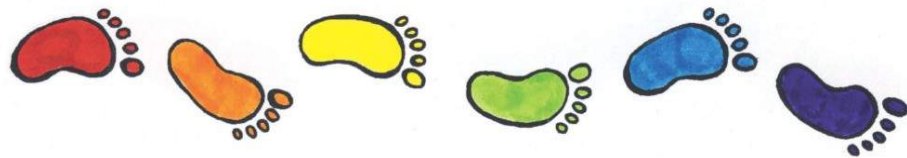


Seminar, Wellington
5th April 2017

No change? It's all change!

A perspective from the UK on tomorrow's energy supplies



John Scott
Chiltern Power Ltd



Chiltern Power

Very briefly

My background:

- ❖ Electricity Distribution & Transmission planning and operations
- ❖ Manager of the GB National Control Centre
- ❖ Engineering Director of National Grid Company in UK
- ❖ Technical Director for Ofgem, the GB Energy Regulator
- ❖ Director, Network Innovation for KEMA Consulting Ltd
- ❖ Independent Consultant, Chiltern Power Limited
 - ❖ Institution of Engineering & Technology, Energy Policy Panel
 - ❖ Visiting Professor – University of Bath
 - ❖ Non Executive Director - Smarter Grid Solutions
 - ❖ Senior Technical Advisor – Pearlstone Energy



A structure for today:

1

A round up of UK energy developments

2

UK government & regulatory policy shifts

3

The Future Power System Architecture project

4

FPSA's agile working approach – a lesson in itself

5

Some key learning: R&D gaps and emerging challenges

NZ

and some pointers for New Zealand



1

A round up of UK energy developments



Transformative Change is ahead

A recap.....

- ✓ Traditional 'centralised' architectures are no longer fit for purpose; the future will likely be a hybrid of centralised / cloud/ distributed systems
- ✓ Integration will be needed across Generation + Transmission + Distribution + Active Consumers + ...
- ✓ 'Edge Technologies' result in variable power sources, reversed power flows, & substantial new demands that are creating serious changes on many networks



- ✓ "Generation follows Demand" will be replaced increasingly by "Demand follows Generation", calling for new flexibility
- ✓ New commercial parties, models, and business platforms are now appearing
- ✓ A growing focus on communities, peer-to-peer trades, local markets, new services with attractive customer choices
- ✓ The old deterministic 'givens' are no longer valid: data analytics, statistical analysis & social sciences will be needed



The Changing Grid in Britain and Ireland

- Winter peak demand c.60GW and not *visibly* growing, 380TWh annual energy
- **Currently 27GW of Distributed Generation, and not visible to the SO**
- Comprising 15GW of Wind & 12GW of PV
- Latest high wind record on metered wind farms is 8.3GW – connected capacity of 9.9GW (84% of theoretical max output)

- **To maintain national system inertia** the SO instructs multiple part-loaded large units (when high renewables & low demand)
- **Need for new EFR** (Enhanced Frequency Response) services market; recent auction was a success for battery investors
- SO demand forecasting errors are rising owing to unmetered distributed generation

- Ireland proposes to increase the System Non-Synchronous Penetration (SNSP) limit from **50% to approx 60%**
- This will underpin an eventual increase to 75% SNSP (supported by investment under their DS3 programme)
- Recent conditions have resulted in near 60% SNSP arising in practice

- EU Network Code has new requirements:
- ...”with regard to information exchange... power-generating facilities... [>1MW]... shall be capable of exchanging information with the TSO in real time.....
 - **A significant data task**; is it wise to ‘simply centralise’ this – might a change from DNO to DSO roles be a better way forward?



The Changing Grid – a new SO market product

- National Grid's new ancillary services product **EFR: ENHANCED FREQUENCY RESPONSE**
- This recognises insufficient 'free governor action' now available from traditional large generators
- Very fast acting 'continuous control' for matching generation and demand (100% output in 1sec)
- Procured by a £66m auction – with large take-up (200MW) by battery project investors

- ...but at a low average price of only £9.44/MW, was this a loss-leader by big incumbents (**and unfair to SME innovators?**)
- NG was also criticised for only offering 4 year contracts, yet the installations will have a much longer asset life (again **very unhelpful to SME's** who have to raise funding from the market, rather than off their own Balance Sheets)

Similarly, auctions in the GB Capacity Market offer generation 15 year contracts, while DSR is offered a 1 year contract.....

The Department for Business, Energy and Industrial Strategy (BEIS) has welcomed the savings for consumers from the recent Enhanced Frequency Response (EFR) service, but **said it may not be profitable for the providers.**

BEIS' head of energy storage Rachel Cooper said at a Navigant storage event that the prices awarded in National Grid's EFR contracts earlier this month were "lower perhaps than we were expecting to see" and added it remains to be seen "whether they are profitable or not."

The EFR service represents one of the first real commercial opportunities in the UK for storage products and will deliver 201MW of storage onto the energy system by 2018.

National Grid said it will save £200 million through the use of batteries to provide frequency response over alternatives, which Cooper said will benefit consumers.

Cooper added that the prices are the result of companies wanting to be involved in the "threshold for an expansion of that service".

Strong calls can be heard for more innovation & flexibility, but is commercial thinking loaded against SME entrepreneurs, commonly the most creative?



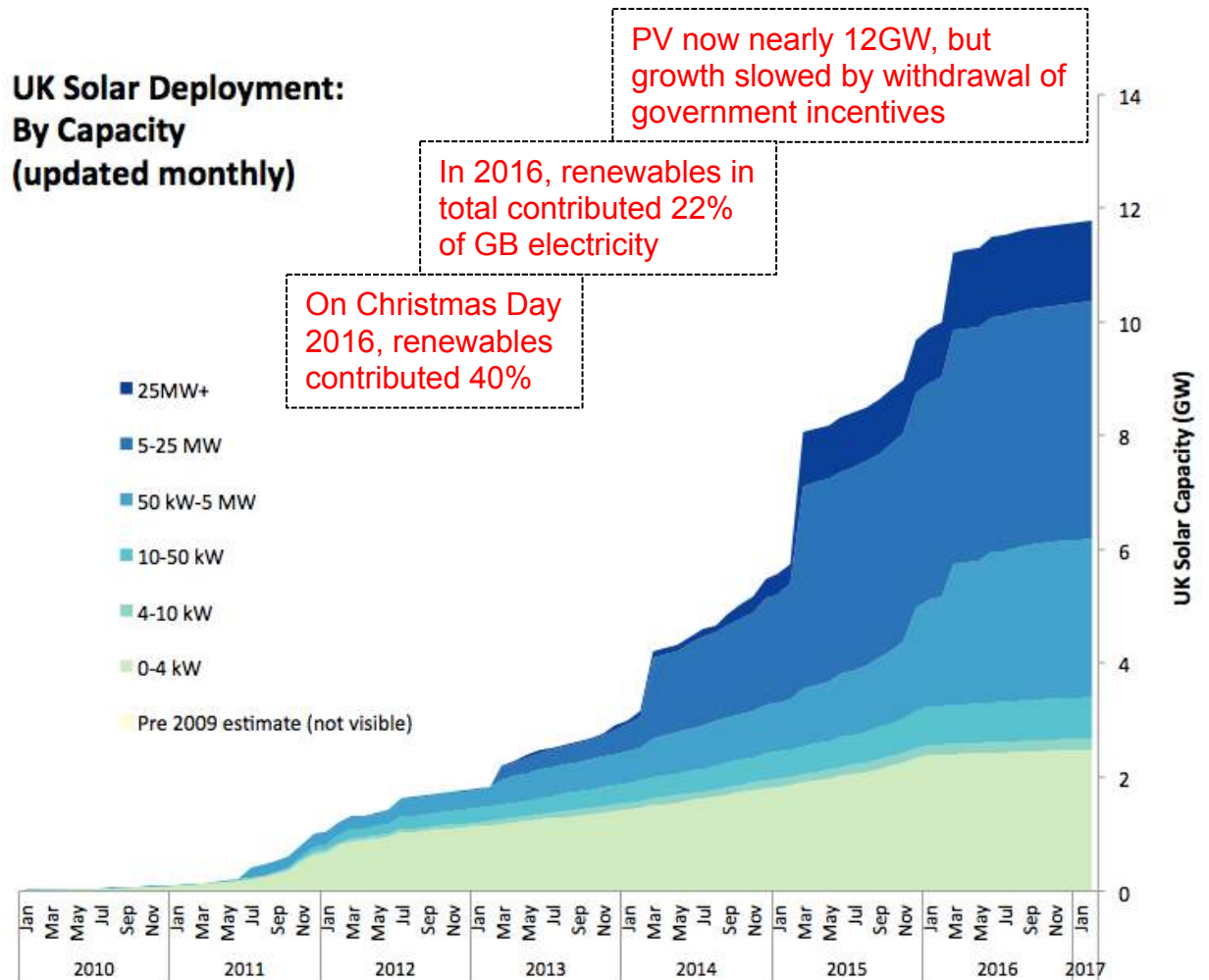
Solar PV deployed in Britain, MW

- 7.6TWh generated in 2016
- 2.5% of national consumption overall
- On occasions, PV delivers some 15% of national capacity
- 815,000 installations
- Largest field array is 48MW in Kent
- Government expect 22GW by 2020

- Largest UK roof installation is at Jaguar Land Rover in Wolverhampton
- 6MW peak output
- Supplies 1/3 of the building's energy
- Presented as 'green credentials'
- Local Authorities may expand roof PV



