valuation

Strategy and Advanced Analytics

Offerings:

- Strategic, commercial, and regulatory support
- Ability to connect the dots between fuel markets
- Analysis-based recommendations
- Highly relevant international experience
- Accessible experts focussed on the region
- Pricing, trends, drivers, risks



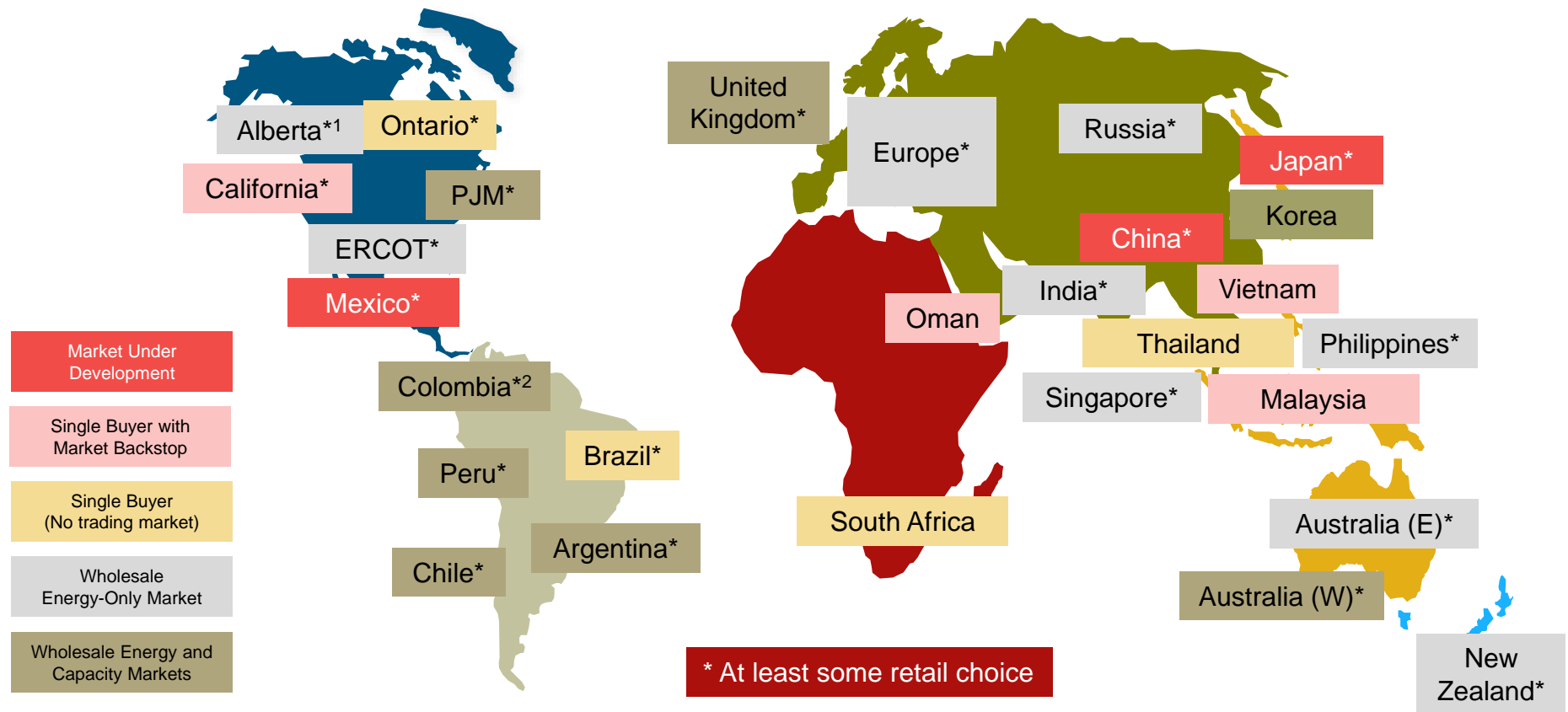
All of our work is related to the profound commercial, regulatory, and policy factors shaping the energy sector

There is no going backwards
(but which way is forward?)

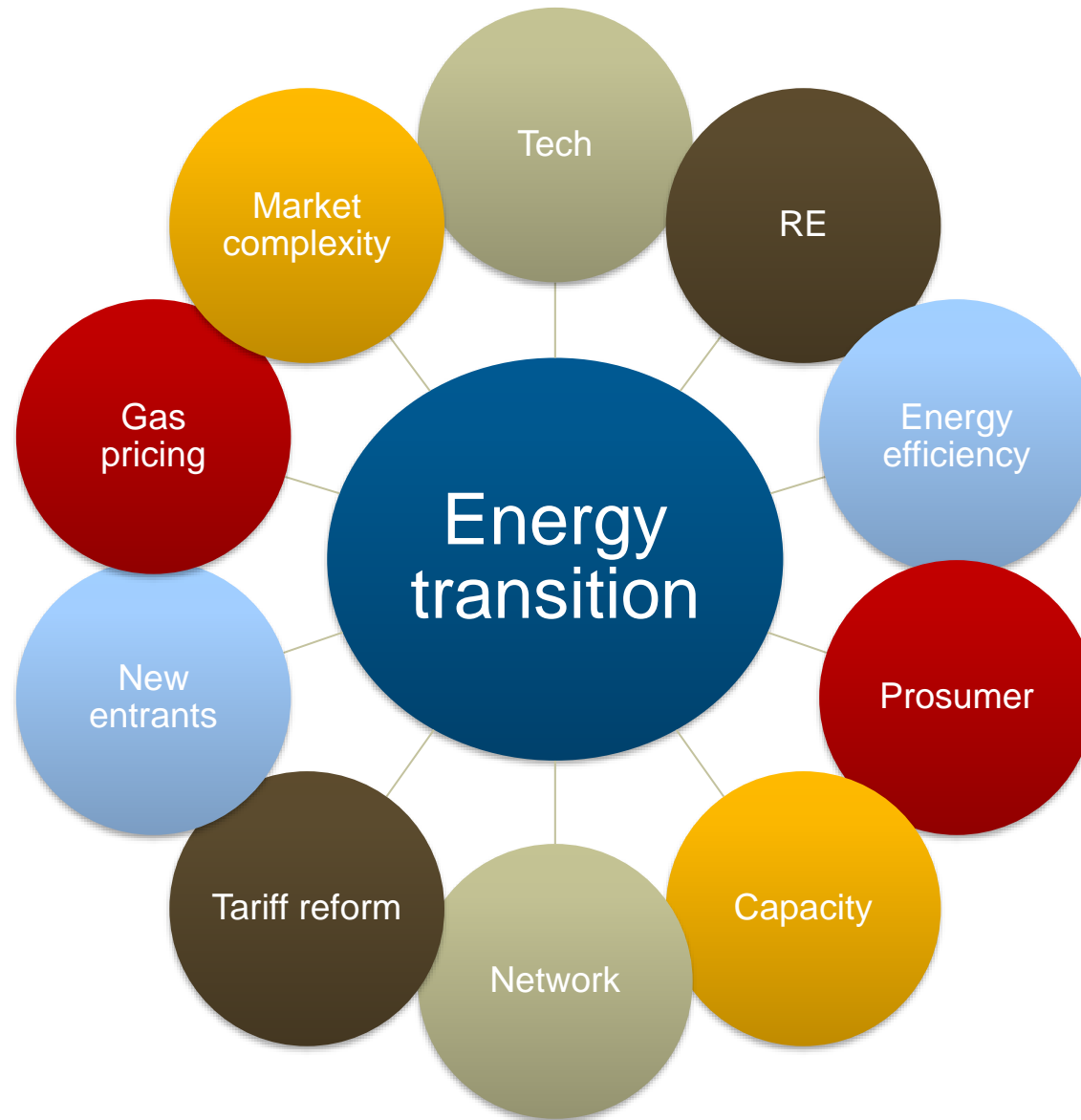


It has become nearly impossible to satisfy all stakeholders using a traditional monopoly utility model

