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Global Energy Transformation
Challenges and solutions for the power sector

Strictly Private
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Draft

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We are seeing the impact of megatrends on all sectors across the globe

Megatrends

Demographic and social change

- From 7 to 8 billion people in the next 10 years
- Half of the girls born today have a life expectancy of at least 100 years.

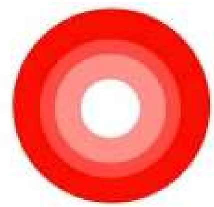
Shift in global economic power

- Welfare growth – by 2030 the E7 will overtake the G7
- How to secure sufficient capital for investments?

Rapid urbanisation

- In 1800, only 2% of the world's population lived in cities – now it is 50%.
- Two-thirds of the world's population will live in cities by 2050.

Climate change and resource scarcity



- A challenge is Supply of resources keeping up with demand growth while reserves are finite
- The carbon target to keep temperature rises to 2°C is will be missed by 2034.

Technological breakthroughs

- Costs of new technologies fall dramatically and adaptation speed rises.
- Achieving a 50% penetration rate for telephones took decades, while mobile phones took <5 years.

"Energy is at the heart of these trends, both as an essential resource for feeding and fuelling the world population and economy, and also as a sector strongly influenced by renewable technologies and business model innovation"

E7 = Emerging 7, being China, India, Brasil, Mexico, Russia, Indonesia, Turkey

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These megatrends are leading to disruptive dynamics impacting the power sector

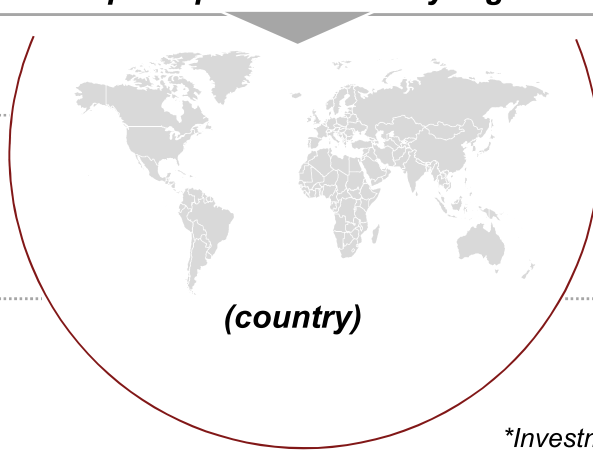
Disruptive dynamics

Customer behaviour	Competition	Production service model	Distribution channels	Government and regulation
Grid provides back up	**Outflanked & outpaced**	**Outdated or stranded**	**Digitalised intervention**	**Caught in the crossfire**
Less need for utilities, consumers produce and store energy themselves	More nimble and able competitors seize key revenue segments	Outdated or out-of-market assets leads to stranded investments	Innovative digital plat-forms matching demand and supply become dominant	Shifting policy goals and regulatory risk undermine business decisions

Disruption profiles differ by region

Europe: European utilities value reduced by **~60%** between 2008 and 2014

North America: ~$20B+ in cleantech venture capital funding between 2008 and 2014



Asia: Black outs hinder economic development : **$6.2 trillion** needs to be invested in the power sector by 2035*

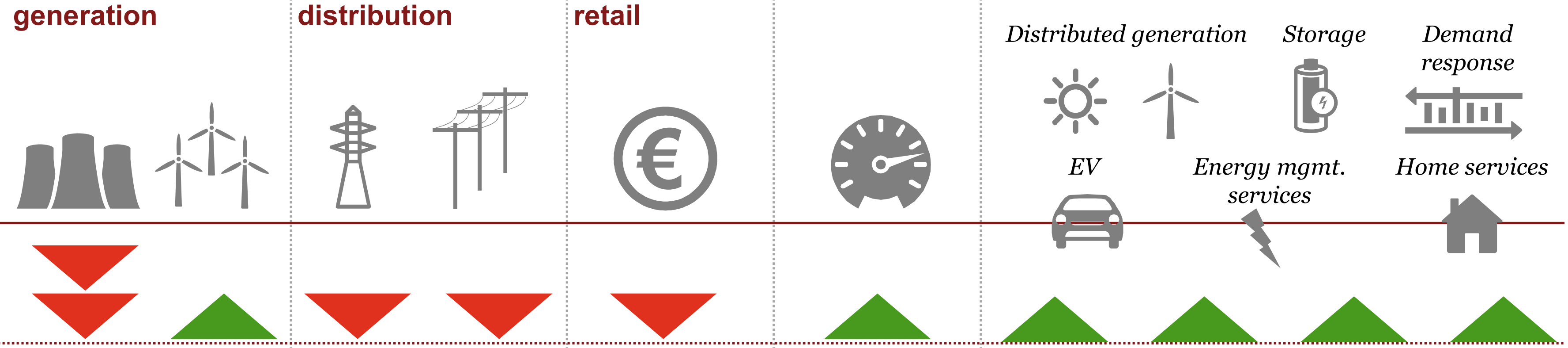
Africa: Technology supports policy aims – 160m new grid connections are required to be supplied by micro-grid and off-grid systems