**UK Solar Deployment:
By Capacity
(updated monthly)**



Electric Vehicle sales

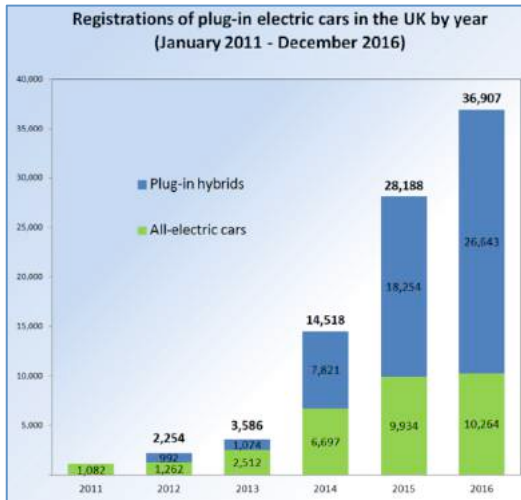
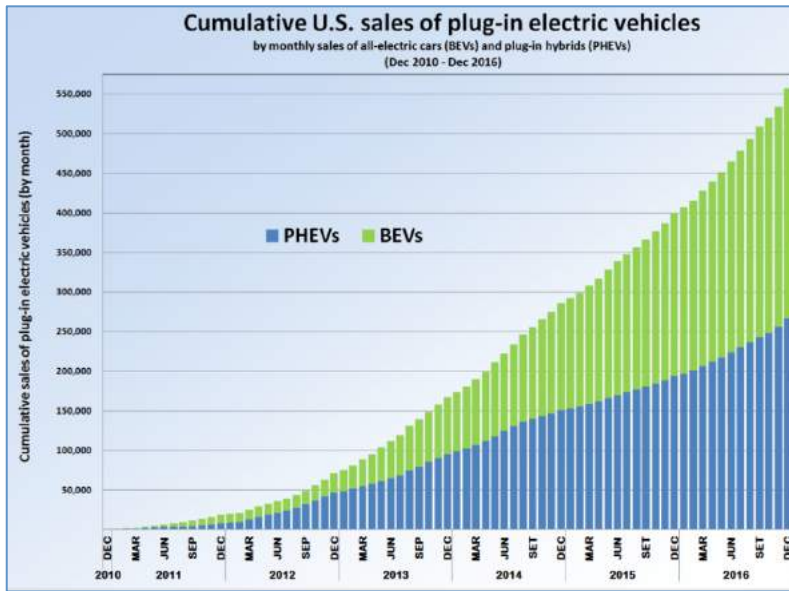
**USA
Monthly
Sales to
Dec 2016**

550k total

Note, 24
available
models in
USA

In the US
400,000
people have
paid \$1,000
to be on the
Tesla Model
3 waiting list.

32m
cars in
UK



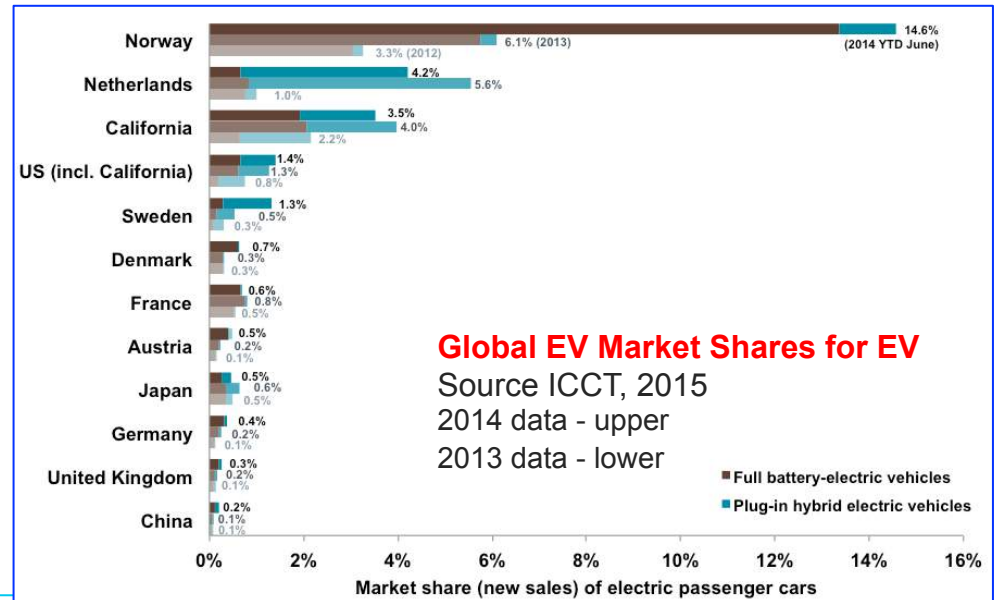
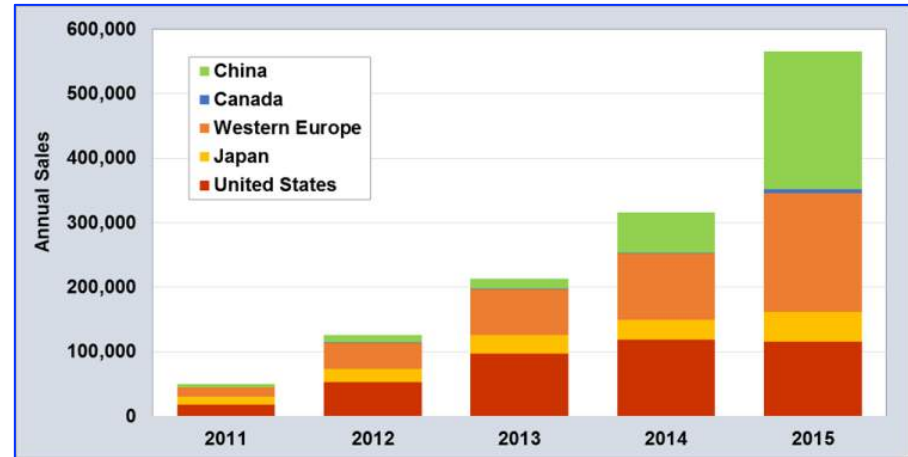
GB EV Sales

35,000
registered in
2016

Approx 1.3% of
all sales in
2016

90,000 Plug In
vehicles in GB

Global Plug In EV Sales 2011-2015 TOTAL 565,000



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<http://insideevs.com/plug-in-electric-car-sales-visualized-from-2011-to-2015/>

http://theicct.org/sites/default/files/publications/ICCT_EU-pocketbook_2015.pdf

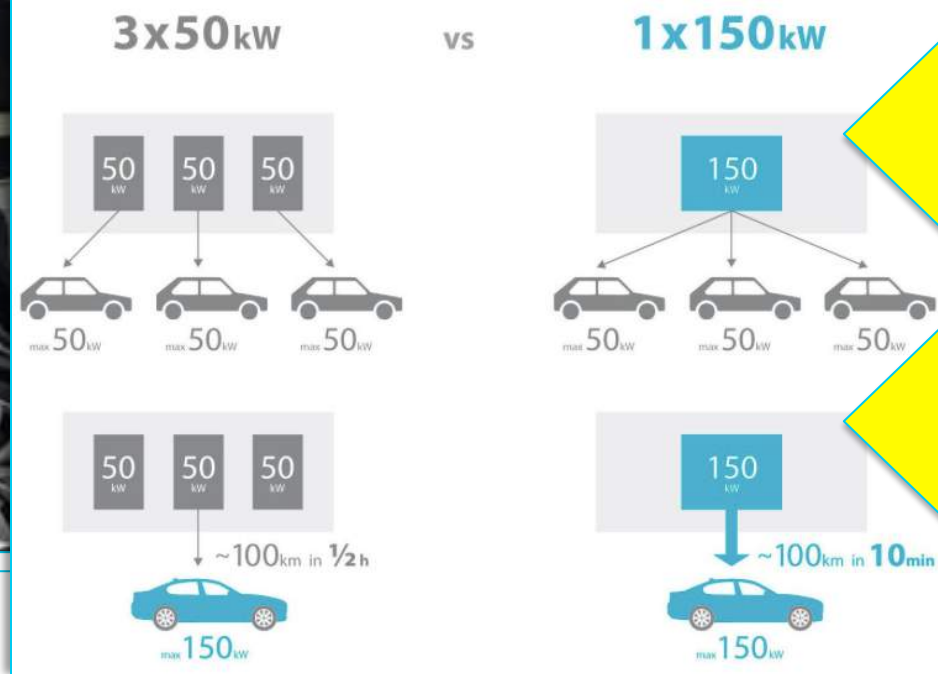
<http://www.businessgreen.com/bg/analysis/2389124/electric-car-sales-quadruple-during-2014>

Charger developments – watch out EDBs

'Supercharger for all': The first 150 kW fast-charging station comes online in Switzerland

Fred Lambert - Aug 10th 2016 11:21 am ET @FredericLambert

CHARGING STATION GOTTHARD FASTCHARGE



A Classic Tipping Point risk?

2 of these at the local Mall?

That's a new demand equating to 100 homes...