Some version of a market or plans for market mechanisms



The number of forces and factors have increased



More Stakeholders

- Renewable energy developers
- Demand response providers
- New business models
- Tech



More Technologies

- Smaller scale technologies
- More technology stakeholders
- More differentiating factors
- Rapidly falling costs and improving performance

[More Policies](#)

- Generous Feed-in-Tariffs
- Aggressive Renewable Portfolio Standards

More “Choices”

- Ability to use competition to get lower prices from exposed suppliers
- Options for “behind the meter” generation or cogeneration
- Households with options for rooftop solar or (say) Tesla batteries
- Industrials with preferences to contract for renewable energy

Easier “Exploits”

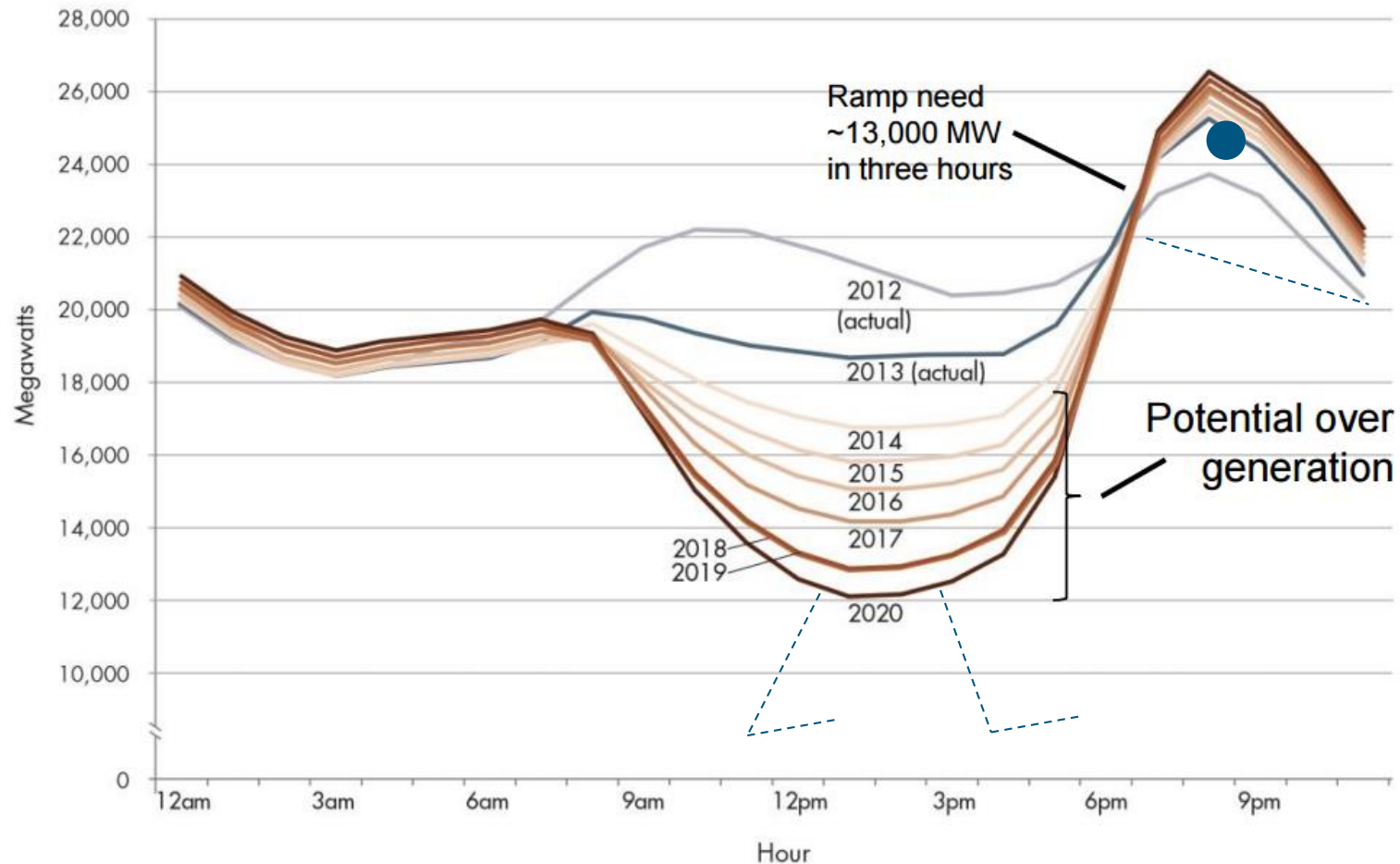
- Use distributed energy resources (DERs) to avoid paying for their share of the grid
- Cherry picking of profitable customers
- Exploiting market mechanisms
- Value shifting

And a whole lot of NOISE to filter to avoid Unintended Consequences

Holes and Ladders and Winners and Losers

System load profiles are changing dramatically due to renewable energy

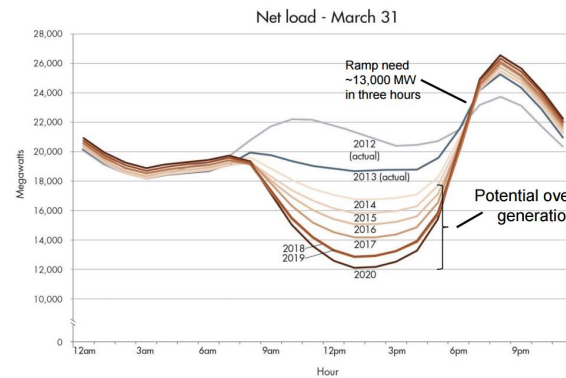
California's "Duck Curve": Impact of Solar Output on Net Generation Requirement



But...if you find yourself in a big enough hole, someone will sell you a ladder !



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Excess renewable energy creates a market for energy storage solutions

Battery storage

Disruption (for some) is simply an opportunity to address a new problem

Technologies are forcing new thinking about tariff structures and incentives

Does Nevada's Controversial Net Metering Decision Set a Precedent for the Nation?



What Nevada's decision could mean for other states

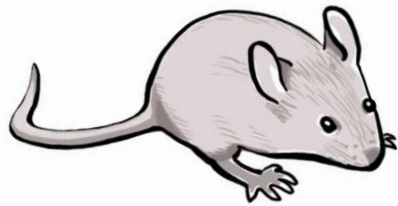
by Julia Pyper

February 04, 2016

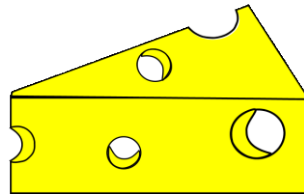
Regulators said the order was designed to make solar customers pay their fair share for use of NV Energy's grid. Solar companies warned that the changes make rooftop solar economics unworkable.

Thinking is hard and often unpleasant → and can be quite the disruption, itself, really.

The source of “disruption” is not always something innovative and sexy...



Solar Rooftop
Customer



Hidden Avoided Cost
Subsidy

(Volumetric Tariff)

Disrupted!