**Investments in China, India and Southeast Asia (2014 - 2035); Source: MSCI index. IEA (2014) World investment outlook 2014 (new policies scenario), IEA (2011) Energy for all.*

European example – Market demand will remain, however value pools will shift “downstream” towards behind-the-meter segments

Evolving Energy Value Chain

	Centralised generation	Transmission & distribution	Trading & retail	Metering	Behind-the-meter (BTM)
Value (growth/ decline)					
Drivers of value shift	• From power provider to power guarantor • Falling demand as result of economic crisis, manufacturing declines and energy efficiency • Significant overcapacity in fossil-fuel-fired gen. • Low plant utilization • Growth in higher-priority renewables	• Due to multi-directional and volatile energy flows, 50% more network capacity is required to meet similar demand • Reducing demand for grid power • Emerging role of the complex system operator	• Falling demand • Fierce price competition • Increasing customer churn • Expanding into energy services • Increasing pressure from trading regulation	• Growth in advanced metering (infra) to optimize demand patterns • New data-driven services, e. g. energy advisory, demand response	• Higher competition upstream – more power to consumers • Maturing DG, storage and EV technologies – new growing market for installation, leasing and service • Increasing level and volatility of power prices increases value of energy management services • Demand for usage insights and control solutions • Demand for holistic home services • Emergence of local island grids • Residual demand visible for upstream player – exposed to risk of surges in demand or supply



Value is shifting towards behind the meter segments

Sources: Expert interviews, PwC/Strategy& analysis

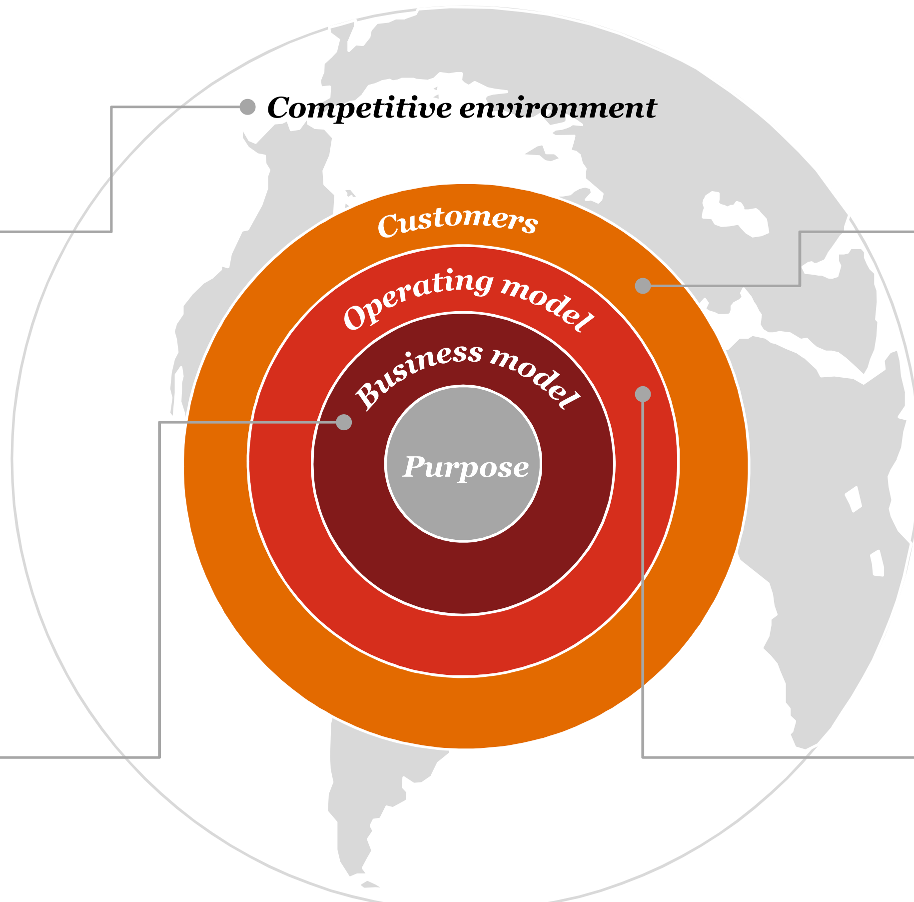
Companies must adapt to remain competitive in this new world

Competitive environment

- How quickly will my market change?
- Who are my new competitors?
- What is the government doing in order to achieve policy goals?