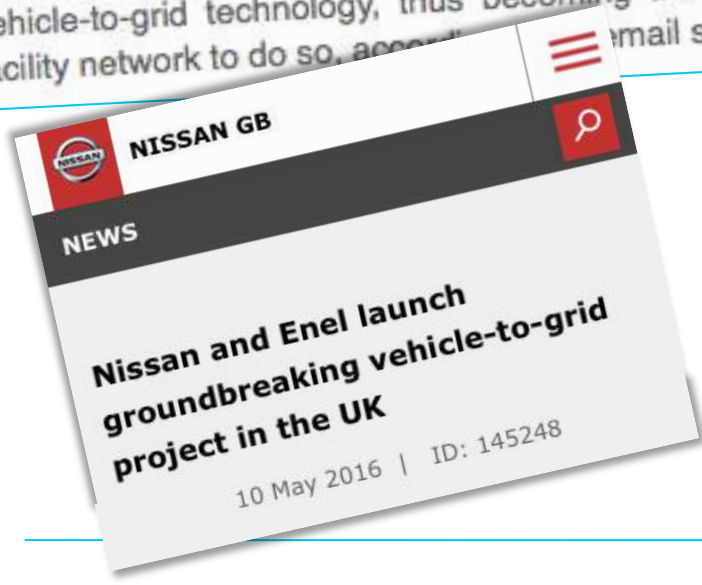
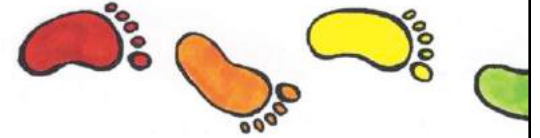
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... and there's more to watch out for

Nissan's UK European R&D Facility Installs Vehicle-To-Grid Technology

November 5th, 2016 by [James Ayre](#)

Nissan's UK-based European R&D facility, Nissan Technical Centre Europe, has installed vehicle-to-grid technology, thus becoming the first Nissan entity in the firm's European facility network to do so. [email sent to CleanTechnica.](#)



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Try some simple maths...

NZ is aiming to double the number of EVs every year to reach 64,000 EV's by 2021.

If that rate of progress continued, by 2022 there might be some 128,000 EVs.

If, say, 75% of these are on charge at the same time, using a 7kW home charger, and if they are on a Time-of-Use tariff, which moves from a high price to a low price period, these EV chargers will switch on simultaneously.

The step change of load will be $0.75 \times 128,000 \times 7 = 672,000\text{kW} = 672\text{MW}$

On today's power system, this step change would exceed Transpower's typical fast reserve holding and would endanger security of supplies across NZ.

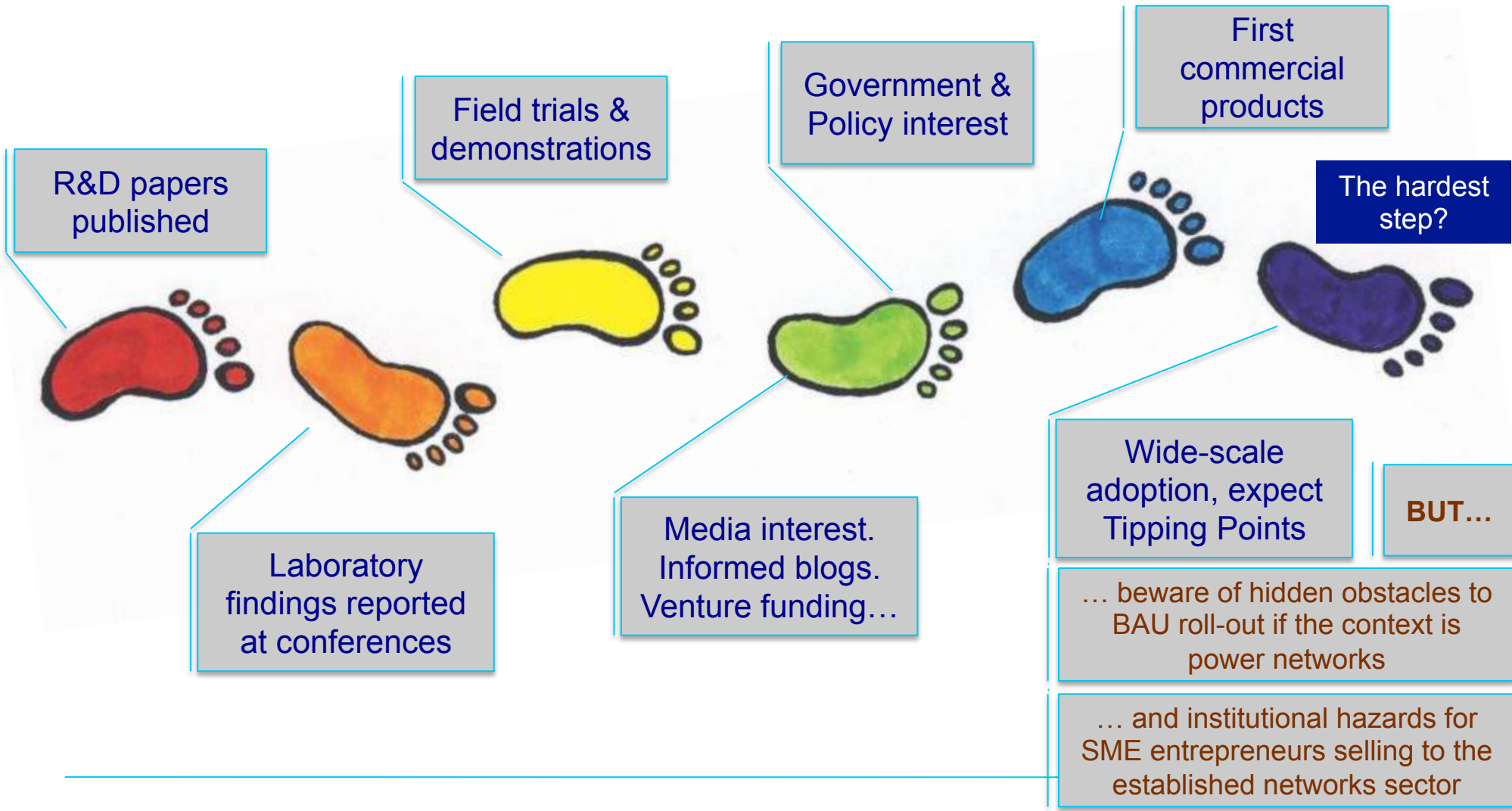
There are many potential solutions to this, other than the expensive option of holding more reserve (eg randomised switching delays, low frequency interlocks) **but they each require a co-ordinated approach designed-in to the cars/charging arrangements.**

It's a new type of challenge. It's 'whole-system' and spans many ownership boundaries. **So, whose job is it to resolve this?** In GB the answer is 'nobody'... is NZ likewise?



Read the direction of travel

Look for the footprints



The changing GB grid – a quick summary



- For a comprehensive review of the operational changes see National Grid's *System Operability Framework* reports published annually
- Key drivers & changes are reducing inertia; concerns for RoCoF trips and voltage depression trips of DG; changing demand Q/P ratios; high system voltages; and periods of low fault levels insufficient to operate protection
- Many of these issues require 'whole-system' solutions & new flexibility



- Wider sector changes now appearing include the growth of Community Energy enterprises, Electric Vehicles, Smart City initiatives, and the Internet of Things. Also home and grid scale storage, new aggregation services, and parties providing home energy management services
- The government is promoting community heat - a cross vector opportunity



- 'Whole system' issues not only span traditional silos and ownership boundaries but also involve new parties operating 'beyond the meter'
- Technical governance and change processes that worked well previously cannot respond with the necessary agility and stakeholder responsiveness



2

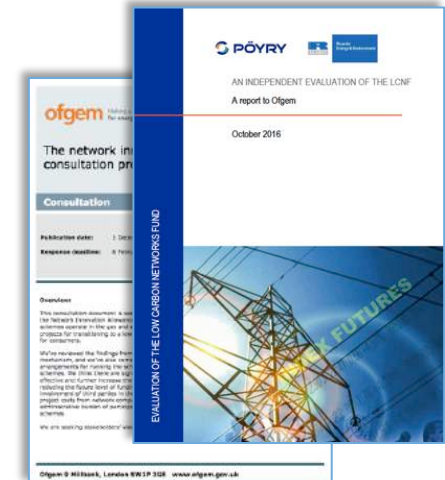
UK government & regulatory policy shifts



Ofgem: Innovation and customer benefit

Ofgem has undertaken a comprehensive review of the value to customers of the Low Carbon Network Fund innovation incentives for the network companies.

Their conclusions are supported by joint analysis from economic consultants Poyry and technical consultants Ricardo.