Invoice

Other
Customers

Implication

CHANGE TARIFF
DESIGN



INCREASING
ENERGY
POVERTY



**EVEN MORE
PRESSING NEED
TO RETHINK
LOW INCOME
SUPPORT**

Disruption (for others) is a threat to their future

In the worst cases, market changes have been extremely bad for investors

Investor exposure to renewable energy in Germany

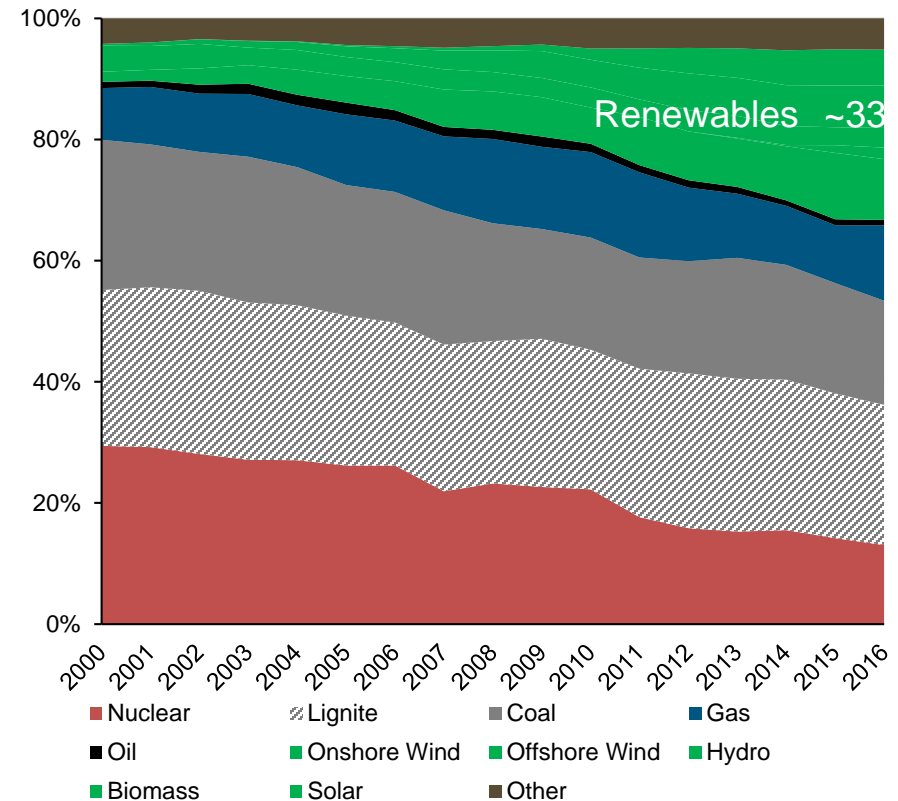
E.ON Market Capitalization



RWE Market Capitalization



Share of Energy Generation



Fear is a factor, because the value implications are enormous!

But not always....

- California has even more renewable energy than Germany, **and investors are happy**



 **PG&E Corporation**
FOURTH QUARTER EARNINGS CALL
February 16, 2017

Continued Progress in 2016



Safety and Operational Performance

- Second best electric reliability year in company's history
- Continued investments to strengthen gas system
- Industry-leading gas and electric emergency response times
- Improved customer satisfaction

Regulatory and Legal

- Final Phase 2 decision in Gas Transmission and Storage rate case
- All-party settlement in 2017 General Rate Case
- Cost of Capital settlement
- Criminal case decision

Clean Energy Economy

- Delivered nearly 70% GHG-free energy in 2016, including ~33% RPS eligible resources
- Leading the nation in electric vehicle and private rooftop solar installations
- Enabling transportation electrification

Well-positioned to Deliver Strong Returns



A Strengthened Company

- Significant safety, reliability and operational improvements
- Improved customer satisfaction

Key Advantages

- One of the greenest utilities in the country
- Constructive regulatory and policy environment
- Multiple infrastructure investment drivers

Robust Growth Profile

- State policies support strong cap ex and ratebase growth
- Resumed dividend growth

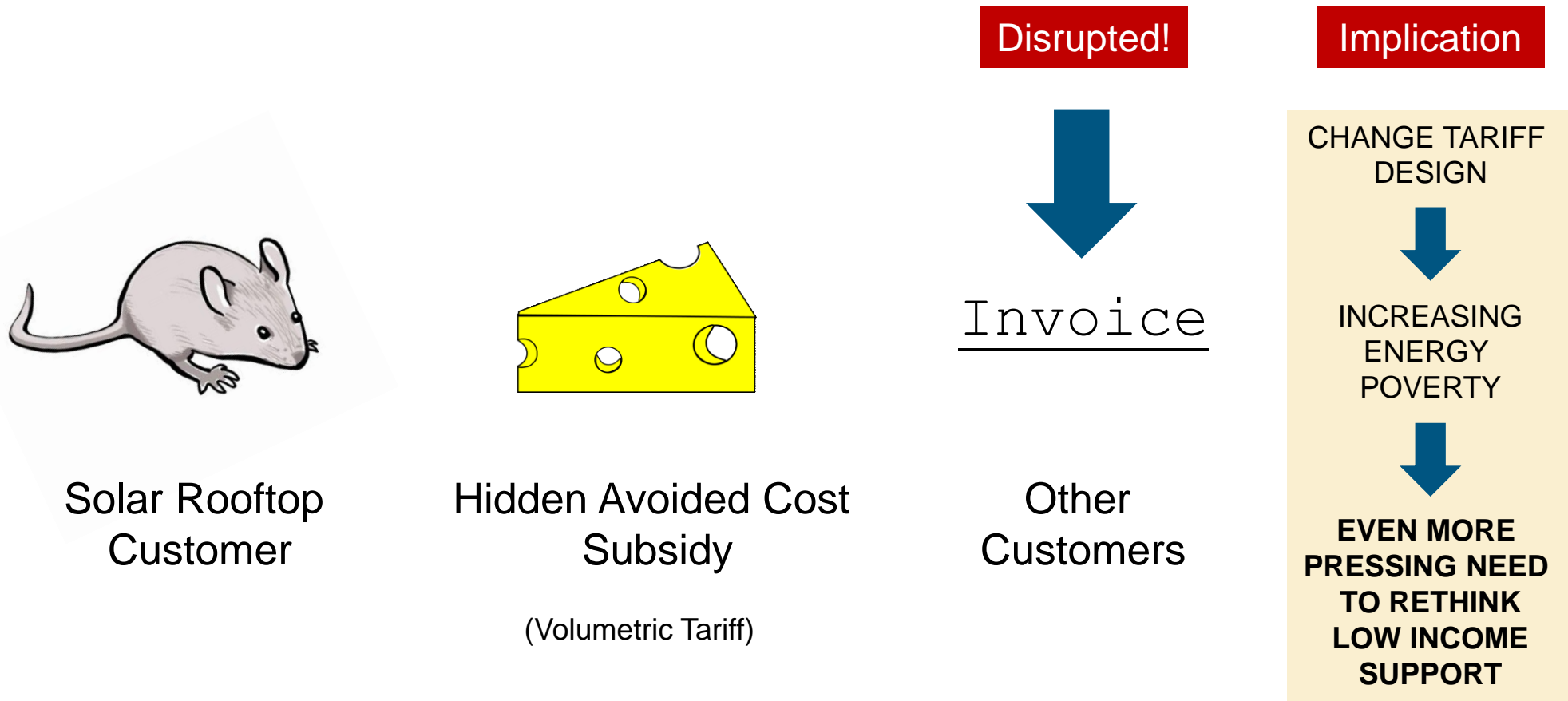
Healthy 3-year growth profile

- ~6.5-7% ratebase growth
- Above average dividend growth

Warning: Statements for factors that could cause actual results to differ materially from the guidance presented and underlying assumptions.