Customers

- How are my customers changing?
- Which customer segments and geographies do I want to serve and how?
- What are customers willing to pay for new services?



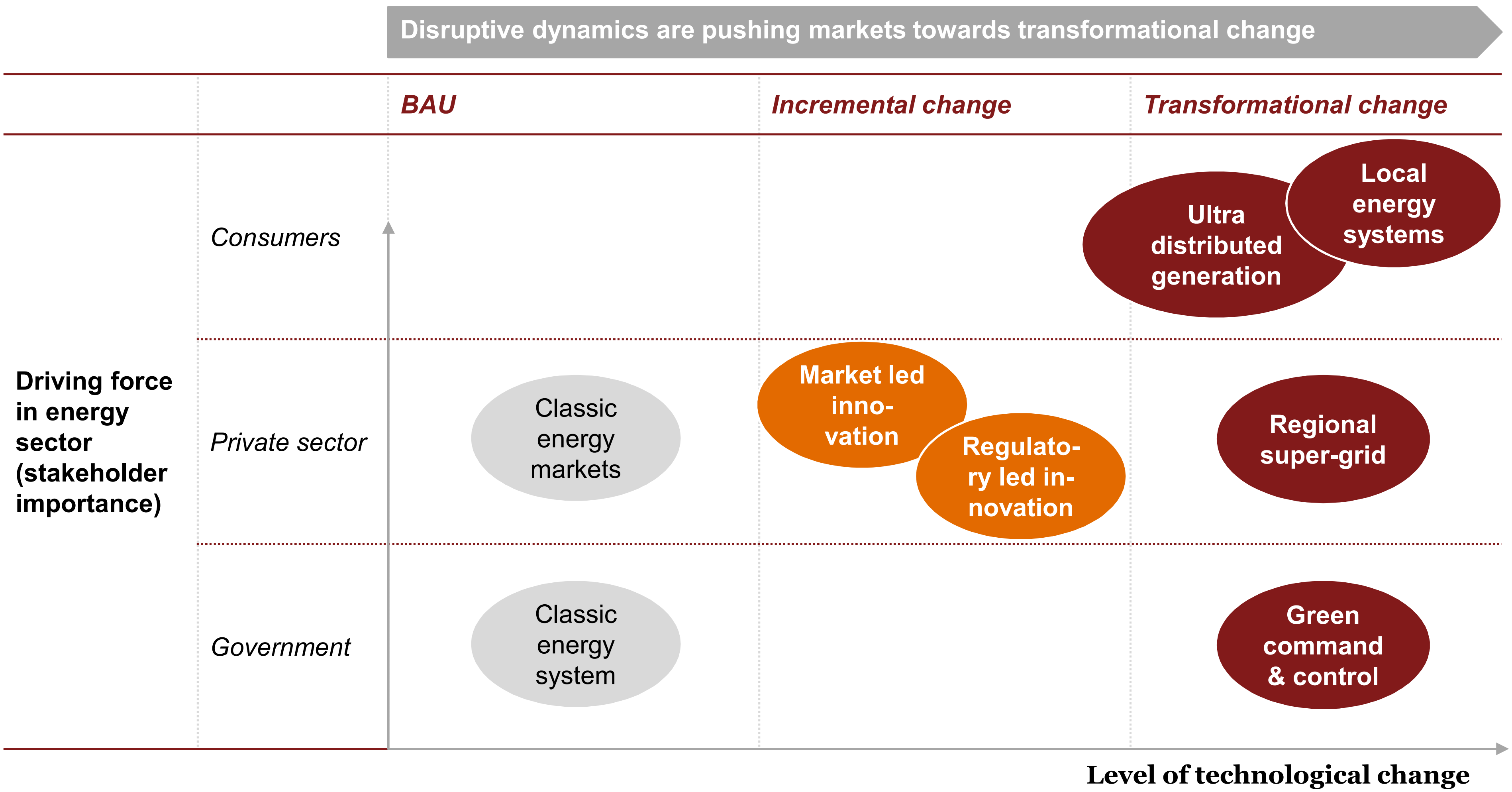
Business model

- What are the new value pools in the market and what should be my focus?
- How should I adapt my current business model?
- How can I enter the market?