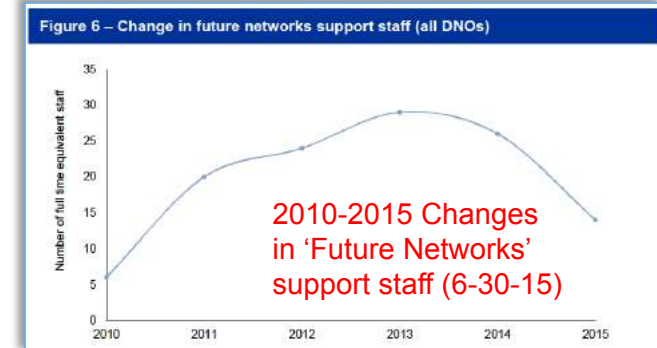
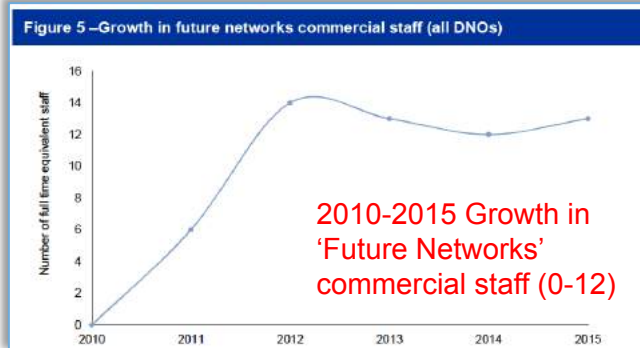
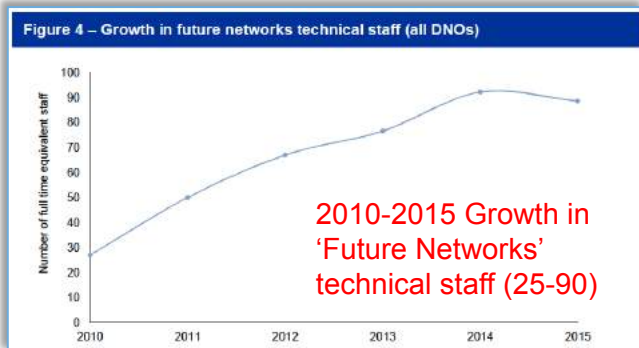
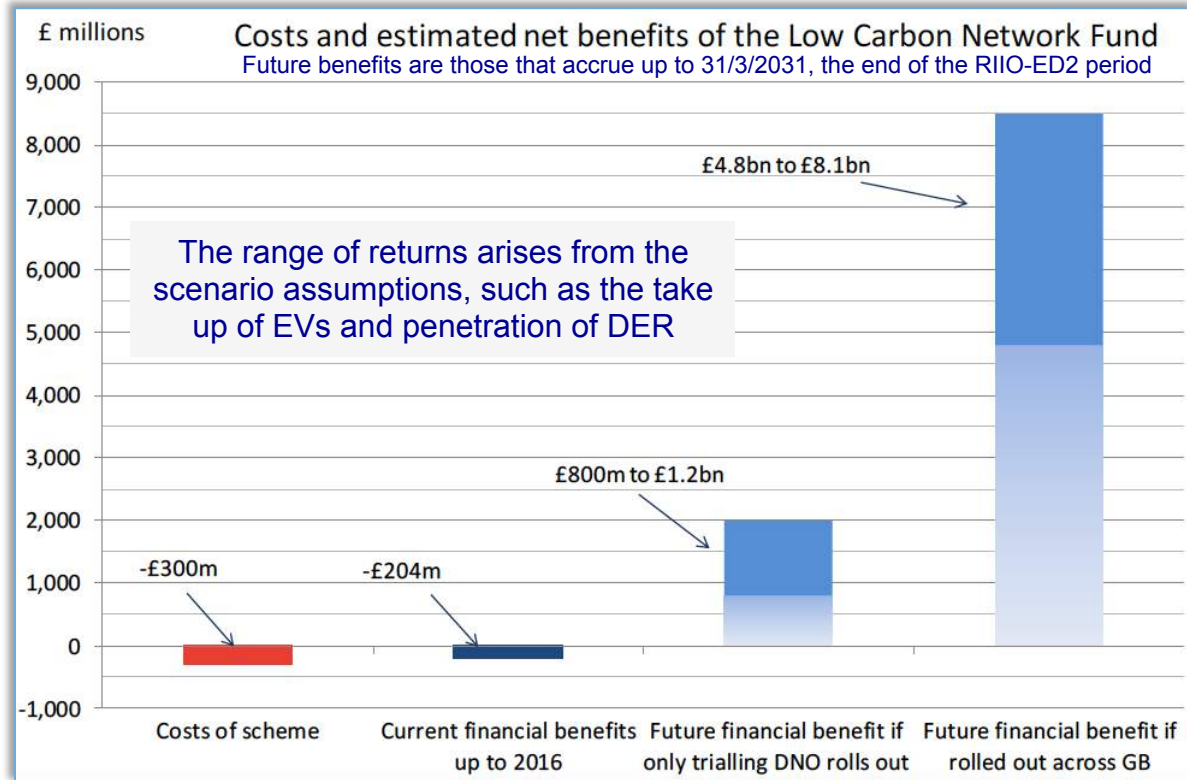


- This follows the completion of the 2009-2015 LCNF programme,
- **It invested some £300m** into 23 flagship and 40 smaller projects
- 37% of the projects could become business-as-usual now
- *The discounted net benefits to consumers is between **£800m and £1.2bn** if projects are only rolled out in the DNO who trialled them*
- *If the projects are rolled out across all GB DNOs, the discounted net benefits are estimated at between **£4.8bn and £8.1bn***
- Ofgem propose to reduce funding from £90m to £70m pa for the successor Network Innovation Competition (NIC) to encourage cost-efficiency
- Ofgem is keen to continue partnerships with third parties, including new players.



Ofgem's key findings

"...the innovation schemes are providing value for money and helping to create a more innovative culture in network companies... (Ofgem)



The Innovation Landscape – a reflection

- The iPhone **created a new product category.**

12 key technologies make smartphones work:

1) miniature microprocessors, 2) memory chips, 3) solid state hard drives, 4) liquid crystal displays, 5) lithium-based batteries, 6) Fast-Fourier-Transform algorithms to convert analogue to digital signals, 7) the internet, 8) HTTP and HTML languages and protocols that access World Wide Web, 9) Cellular phone networks, 10) Global Positioning Systems - GPS, 11) The touchscreen, and 12) Voice-activated intelligence (Siri).



- **Every one of these 12 key technologies was supported in significant ways by governments** - often the US government (and commonly involving some arm of the military).
- Government supports funding *and* off-sets risk for entrepreneurs.
- **So, with energy changing, is Regulatory/Government engagement needed to *support* those who deliver breakthrough innovation?**



Ofgem, looking ahead: Community Energy



A recent Ofgem report defines local energy as: *Energy arrangements led by (or for the benefit of) a local group and for the benefit of local consumers. A local group is a collection of people and organisations with shared interests in local energy outcomes within a common geographical area.*

***“We believe that the viability of local energy models should be founded on improving consumer outcomes.*”**

Ofgem’s view: What’s driving local energy?

- **Devolution:** for some projects, **the broader devolution agenda** is an underlying motivation for a move away from the current centralised system
- **Consumer preferences and involvement:** a powerful motivation for some consumers may be **the desire to be more independent** and have greater control over their own energy affairs. More broadly, **consumer involvement appears to be a crucial factor in the appeal** of local projects; this is particularly so for local generation schemes, **where the relationship between community engagement and reward** is self-reinforcing
- **Trust:** general consumer dissatisfaction with larger energy utilities may mean a greater proportion of those **disengaged consumers willing to engage with entities they trust** (e.g local authorities).



Thinking ahead: Community Energy

Note that developments in Social Media, such as big data analytics, smart phone Apps, and crowd funding are enabling
Community Energy in two models:

1) *Communities of Place*

and

2) *Communities of Interest* (or *Virtual Communities*)

For example a town, suburb, campus or business park, who want to create local energy engagement, investment & jobs.

If left simply to their own interests these communities might be unaware of the problematic impact their aggregated action may create for local networks and the national power system... ***Might some facilitation and timely intervention be helpful?***
(but whose job would that be....)

For example, the members of a club or the owners of a brand of EV, offered 'tailored services' or businesses with energy assets located across multiple sites wanting to benefit from co-ordinated demand flexibility.



Community Energy focus: 2 examples from GB



The Community Action Group (CAG) Project consists of almost 60 groups across Oxfordshire. It is a community led group, organising events and projects to take action on issues including waste, transport, food, energy, biodiversity and social justice. Started in 2001, the network is the largest of its kind in the UK.

PROJECT IMPACTS TO DATE (NOT INCLUDING SANDFORD HYDRO)



36

Low Carbon Hub solar PV sites in Oxfordshire

1173

tonnes of CO2 saved every year

3.1

Megawatts of total installed capacity

2609

MWh of clean electricity generated every year

£1.8M

returns to Oxfordshire communities as community benefit funds

17K

school pupils benefitting from renewable energy every year

4500

employees of Oxfordshire businesses benefitting from renewable energy every year

Low Carbon Hub is “a pioneering *social enterprise*, working for a massive change in the UK's energy system...we need to get *much more local* about our energy system, and *much more renewable*, so that the benefits... strengthen local communities. We develop community-owned renewable energy in Oxfordshire and re-invest 100% of our own surplus.” (Founded Dec 2011)



UK government developments (i)

A fundamental policy shift, spurred by Brexit?
exploiting the impending removal of EU state aid rules

Theresa May said the new **Industrial Strategy** represented a “new approach to government” of “***not just stepping back but stepping up to a new, active role***”.

... “***it does not mean government telling business what to do...***” (Greg Clark, Minister)

Under David Cameron’s leadership, the government pursued a more hands-off approach.

The **Modern Industrial Strategy** is based on ten “pillars” including: skills, R&D, upgrading infrastructure, affordable energy and clean growth, effective institutions, and improving public procurement.



Complete with a new
Whitehall department



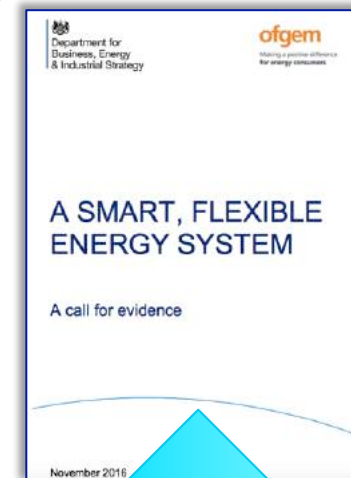
UK government developments (ii)

The **Smart, Flexible Energy System** consultation

“Our ultimate objective – clean, secure and affordable energy – is clear, *but a number of possible pathways lie before us*. In this Call for Evidence we ask open questions about these strategic choices...

“...The approach set out here is aligned with the development of the Government’s *Industrial Strategy*.... in Spring 2017 we will set out specific actions to remove barriers, sharpen price signals and shape roles and responsibilities in the shift to a smart, more flexible energy system....

