# DISRUPTIVE CHANGE IN ENERGY MARKETS – THE ENERGY CLOUD

ENERGY CORK CONFERENCE

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### DISRUPTIVE CHANGE IN ENERGY MARKETS – THE ENERGY CLOUD DISRUPTION OF THE ENERGY SECTOR IS HERE ...

## We're only in the first phase today

During the **next 5-15 years**, Navigant expects massive disruption across the entire energy value chain that will affect a broad set of stakeholders. This transformation is primarily being fueled by multilateral efforts focused on **decarbonizing the global economy** to address climate change and a shift toward an increasingly **clean**, **intelligent**, **mobile**, **and distributed energy** ecosystem.

Strategic drivers of energy sector disruption are often called "The 4 Ds":

Decarbonisation Digitalisation Decentralisation Demand changes



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## DISRUPTIVE CHANGE IN ENERGY MARKETS – THE ENERGY CLOUD THE EMERGING ENERGY CLOUD: TOWARD AN INCREASINGLY CLEAN, DISTRIBUTED, INTELLIGENT AND MOBILE SYSTEM

**TODAY: Traditional Power Grid** Central, One-Way Power System

#### **EMERGING: The Energy Cloud** Distributed, Two-Way Power Flows



#### Source: Navigating the Energy Transformation: Building a Competitive Advantage for Energy Cloud 2.0 (white paper)

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### DISRUPTIVE CHANGE IN ENERGY MARKETS – THE ENERGY CLOUD SEVEN MAJOR ENERGY CLOUD PLATFORMS ARE EMERGING



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### DISRUPTIVE CHANGE IN ENERGY MARKETS – THE ENERGY CLOUD DECARBONISATION IS NOW FOCUSED MUCH MORE ON TRANSPORT

## Electrification of transportation sees the collision of two massive industries

- Lower battery prices will make passenger cars cost competitive with ICEs by late 2020s
- Utility/work fleets electrifying to reduce emissions and noise, and extend work day
- Electric buses gaining larger share of municipal bus fleets
- Autonomous/shared fleets will largely be electrified
  - Greater annual vehicle miles traveled (VMT) equates to more fuel savings; requires more frequent replacement
  - Sensors, camera and computations require higher power output
- EV charging rates increasing to 300 kW (or take 30+ hours to charge your car!)



- **9.2MM** plug-in vehicles will be on the road globally by 2020
- Impact on energy security has risks via demand growth and opportunities such as V2G

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### DISRUPTIVE CHANGE IN ENERGY MARKETS – THE ENERGY CLOUD DECARBONISING HEAT IS EVEN TOUGHER – FOCUS ON THE ROLE OF GAS

 Model the 2050 Energy System needed to achieve agreed emission targets



Consider what role gas can play

 Assess the Pathway(s) to the target 2050 Energy System



· Identify required short-term actions

GB Energy Networks Association has asked Navigant to lead a project to consider how we can decarbonise our energy system including a major focus on HEAT







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### DISRUPTIVE CHANGE IN ENERGY MARKETS - THE ENERGY CLOUD

We modelled two net zero 2050 End-State scenarios: **Balanced** with both gas and electricity; and **Electrified** with electrification of most demand

#### Balanced Energy System Scenario Net Zero Emissions

Renewable and low carbon gas are used in a smart combination with renewable electricity



#### Electrified Scenario Net Zero Emissions

Renewable and low carbon gas use is limited to industry, in cases where no reasonable alternative exists

- Heat supply by electricity Deployment of all-electric heat pumps Deployment of district heating · Renovation to very high level for all buildings with all-BUILDINGS electric heat pumps No hydrogen infrastructure Hydrogen is produced on site, so no central hydrogen from \_ \_ \_ dedicated renewable electricity INDUSTRY Electricity Advanced biodiesel TRANSPORT Dispatchable power generation using · Biomass power plants
- H<sub>2</sub> and biomethane could each provide approximately 255 TWh in 2050, together delivering about 60% of today's gas consumption
- Total Energy System Costs are approximately GBP 21
  bn / year lower in the Balanced Scenario
- The Pathways to get there are complex with many vital enablers and the need for policy and regulatory support





### DISRUPTIVE CHANGE IN ENERGY MARKETS – THE ENERGY CLOUD

Some key uncertainties will provide opportunities for low-carbon gas, others will challenge its viability

- Gasification of biomass to biomethane
  - Technical and cost challenges may result in less biomethane
- Electrolysis costs for H<sub>2</sub> production
  - Significant R&D required to reduce Electrolysis costs (and possibly mitigate water quality requirements)
- Biomass import potential
  - Reliance on biomass imports may be challenged; or
  - Import potential may increase beyond our current expectations
- Commercial viability of CCS
  - Will CCS work on commercial scale? Can we deploy more CCS and over a wider geography?
  - CCS is vital in the transition period for Blue H<sub>2</sub> and to enable negative emissions from Biomass / BioSNG
- Carbon pricing impacts
  - Balancing inception of (Blue) H<sub>2</sub> and long-term ambition to move towards Green H<sub>2</sub>
- Peak demand management
  - The Balanced Scenario requires 70 GW of  $H_2$  GT / CCGT with low utilisation
  - Can this be reduced through demand side management?
  - How will this "keep the house warm / lights on" capacity be paid for?



# SEVEN OUT-TAKES FOR ENERGY SECURITY

- 1. Increasing integration of DER and adoption of a platform-based approach is vital to embrace low carbon solutions without seriously compromising security
- 2. A Whole of System approach to energy system management involves very different ways of working, but is an important element in reducing costs and improving security overall
- 3. Increased **interconnectivity** definitely helps, however we can't assume that other countries will simply meet our energy security deficits during windless winter weeks
- 4. Don't think that decarbonisation = electrification. Green gas (biomethane, hydrogen) offers storage, peak energy release and has a real role to play for heat and some areas of transport (shipping, HGV)
- 5. Recognise that low carbon transformation increasingly requires **customer engagement** and new in-home/in-business technology with higher costs than currently
- 6. Accept that **100% security of supply** is not possible or desirable economically how do we best manage this in a low carbon world?
- Embrace the need for change and action disruption is uncomfortable but the opportunities are many and varied immediate focus on policy and regulatory enablers for low-regret decisions

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