Operating model

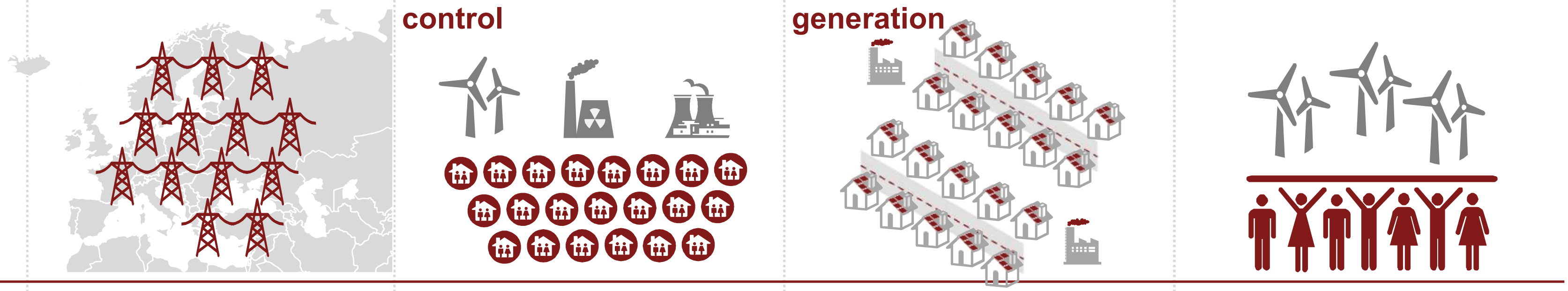
- How do I align my operating model and culture?
- How do I finance this path of change?
- How can I put technology at the forefront of my operations?

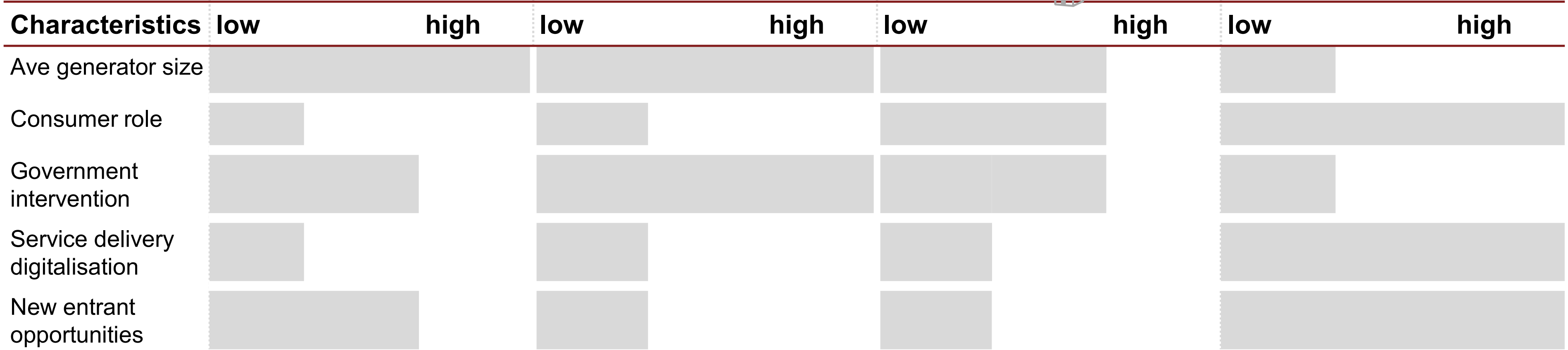
We believe that the disruptive dynamics are causing transformational change in power markets



New transformational market models will emerge as markets shift away from incremental change

Market models	Regional super-grid	Green command and control	Ultra distributed generation	Local energy systems