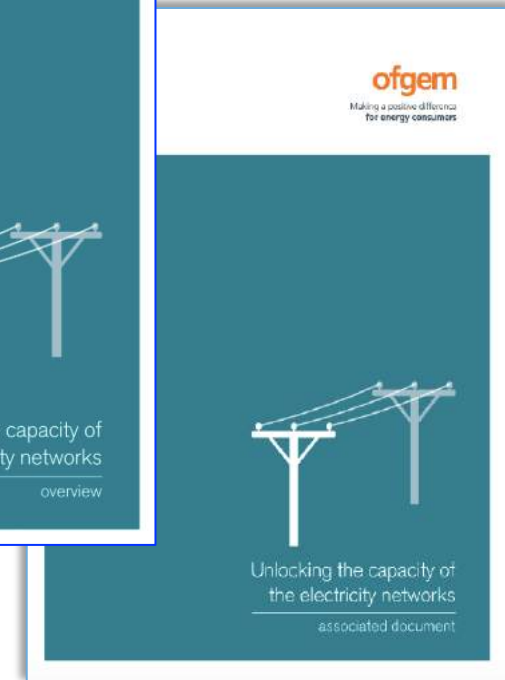
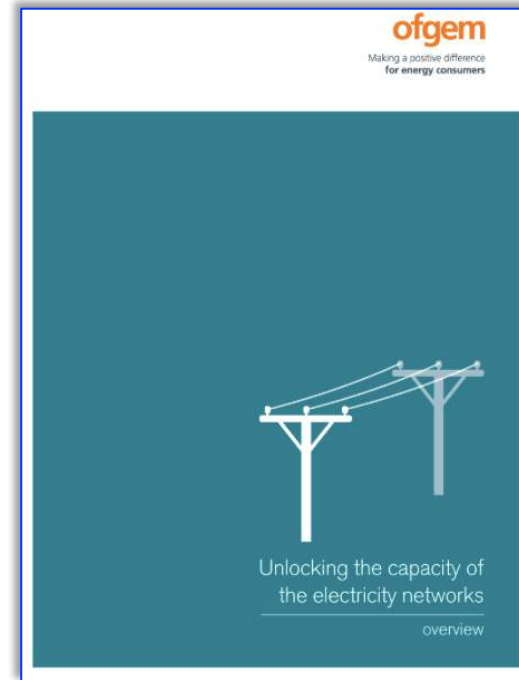
Key topics: increasing Flexibility – DSR, Aggregators, new ancillary services; the Capacity Market; Storage; DNO to DSO; independence of the TSO; smart metering national roll out; Time of Use tariffs; D-charging reforms, Cyber security; TSO-DSO coordination;



It's NOT a 'plan' but it considers 'pathways'. Could these provide the sense of direction that the market lacks?



On Ofgem's radar: new connections angst



“Ofgem believes the solution will **not** always be new pylons and wires.....



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<https://www.ofgem.gov.uk/system/files/docs/2017/02/unlocking-the-capacity-of-the-electricity-networks-overview.pdf>

<https://www.ofgem.gov.uk/system/files/docs/2017/02/unlocking-the-capacity-of-the-electricity-networks-associated-document.pdf>

Unlocking the Capacity of the Electricity Networks

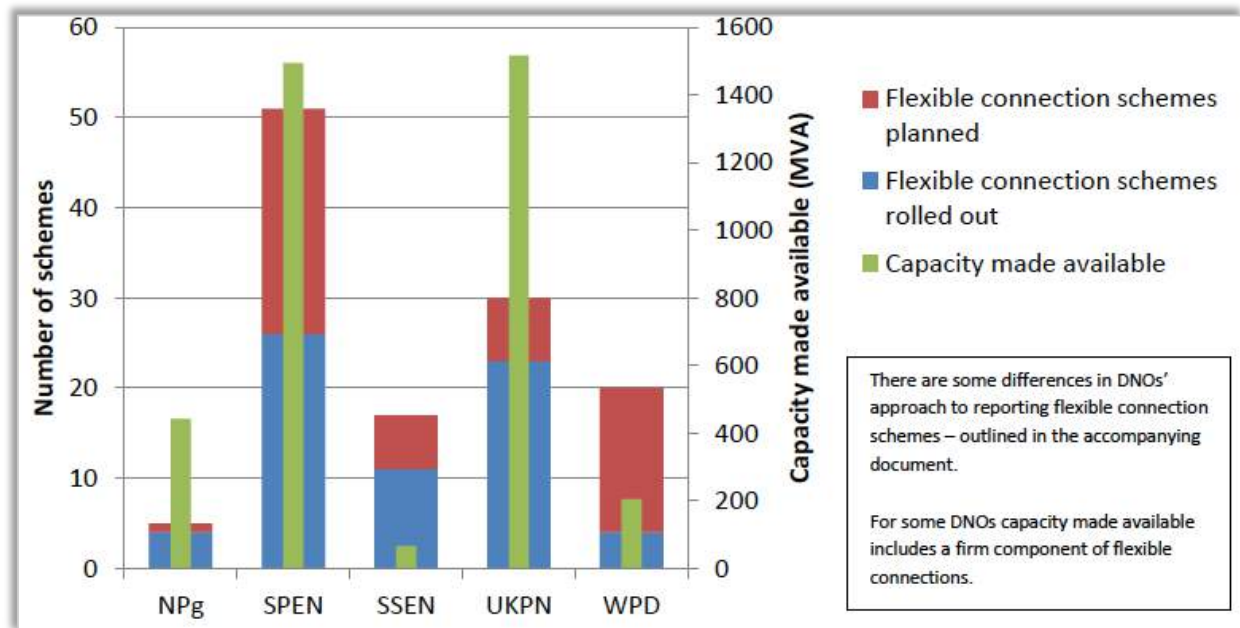
Ofgem's report Feb 2017



“An efficient process to get connected to the electricity network is essential for the social and economic wellbeing of the country....

“We are publishing this document to give you an overview of the status of constraints across the **distribution and transmission** networks and the changing interactions between them...

“DNOs must be **proactive in their approach** to planning and forecasting and **the choice of flexible connections** they make available. They must understand what constitutes **best practice**, they must listen and respond to their **stakeholders' changing needs** and they must manage their **investments efficiently**.

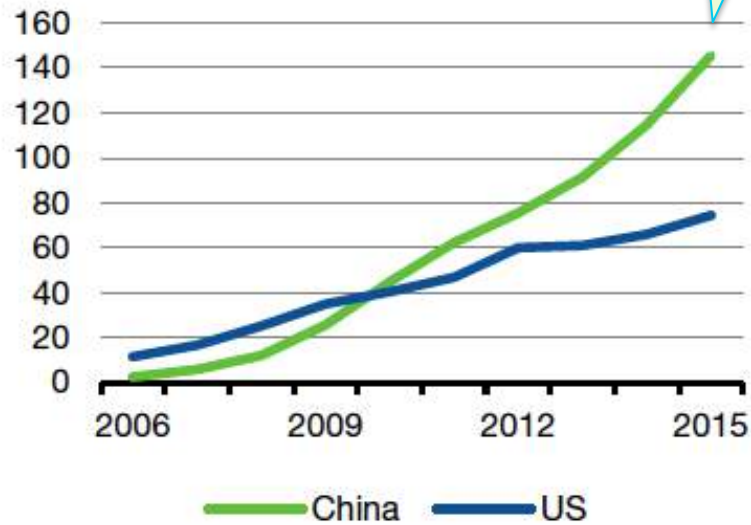


Network constraints – big time!

China has twice the wind capacity of USA

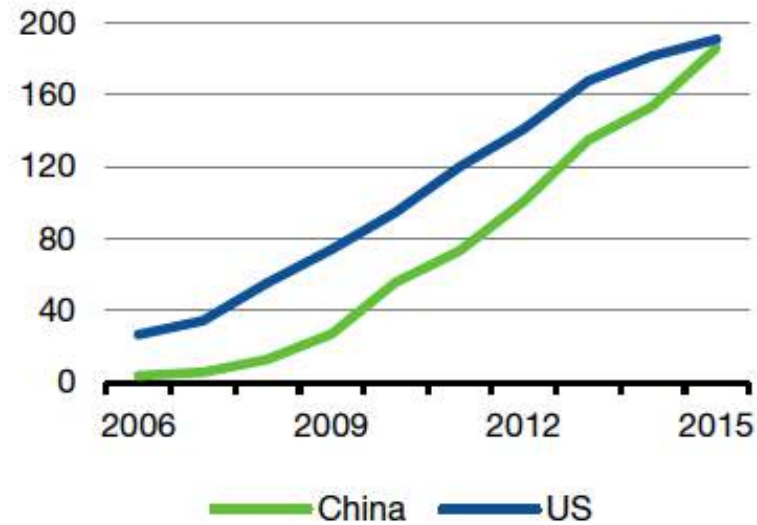
But generates the same amount of wind energy

Figure 40: Installed capacity (GW)



Source: GWEC

Figure 41: Wind production (TWh)



Source: GWEC



One DNO cites the following benefits



UK Power Networks says:

“The roll out of **Active Network Management** of Distributed Generation has already allowed 330MW of generation to connect **saving of over £100 million to DG customers**. Research shows that a smart, flexible energy system has the potential to save customers up to **£8 billion a year by 2050.**”

Around 8.5GW of energy from renewable DG sources have now been connected across UKPN's service area in total



In summary

The UK Government and the Regulator are:

- *Seeking to both promote network innovation and take steps to ensure it is rolled-out at scale as ‘BAU’*
- *Responding to increasing network constraints that are creating additional costs and delays for new connections*
- *Taking steps to be more forward looking*
- *Taking a joint approach to progressing government and regulatory thinking for energy, including cross-vector actions*
- *Re-launching the Smart Grid Forum as a **Smart Systems Forum**. This will “provide input, assistance and advice to BEIS and Ofgem on the implementation of **the Smart Systems Plan** ...in the development of the electricity system”*



3

The Future Power System Architecture project

“The Future Power System Architecture (FPSA) project is an ambitious effort involving dozens of industry professionals, academics, policymakers and stakeholders to assess the challenges to be faced in the electricity system by 2030 and to identify new functionality required...”