After the crisis, California developed a hybrid regulatory/market model with strong investor protection

But California has an increasing energy poverty problem



You can't mitigate energy poverty and prepare for future "energy" if you work only within the energy regulatory and policy framework

Observations

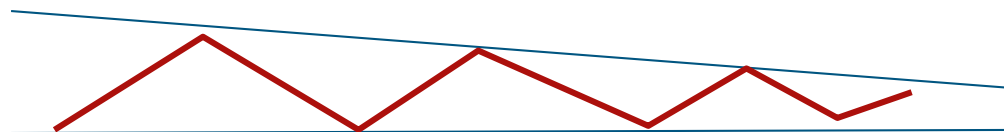
- The energy market and the environmental and technology agenda have long been out of sync
 - Higher financial risk to shareholders
 - Greater risk of blackouts
- Few fully understand these trends and their implications
 - Too many conflicting messages from competing stakeholders
 - Tariffs are too political and do not respond to changing conditions or risks
 - Policies may be developed without a realistic view as to what they will cost or what impact they will have

How to drive “forward”

The Revenge of the Economists

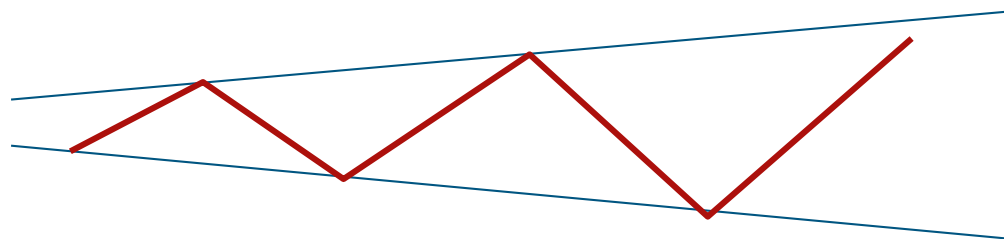
- The introduction of new technology (or the maintenance of existing technology) into the electricity sector is likely to be problematic if:
 - It is adopted (or not adopted) due to a pricing anomaly (i.e., a distorted or incomplete, or missing price signal)
 - Its adoption (or non-adoption) creates or worsens a pricing anomaly
 - Its inappropriate presence (or absence) reduces reliability or security of the system
 - It results in a material shift of costs to other stakeholders
- Usually there is some triggering of additional forces, which can either be:

– Self regulating



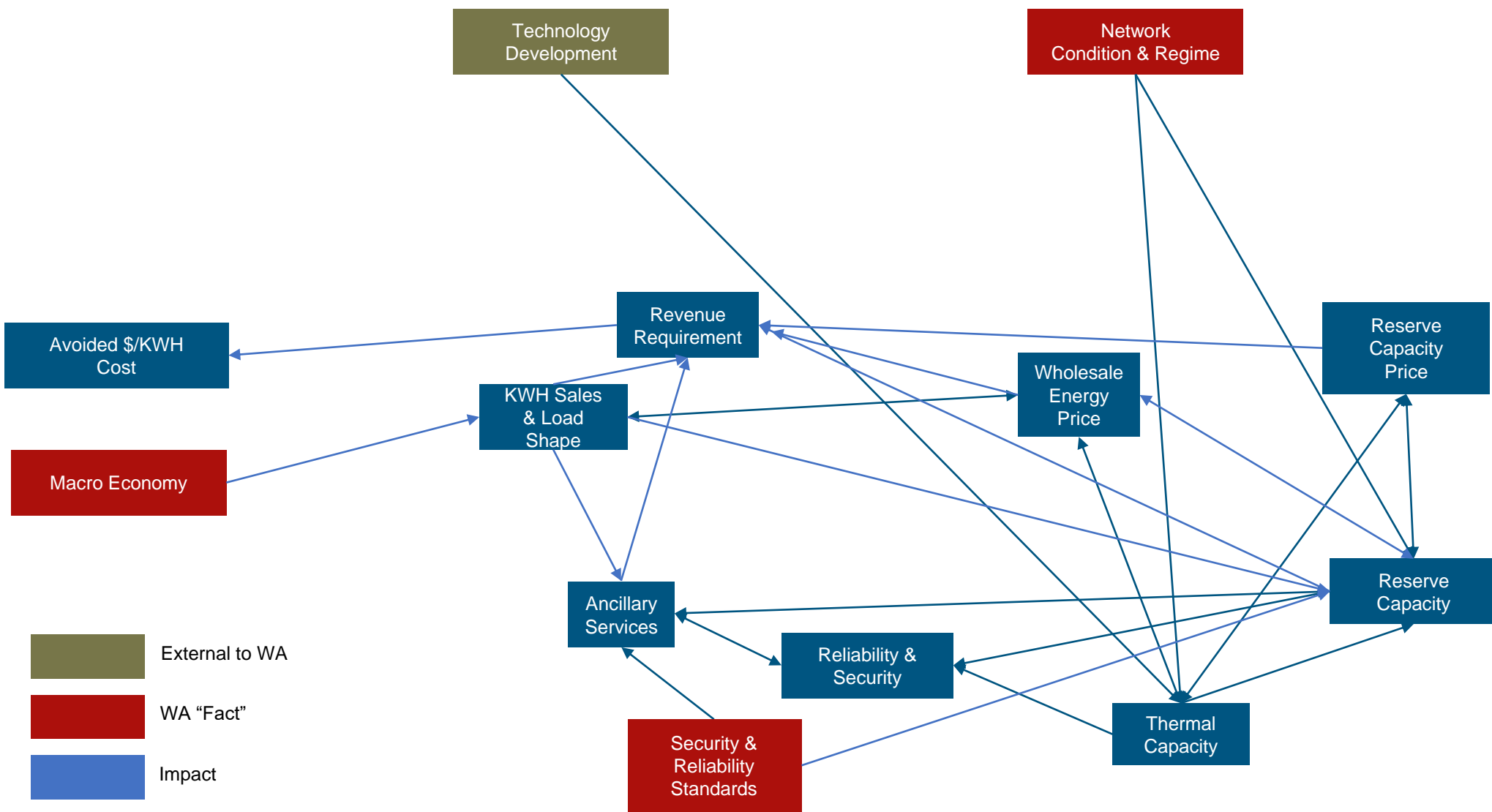
Benign

– Auto-catalysing

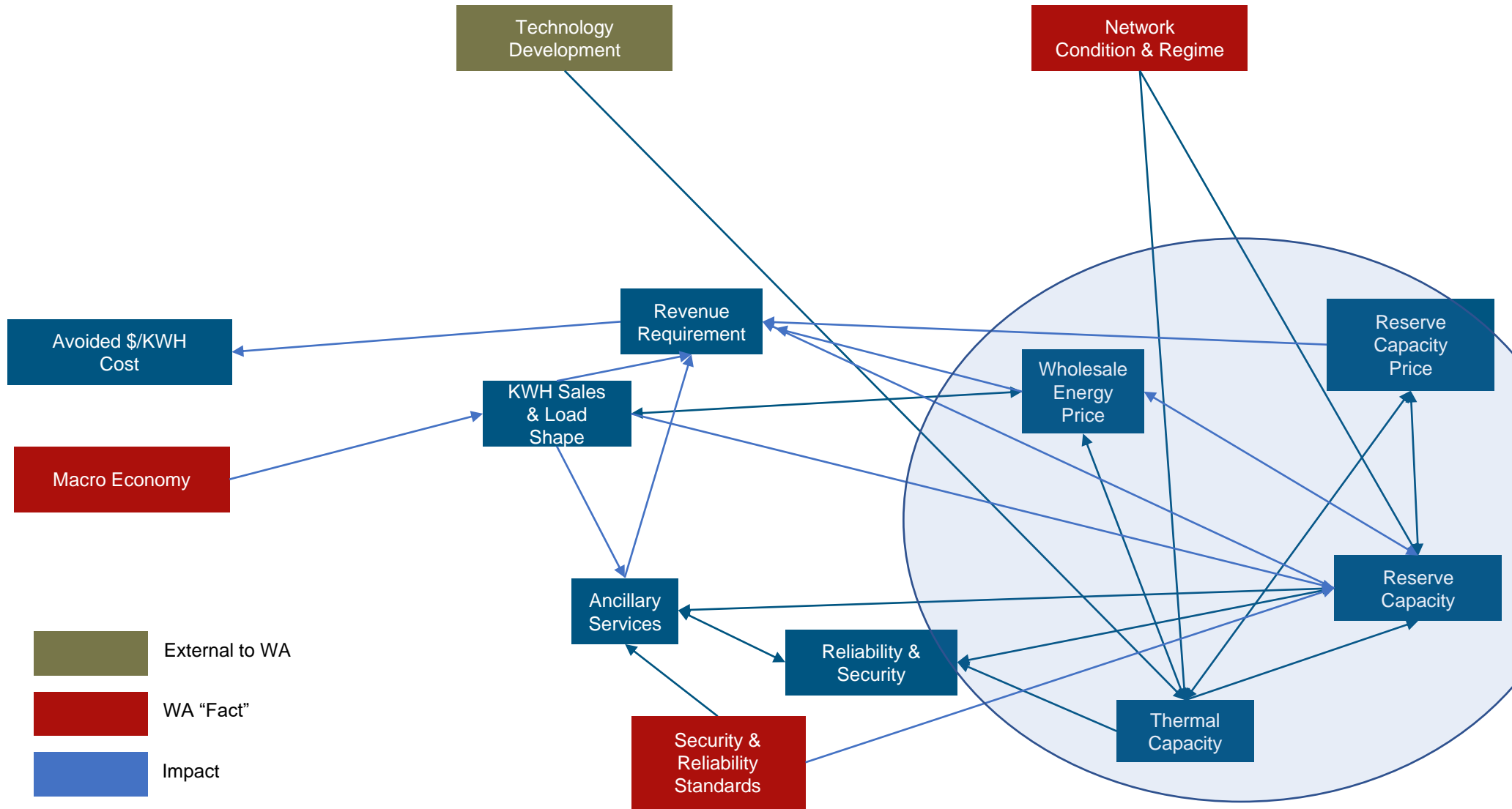


Disruptive

A Simpler Time

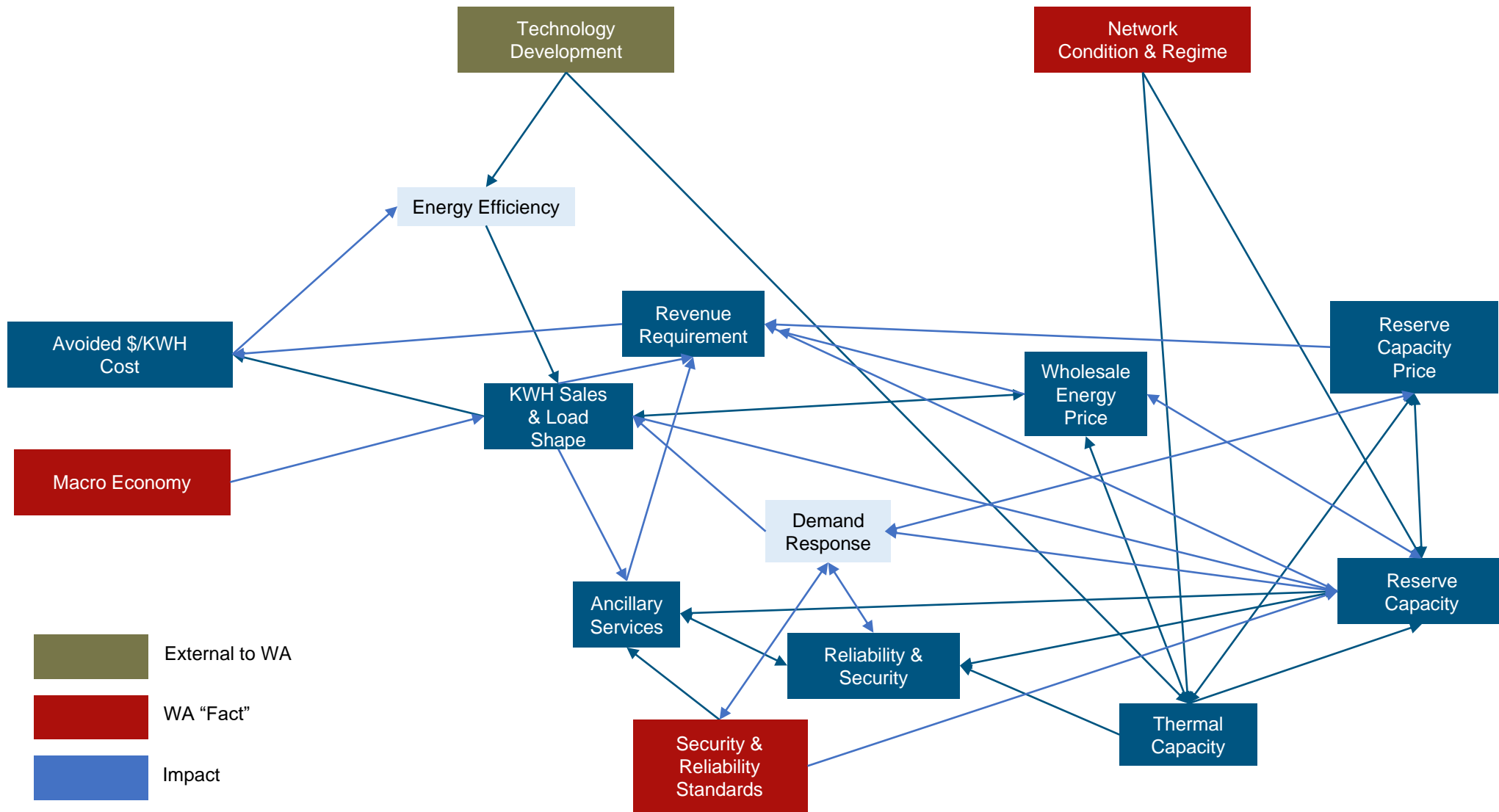