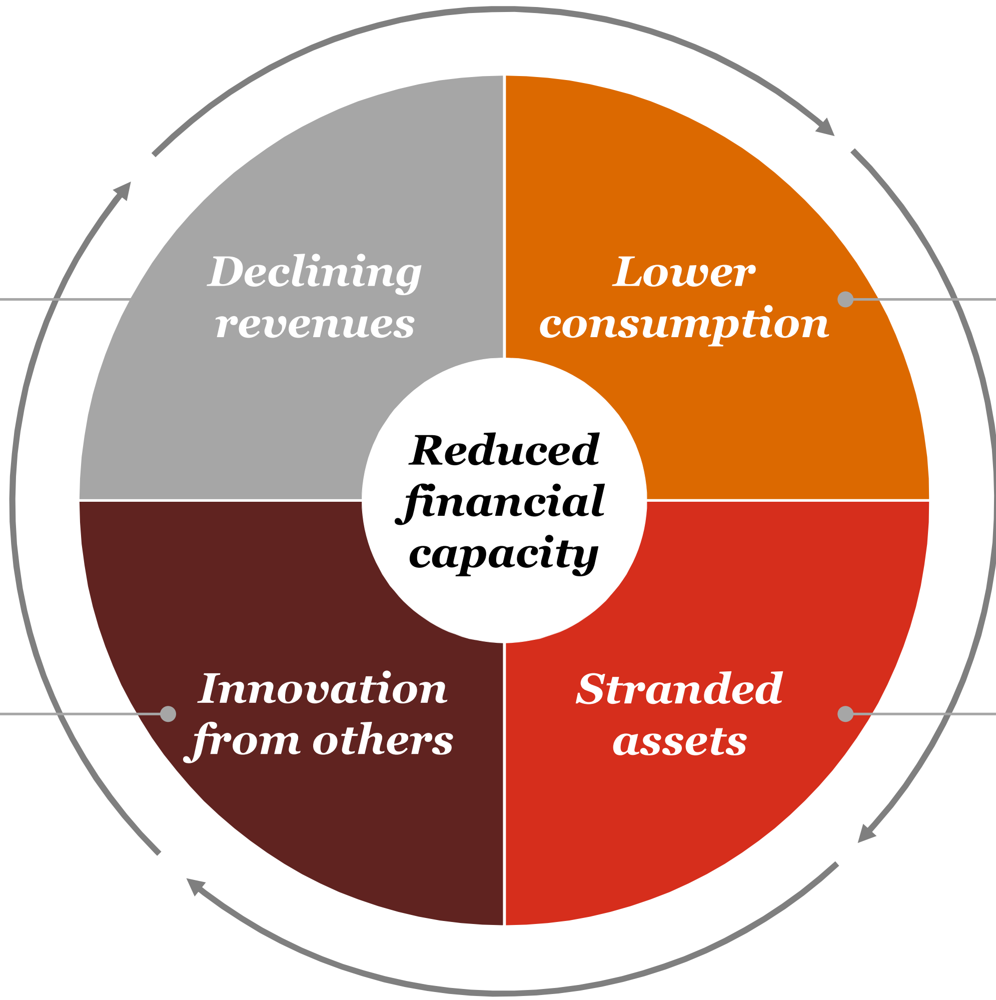


Local factors	Regional super-grid	Green command and control	Ultra distributed generation	Local energy systems
	• Mature national infrastructures • Limited indigenous fuel sources • Clear cost benefits of market integration • Political stability	• Limited private sector involvement • Government direction on capital investment • Reliability and price stability are valued over cost	• Mature infrastructure • Strong customer engagement in micro-generation • Interest from private capital • Average/peak demand differential	• Sufficient private funding • Rural electrification policy • Interest from private capital • Local communities taking control

Utilities need to break out from traditional business models to be competitive in transformational markets

New service offerings e. g. aggregator

New routes to market e. g. alliances



Technology support for customer demand management

Investment to enhance environ-mental reputation

In defining a future business model(s), companies need to first align on several fundamentals …

Foundation strategy factors

Where do we play?

Determine our ***"purpose"*** and desired outcomes, e. g. "end-to-end" participation or selected parts of the value chain

How do we play?

Establish the ***"positioning"*** we wish to achieve, e. g. full offering portfolio or highest value products

How do we win?

Define the ***"role"*** we would like to perform, e. g. go it along or strategic partnering