<http://www.theiet.org/sectors/energy/resources/fpsa-project.cfm>



IET Power Network Joint Vision

FPSA commenced 2015

Future Power System Architecture project

Discussions prompted by IET's expert group (Power Network Joint Vision, PNJV) **concerning future power system architecture, resulted in the UK government funding an evidence-gathering study.** This work, led by the IET in conjunction with the Energy Systems Catapult, completed in 2016 and all findings are public.

The follow-on FPSA2 is now running and will complete April 2017.



FPSA1 outputs were:

- Summary Report
- Main Report and appendices
- International Study
- System Engineering Methodology
- Functional Matrix Spreadsheet
- Function Sequencing Spreadsheet



All the reports are available at:
<http://www.theiet.org/sectors/energy/resources/fpsa-project.cfm?origin=reportdocs>

IET's study of best practices in other sectors highlighted their use of 'System Architect' roles

- Sometimes this is called **System Designer, Consultant Engineer, System Authority, Systems Coordinator, or Strategic Planner**
- These parties are neither the stakeholders that set the objectives for the system, nor organisations that design, build, own and operate the hardware
- Their role is to ensure 'systems of systems' operate seamlessly to meet declared business objectives

Key Point to Note: The term System Architect should not be confused with 'central planning' – which categorically it is not.

Key Outcomes from FPSA1

- Substantial new or extended functionalities, both technical and commercial,
- Implementation challenges
- Delivery by 2030 is possible
- the whole system
- presents new challenges for today's institutional arrangements



New or extended functionality

- **35 new or significantly extended** functions identified for the power sector
- Heavy interaction between these functions, so no simple prioritisation
- Incremental delivery would be risky
 - Extra costs
 - Breached engineering limits
 - Compromised system security
 - Policy objectives not met
- A coherent transformation programme is needed
- It's a whole-system challenge, that involves many parties and crosses many boundaries.



Five examples from the 35 Functions

Investment planning in a fast moving world

Monitor the energy landscape in a systematic way to enable the power sector to respond in an agile and coordinated way to continuous change, and ensure the timely introduction and implementation of investments and functionality

Black Start restoration in a system with widely distributed resources

Enable timely restoration of supplies following a national failure - with an increasingly distributed and weather-dependent generation, storage and demand management portfolio

Operating with Local Markets and Community Energy

Provide a mechanism for peer to peer trading (intra and inter community) with appropriate charging for use of the power system, recognising both physical and virtual communities of users

Recovery from local failures where network diversity has been lost

Enable restoration of supplies following a prolonged local supply failure – that results in loss of both local generation and diversity in demand (e.g. where all Heat Pumps and all EVs are calling for power)

The active management of networks, generation, storage and demand

Provide automated and secure management of demand, generation and an increasing range of energy resources and ancillary services, including smart appliances, and building and home energy management systems, while avoiding adverse T & D interactions.

Project status & looking ahead

The Future Power Systems Architecture project

Today



Power Network Joint Vision
PNJV
Framed the issue
2012-2015

FPASA1
Defined future functional needs
Reported in July 2016

FPASA2
Fuller Stakeholding
Wider Implications
Enabling Frameworks

FPASA3
Proving Trials

Expanding & on-going

FPSA2 Programme Work Packages

These were competitively tendered

Work in Progress

WP1A: Engage with Stakeholders

- Establish a survey technique to identify the barriers being encountered, especially for communities and grid-edge technologies

WP1B: Future Stakeholder Needs

- Research future socio-political drivers on customer and stakeholders behaviour

WP2: Review the Functional Analysis from FPSA1, Identify no-regrets actions, assess RD&D required to accelerate deployment

- Check validity and completeness of Functions and options for delivery
- Progress no-regrets actions where feasible through today's sector processes, including touch points with other vectors
- Identify RD&D and innovation opportunities to accelerate delivery

WP3: Impact Analysis

- Identify the barriers to developing and implementing the Functions within current sector processes and assess the impact of non or late delivery

WP4: Enabling Framework Identification

- Assess architectural options to remove institutional (regulatory, market, technical, cultural, etc.) barriers to delivering Functions
- Identify Enabling Frameworks and potential trials for development under FPSA3

WP5: Synthesis Integration and Reporting

- Ensure key findings are integrated between Work Packages
- Deliver final reports

WP6: Dissemination

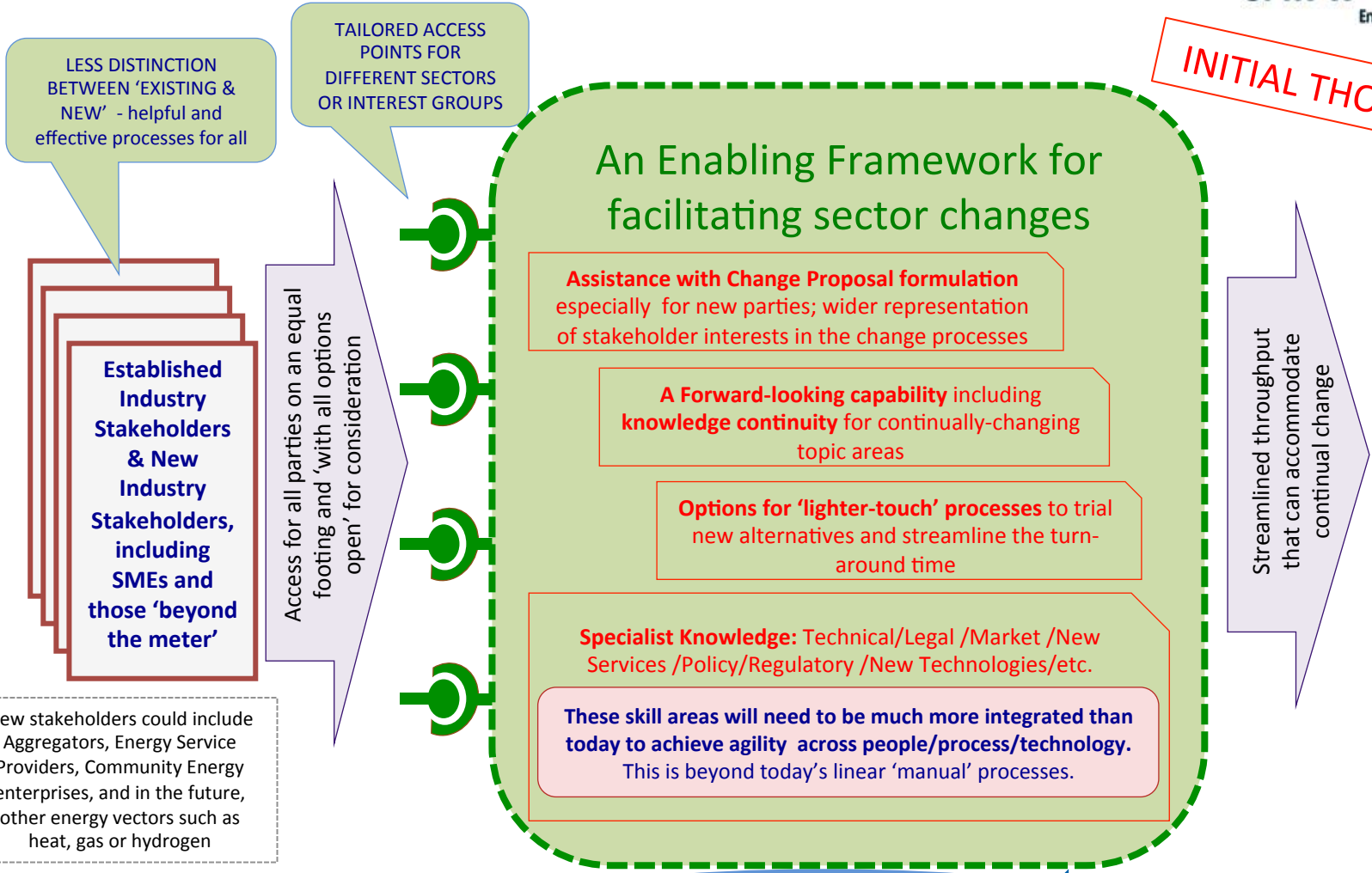
- Ensure complexities of FSPA are appropriately briefed to diverse audiences
- Explore improved communication techniques

A key output from FPSA2 is the identification of “Enabling Frameworks” (WP4)

Improving Today's Industry Change Processes

Some pointers for the way ahead?

INITIAL THOUGHTS



New stakeholders could include Aggregators, Energy Service Providers, Community Energy enterprises, and in the future, other energy vectors such as heat, gas or hydrogen

RE-THINKING WILL BE REQUIRED HERE

2. CHANGE DESIGN/ CONSULTATION/ APPROVAL

In an agile multi-party world, what is 'Consultation'?