A Simpler Time

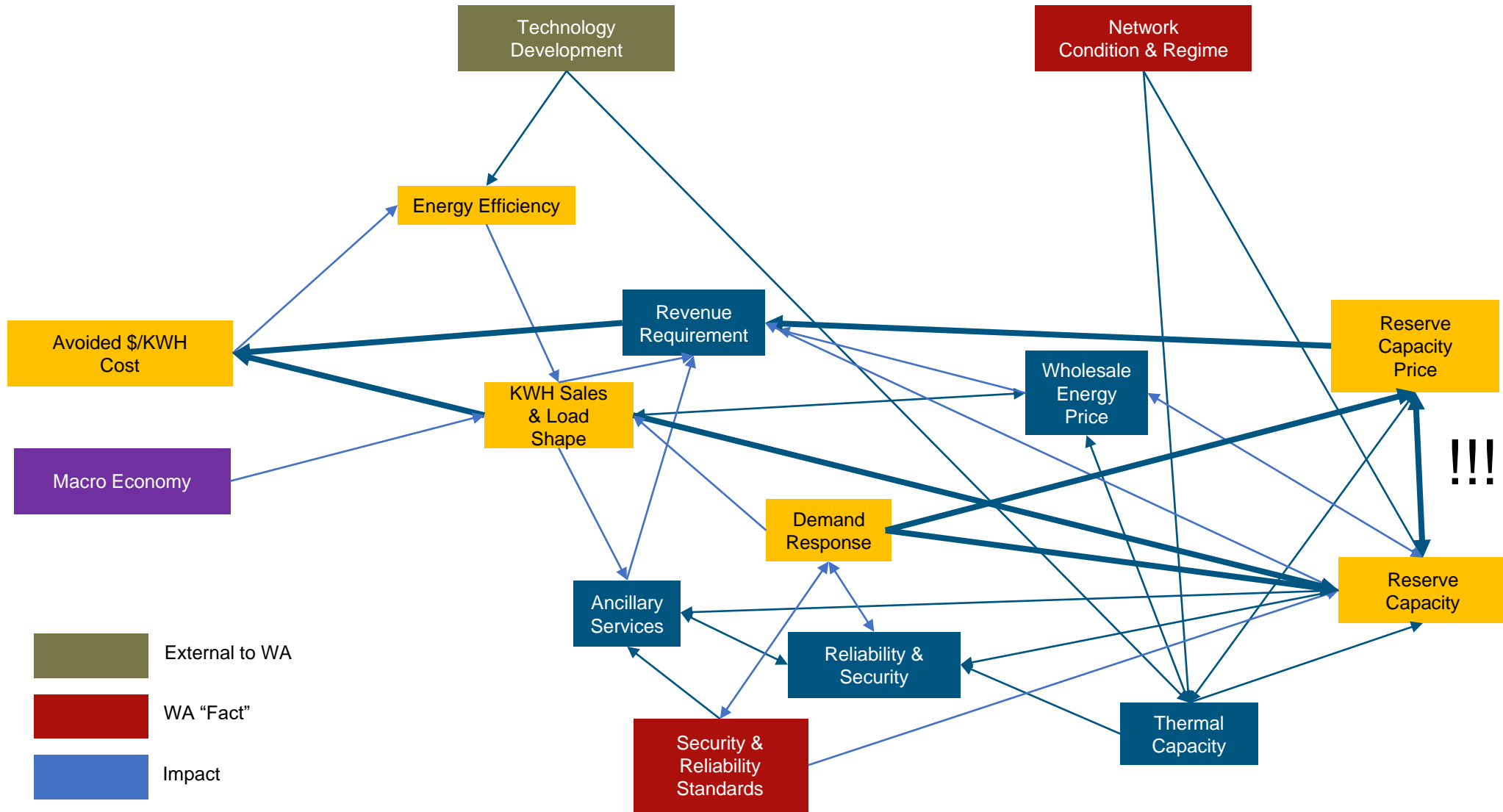


A Simple Market!

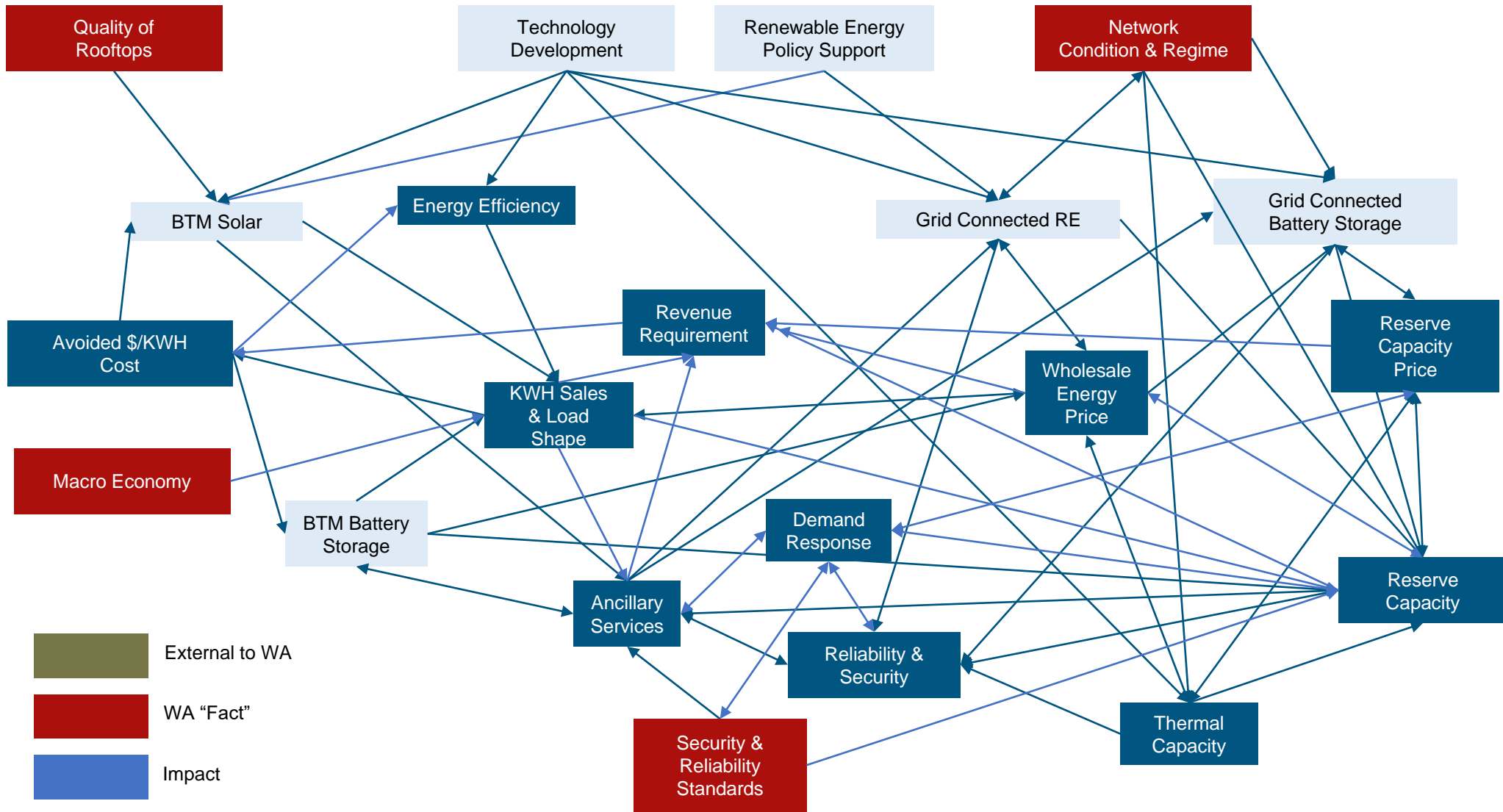
Customer Enablement (Before the iWorld)