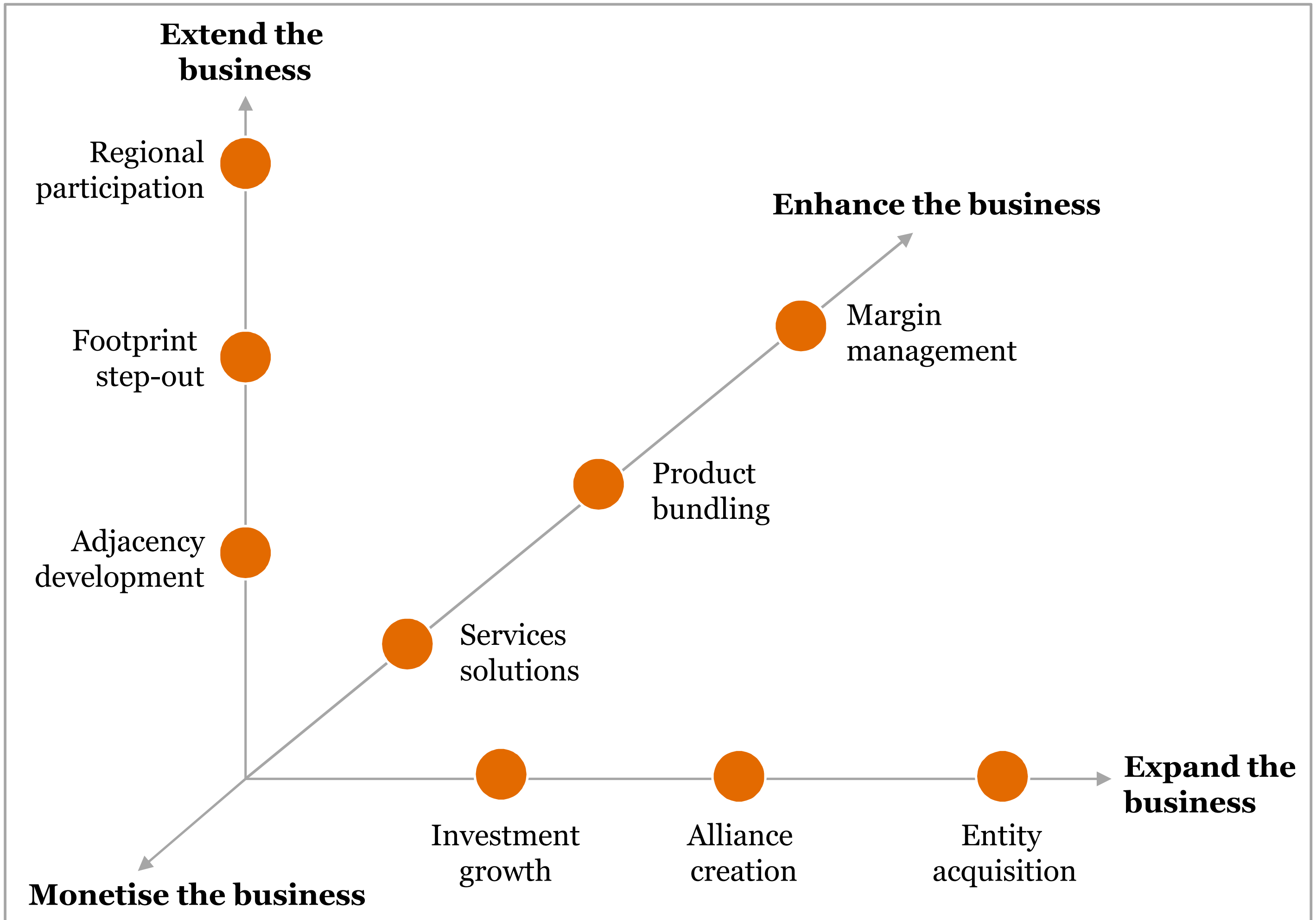
Future strategy

How competitors choose to play impacts our choice of business model?

… and then determine the dimensions of its available options

	Future role evolution			
Emergent roles	***Energy supplier*** → "Asset focused"	***Integrator*** → "System focused"	***Enabler*** → "Value focused"	***Optimizer*** "Insight focused"
Primary segment focus	***Generation*** "Have to do" to if asset heavy or 'short' in supply	***Transmission/ distribution*** "Will do" regardless of new area participation	***Distribution/ customer*** "Should" migrate into depending on role	***Customer*** "Could" evolve into as new business models mature
Key focus areas	• Focus will be directed at ensuring **assets are optimized** in the market to match price signals • Focus will move toward **achieving the right balance** of asset-based and notional transactions within risk parameters	• Focus will address facilitating **grid interconnection** with other transmission developers • Focus will also extend to the **deployment of technologies** or equipment into the distribution network	• Focus will be on enhancing the **'value of the grid'** to all stakeholders • Focus will also address how to **leverage technology** to enhance system performance and customer engagement	• Focus will be on enabling customers to better leverage **behind-the-meter** technology • Focus will also extend to **broader engagement** with the customer by providing value through advanced data analytics