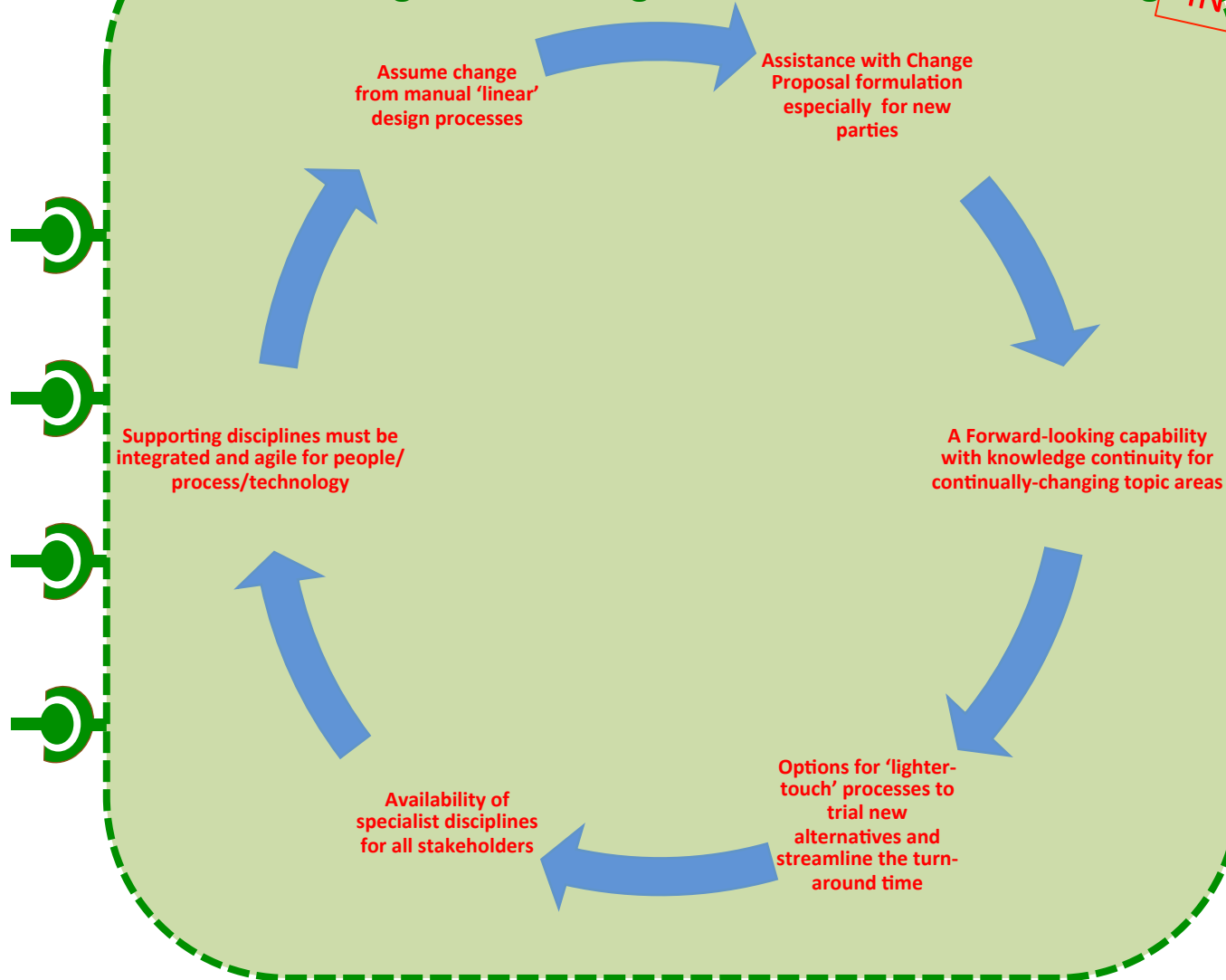
In an agile world, what is a 'Change Proposal?'
Could it be a 'publish - subscribe' model as used in software messaging architectures?

1. CHANGE PROPOSAL FORMULATION

3. OUTCOME IMPLEMENTATION

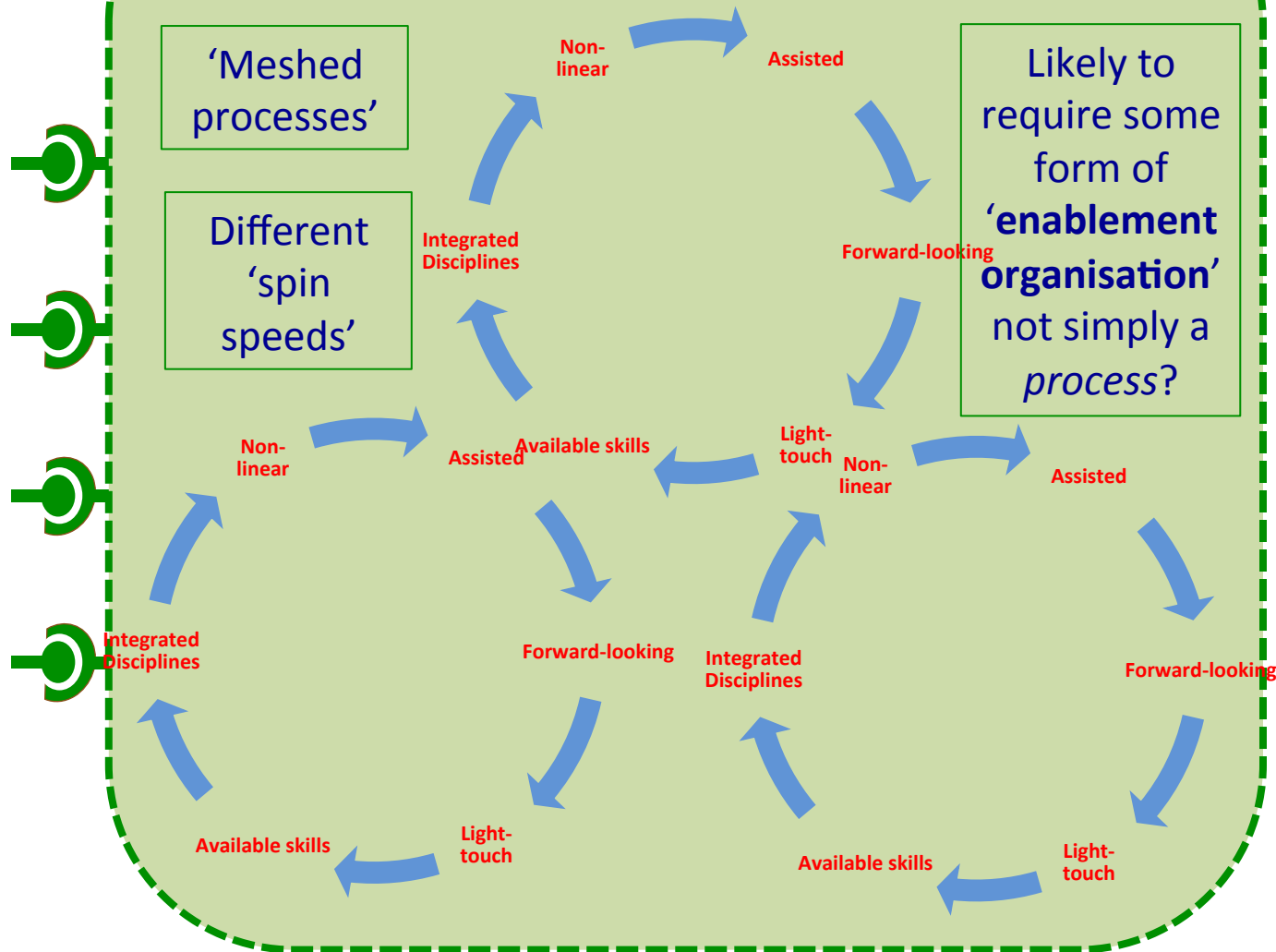
Summarising - an Enabling Framework for new thinking

INITIAL THOUGHTS



INITIAL THOUGHTS

The biggest challenge?



4

FP2SA2's agile working approach –
a kind of 'enabling framework' in itself?



FP5A2 project: Synthesis & Integration Approach

Not a traditional 'waterfall' project plan using PRINCE2 principles

- **Close integration** to ensure that the work packages exchange findings as they develop
- **A distinct Synthesis & Integration activity** to provide the framework and management to enable this to happen
- **Agile project principles** will ensure controlled, interactive development
- At the outset, a meeting with all the appointed consultants agreed the working arrangements; this included weekly update conference calls to set the 'drum beat' of pace.