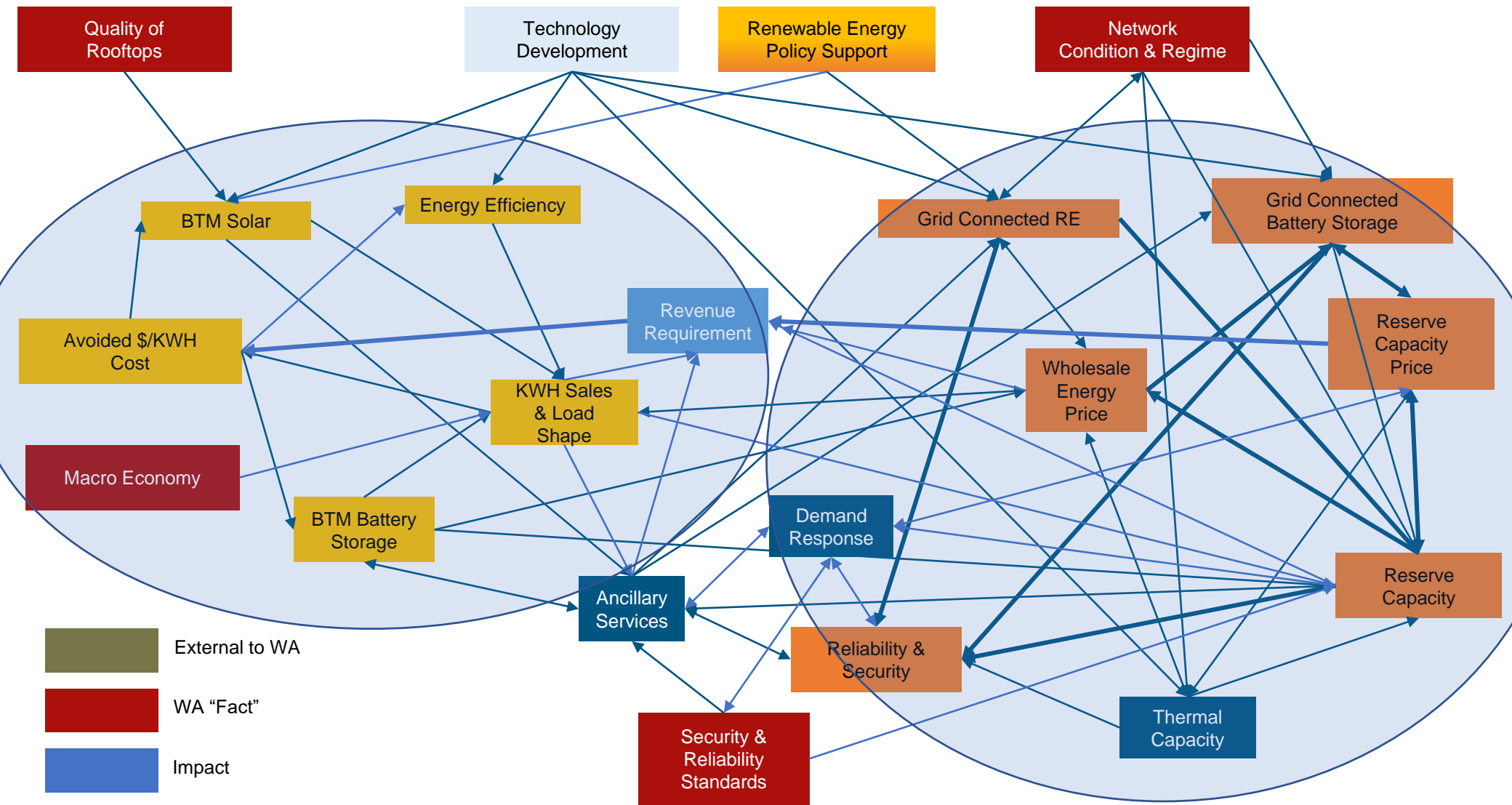
Why the RCM Got So Much Attention



Why it is Harder to Find a Way “Forward”