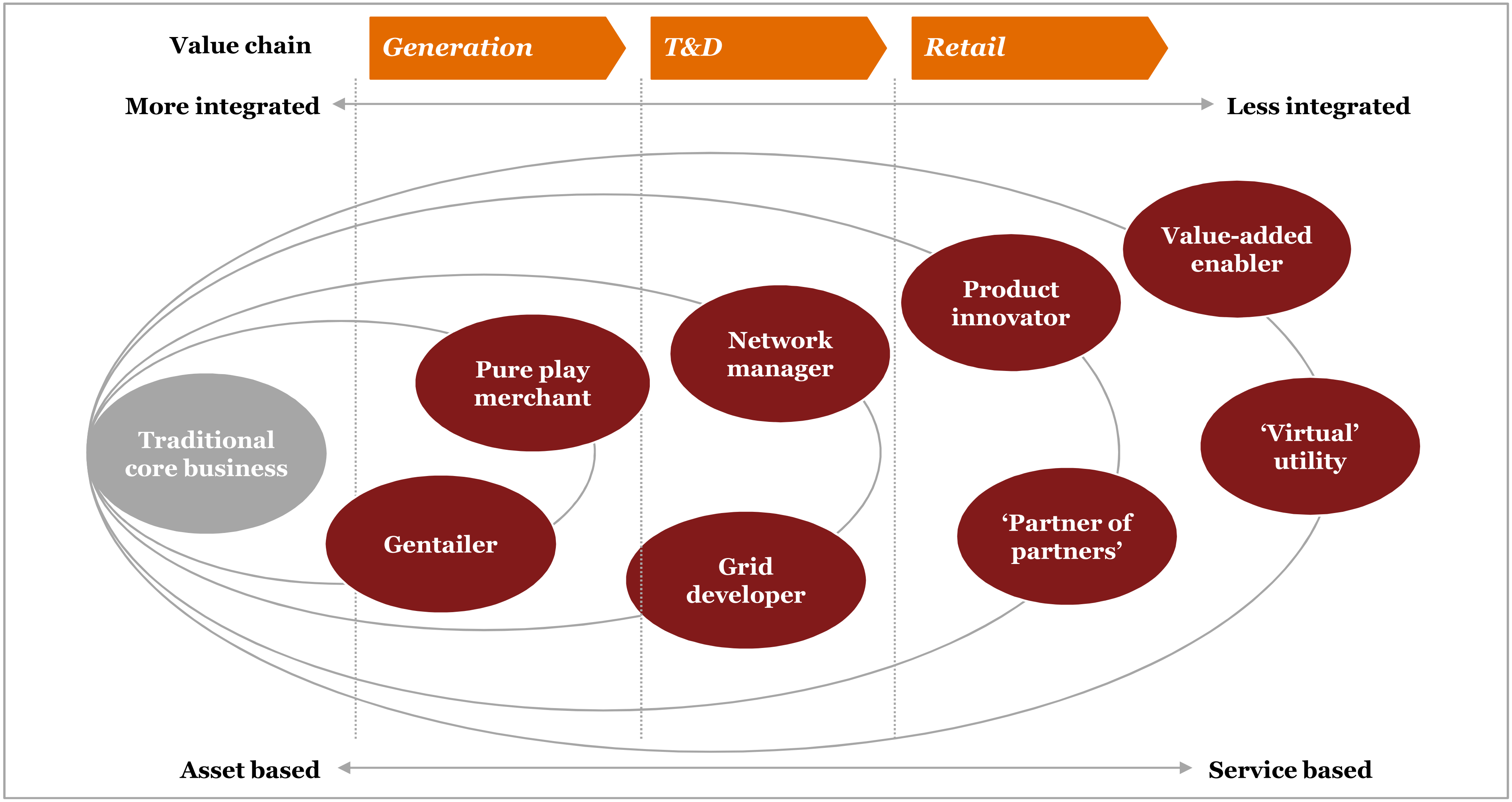
Market participants have a range of strategic options to choose from when determining the business model



Description

- **Extend the business (Where to play)**
  Growing outside of the core footprint requires enhancing regional market knowledge and more flexible participation models
- **Enhance the business (How to play)**
  Developing attractive customer solutions and improved margins will require broader offerings and tailored prices
- **Expand the business (How to win)**
  Growing the current business will require alliances and/or partnerships with providers and market participants

Players may choose to operate in one or multiple business models across the value chain



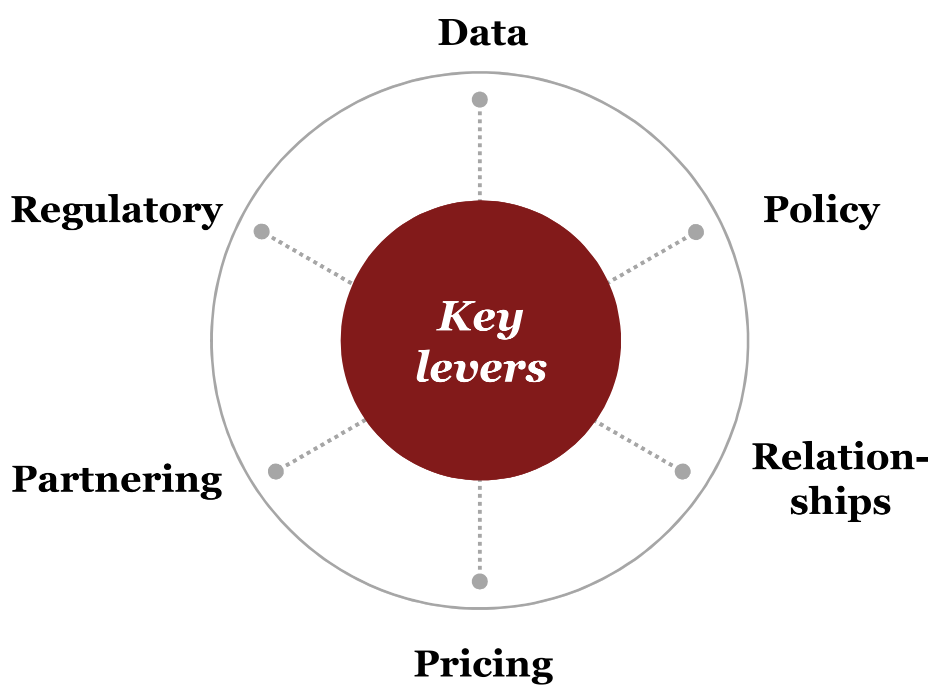
Business model options vary based on scope, basis of competition, and source of earnings

Business models	Traditional core business	Gentailer	Pure play merchant	Grid developer	Network manager	Product innovator	"Partner of partners"	Value-added enabler	"Virtual" utility
Business focus	Assets – customers	Assets – customers	Assets	Assets	Assets	Customers	Customers	Customers	Customers
Business alignment	Generation – T&D, retail	Generation – retail	Generation	Trans-mission	Trans-mission – distribution	Retail	Retail	Retail	Distribution – retail
Profit-ability basis	ROIC	Com-petitive margin	Com-petitive margin	Regulated ROIC	Regulated ROIC	Com-petitive margin	Com-petitive margin	Com-petitive margin	Com-petitive margin

Utilities should select their business model(s) based on future market opportunities and capabilities required …

	Description	Capabilities req'd		Description	Capabilities req'd
Gentailer	Own generation assets and sell retail energy to customers in a competitive market	• Market insights • Project development • Energy trading/hedging • Origination, product development & pricing • Customer management	**Product innovator**	Offers electricity and behind-the-meter products such as solar, fuel cells, EV chargers, and smart devices	• Customer acquisition, retention, cross selling • Pricing and bundling • Energy sourcing • Customer service
Pure play merchant	Owns generation assets and sells power into competitive wholesale markets or through bilateral contracts	• Market insights • Project development and finance • Origination • Energy trading/hedging • Risk management	**"Partner of Partners"**	Offers standard power and gas plus a range of energy services using high quality, branded partnerships	• Customer acquisition, retention, cross selling • Partner management and service delivery • Innovative financing • Customer service
Grid developer	Acquires/develops, owns and maintains transmission assets connecting generators to distribution systems	• High voltage line design and operation expertise • Real-time electricity supply/load mgmt. • Stakeholder mgmt. • Investor relationships	**Value-added enabler**	Uses core "big data" capabilities to provide enhanced energy services to customers not wanting to actively manage their energy use	• Big data management, analytics, and security • Customer acquisition • Ability to educate and guide customers, and deliver value
Network manager	Operates transmission and distribution assets and provides network access to generators and retail service providers	• T&D line design and operation expertise • Real-time supply/load mgmt. and central/DG resource integration • System data analytics	**"Virtual" utility**	Aggregates generation from distributed systems and acts as intermediary between/with energy markets without owning generation/T&D assets	• Energy sourcing and real-time balancing • Customer management • Partner development and management • Demand management

... and determine how to leverage their strengths to enhance their future competitive positioning



Business Model Levers

- **Data:** Ownership of grid and customer information can provide a knowledge platform that enhances the value proposition
- **Policy:** Mandates and legislation can shape the playing field and enhance the incumbent's ability to compete
- **Relationships:** The natural interfaces of the incumbent with customers, suppliers, stakeholders and other providers creates a natural platform
- **Pricing:** Shifts in traditional cost recognition models can provide greater certainty to cost recovery and additional flexibility to rate design
- **Partnering:** Enhanced creative and delivery capabilities can extend the incumbent's existing platforms and market "reach"
- **Regulatory:** Decisions can provide both offensive (exploit) and defensive (preserve) mechanisms to enhance market competitiveness

Our four step approach can help you with your strategic decision making

1

What markets will emerge

- Identify most likely emerging markets
- Analyse the likely impact of emerging market models and value pools

2

Where do we play?

- Identify future business models
- Estimate size of future value pools
- Develop scenarios for different roles and play vectors

3

How do we play?

- Analyse strategic business model dimensions
- Enable strategic business model decisions

4

How do we win?

- Capability development
- Operating model design
- M&A activity and development partnerships
- Invest in regulatory debate
- Develop financing plan and analyse impact on credit rating
- Plan culture change management programme

PwC as your partner in realising change

- We can support in driving the strategy process and conduct in depth analysis.
- We can help you achieve optimal implementation of strategic decisions and clear measurement of success.

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Thank you!!