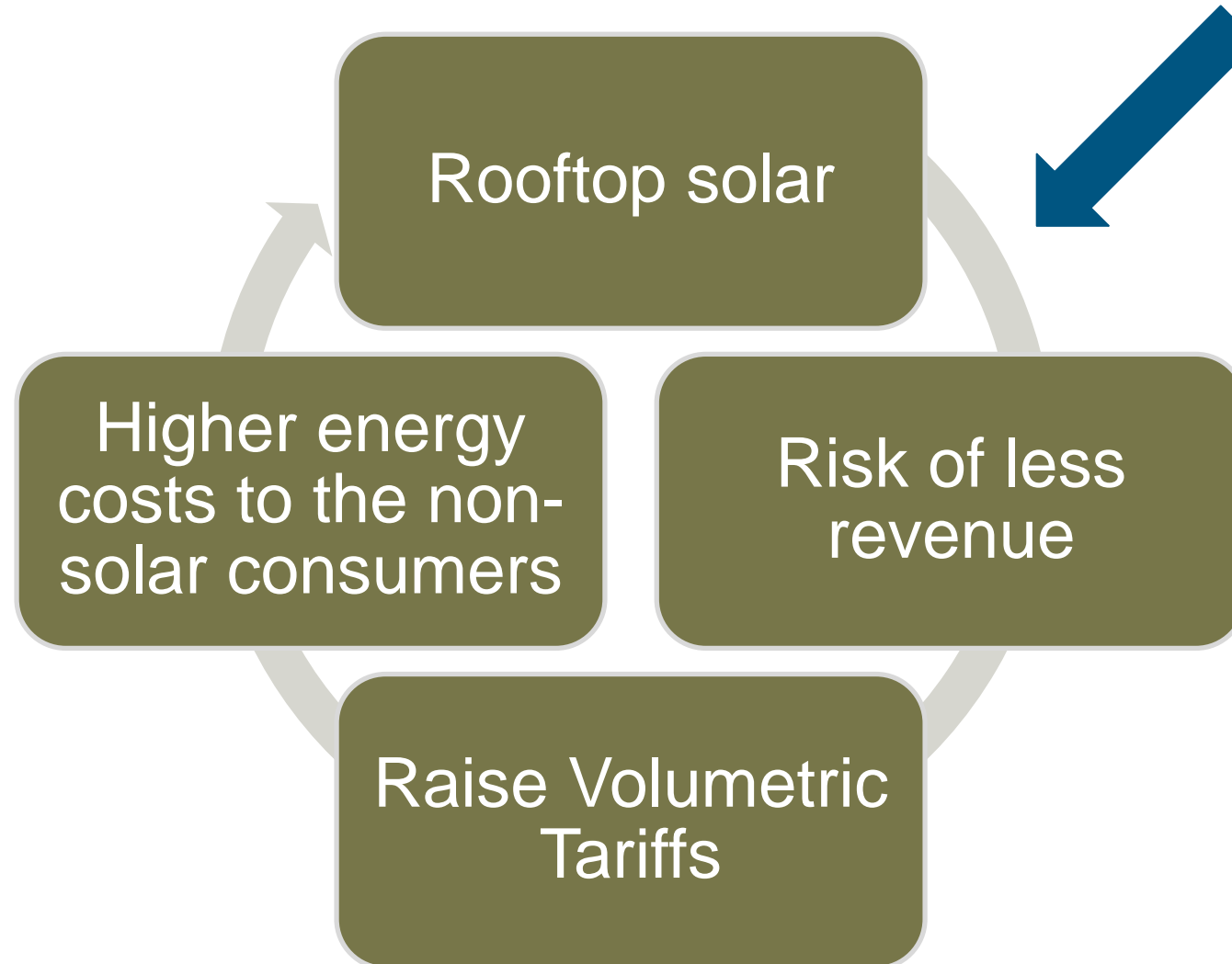


Why the Focal Areas are Shifting: Dueling Loops

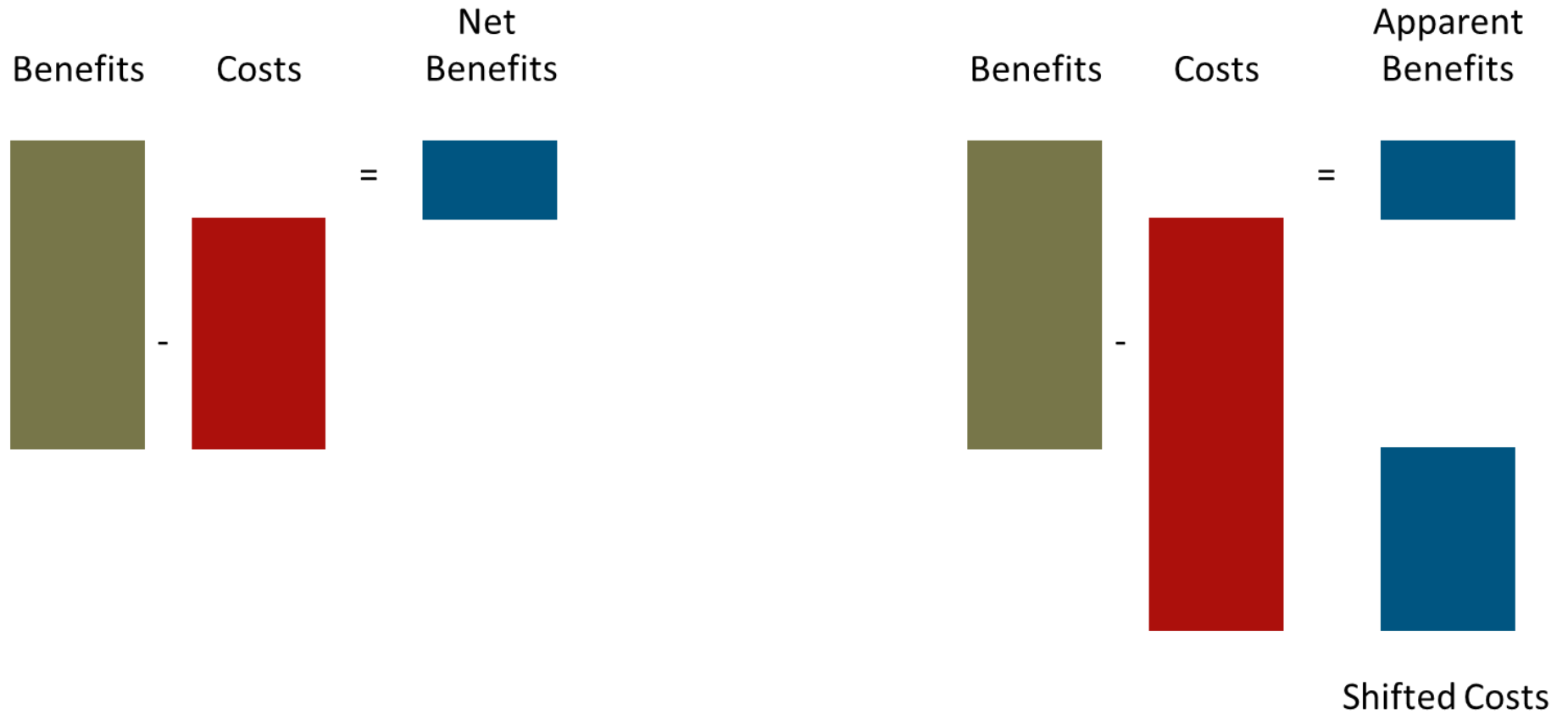


Need to “solve” this one

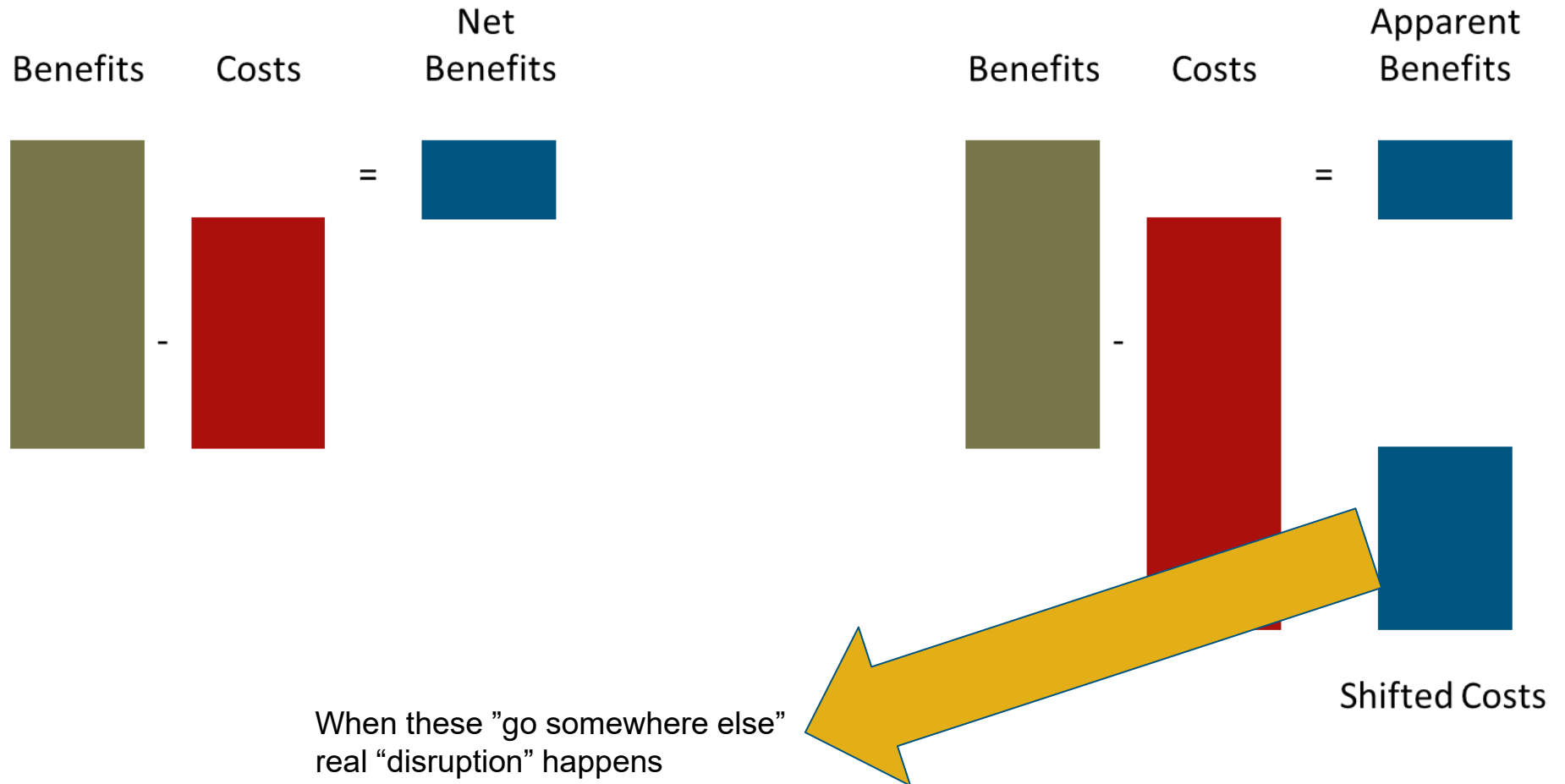
Batteries



If you want to reduce unintended consequences, then pay attention to cost shifting....



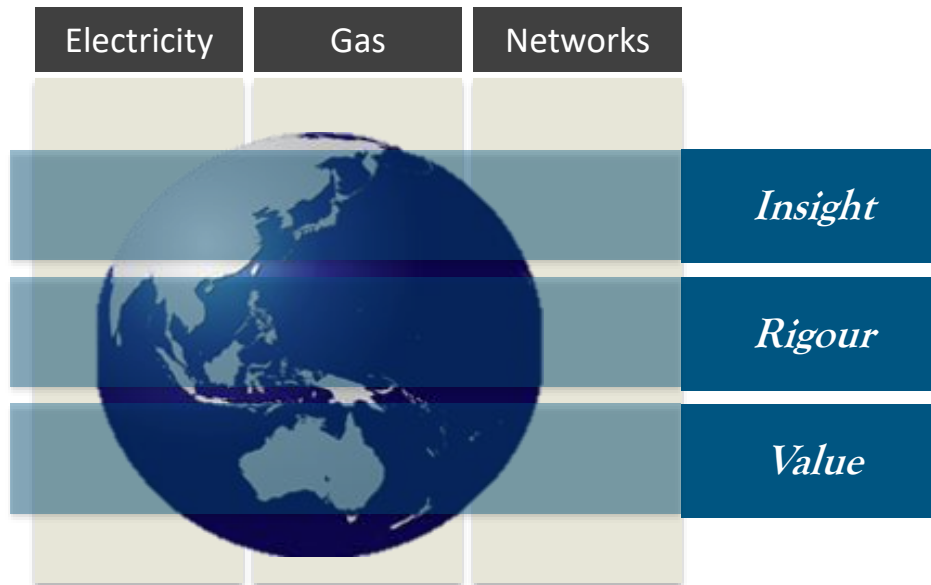
When will networks be able to “fight back” rather than just automatically “shift cost”?



Future Focus

- Getting signals right for ancillary services (and promoting them from being merely “ancillary”!)
- Tariff design / regulation
 - What is the right charging and cost recovery structure, especially for networks?
- Ensuring a regime that gets price and performance signals right for storage (not just batteries)
 - Ensure appropriate access to ancillary service value as well as energy arbitrage
 - Recognise that storage can accelerate / amplify feedback between BTM and Grid Connected Options
 - Cost-shifting can worsen, more quickly → tariff design and responsiveness
- RCM continues to be a key focal point
 - Locational aspects and responsiveness
 - Value management aspects become even more important in a disrupting world
- Recognise that socialised energy pricing can trigger challenging feed-back loops that ultimately make it even harder to address energy poverty – need mechanisms outside the energy sector

Thank you



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