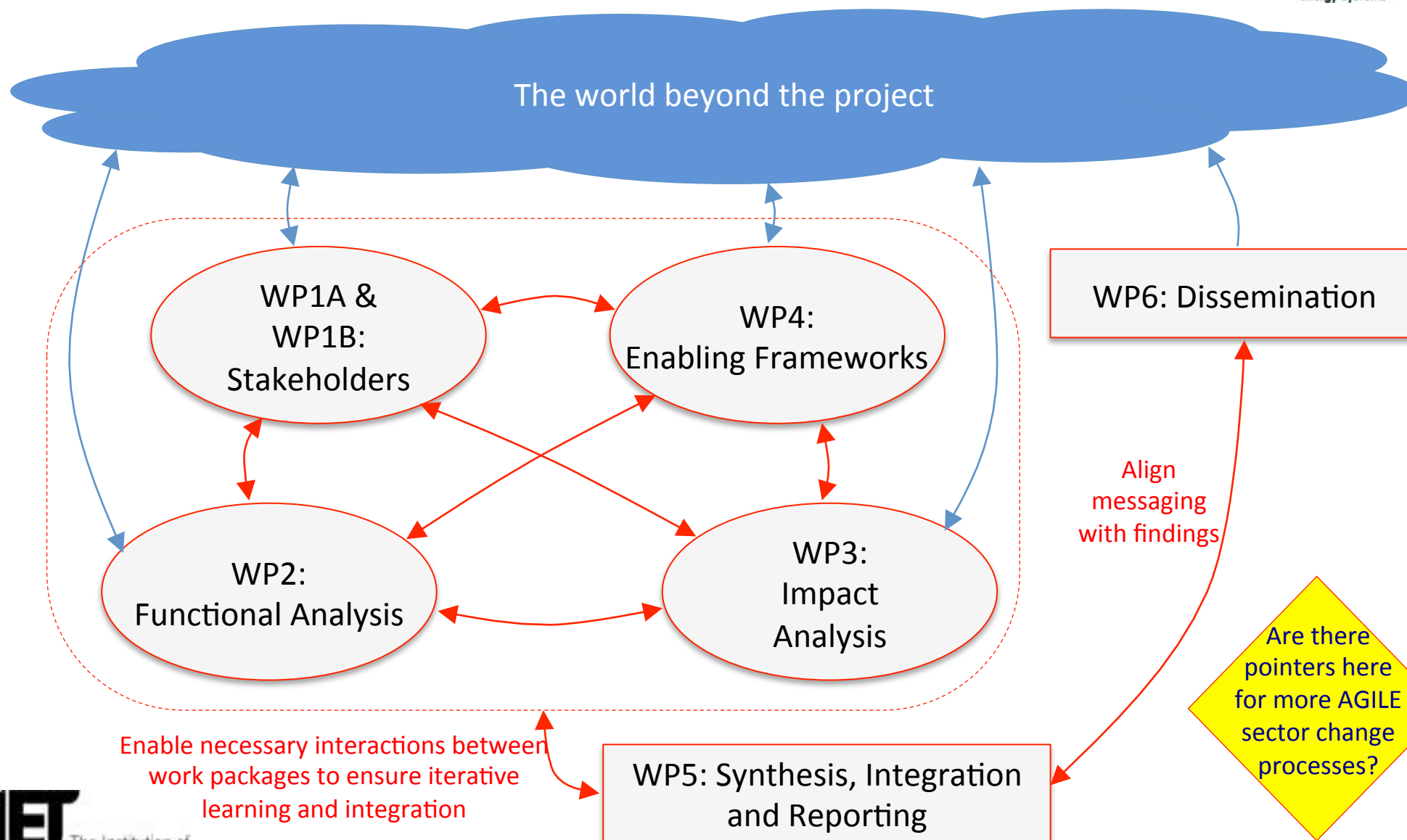
Agile software development is an established IT methodology.

It describes a set of principles under which requirements and solutions evolve through the collaborative effort of self-organizing cross-functional teams.... adaptive planning, evolutionary development, early delivery, and continuous improvement, and it encourages rapid and flexible response to change.



WP = WORK PACKAGE
(competitively bid by consultants)

FPSA2: Synthesis & Integration Using AGILE project methodologies



Enable necessary interactions between work packages to ensure iterative learning and integration

Align messaging with findings

Are there pointers here for more AGILE sector change processes?

5

Some emerging learning: R&D gaps and anticipated challenges

Ideas for
NZ/UK
collaboration
welcome

- **Data & Analytics:** suited to 'many to many' services; whole-system cyber secure
- **Optimisation of network outage plans:** including flexibility providers and DERs
- **Active Network Management:** ANM interactions and between T & D networks
- **DSOs:** Decision support tools for Decentralised Energy Systems
- **Optimisation of networks-scale batteries:** addressing their whole value stack
- **Markets for near-zero marginal cost energy;** valuing of other characteristics...
- **Protection devices:** able to respond at times of low fault infeed
- **Waveforms:** monitoring and cleaning techniques, especially at LV
- **Security of Supply:** inc VOLL reassessment in high DER systems; HILP events
- **Network charging:** including social equity, community energy and smart cities
- **Cross-vector energy:** modelling, investment support and R/T operational tools
- **Block Chain application:** including peer to peer trades, local markets & services

Some topics may warrant investigation/exploration as a first step, before 'solutions'



5

Emerging learning – stakeholder responses

FPSA2 was tasked with establishing closer stakeholder engagement, especially the new, beyond-the-meter parties. Two influential strands of work are:

1. The dedicated Work Packages, contracted to separate consultants, to address **(i) today's stakeholders** (WP1A) and **(ii) future stakeholders** (WP1B)
2. The work of the Communications team (WP6) that includes an analysis of **stakeholder segmentation**, and an examination of how issues look through their different “Lenses”. The five Lenses being examined are:

SO, DNO/DSO, TNO, Large Generators, established networks vendors, key consultancies, technical media

Domestic / micro-SME customers, Suppliers, the smart metering community, smart home and energy services

Large I&C Customers, Aggregators, Energy Communities, Smart Cities, DG Operators, Storage Operators

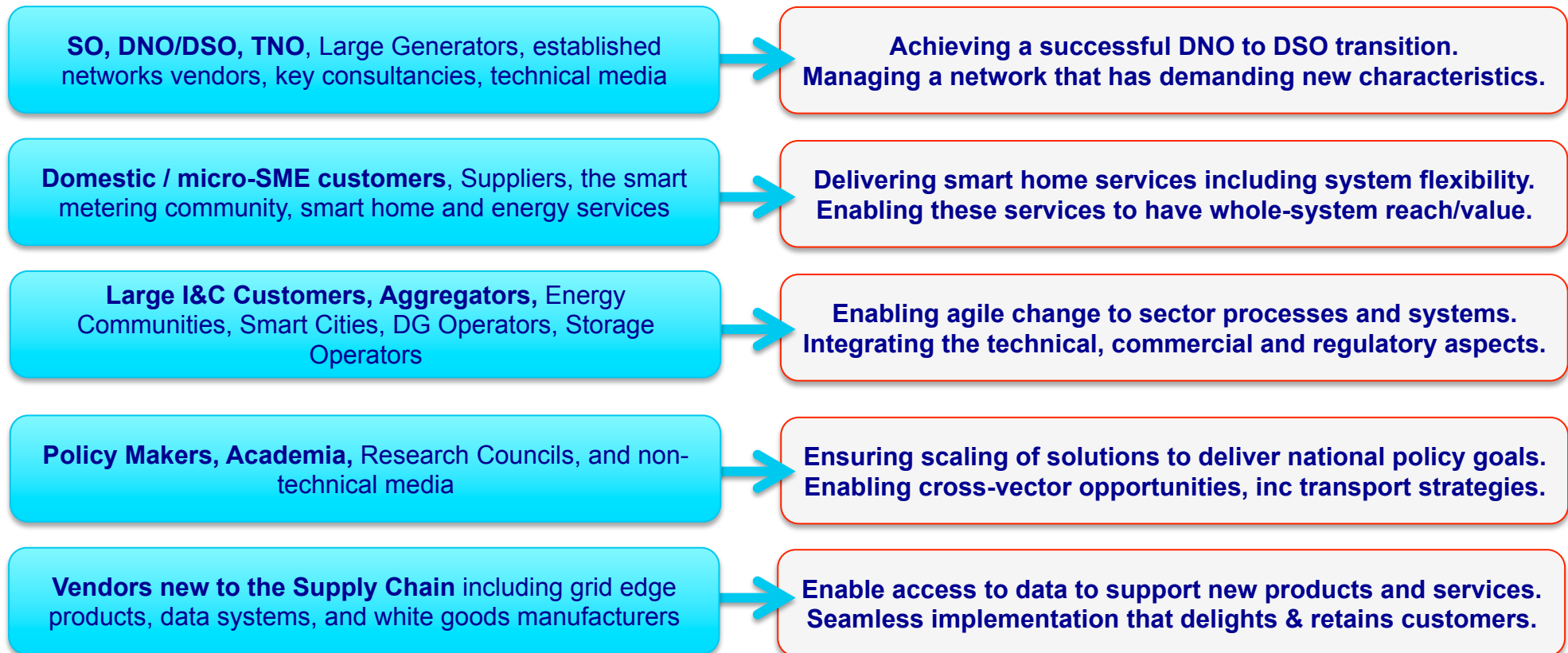
Policy Makers, Academia, Research Councils, and non-technical media

Vendors new to the Supply Chain including grid edge products, data systems, and white goods manufacturers



Examples, the different views through the five Lenses

Business Drivers > Opportunities > Why are these important > Which of the '35' new Functions are needed?





Some pointers for New Zealand?



NZ

Would there be value in ELBs/DNOs developing their roles to become DSOs/DSPPs?

- **This is clearly on GB, EU & US agendas: *regulators see benefits for customers***
- Perhaps local balancing & flexibility management roles; solutions for local networks and services to the SO; creating/enabling markets for non-traditional flexibility, addressing real and reactive power challenges
- Providing or enabling platforms for community energy, smart cities and distributed systems that in due course might link across energy vectors and transport
- Managing new kinds of 'big data' ensuring open systems, privacy and cyber security
- Increasing network visibility, and sharing this data with multiple parties as needed
- Interfacing to parties 'beyond the meter', including home energy management services, smart EV charging, smart city developments, commercial players in data and services such as aggregators...
- **DSO roles should add value to ELBs. It might bring changes to risk/reward profiles and a need to consider owner and funder appetites. Associated changes could be anticipated in regulatory frameworks. There might be value in building evidence for these discussions. The FPSA lessons concerning different lenses apply here.**



NZ

A recent ENA (UK) report remarks on DSO transition

Page 5: “ The transition from DNO to distribution system operator (DSO) **will require investment** to increase the active network capability at distribution level to support both local and whole of system balancing, and ensure optimal use of assets.”

Page 9: “...There are **gaps in existing systems**, policies, processes, data & technology

Page 65: “ The distribution network does not have the same level of automation, protection and control as the transmission network, and **significant investment and development**will be required to enable the market-driven options so far identified.”

Page 42: Routine and Emergency: No framework exists for DNOs to manage and control customer reactive response within the distribution network. It is expected that **changes may also be required to relevant industry codes**. ...an appropriate funding mechanism for payment to customers for services will need regulatory clarification.

The message is that transition to DSO is non-trivial. It requires investment, but would enable new customer choices, promote competition and offer cost-effective solutions.



NZ

Block chain technology isn't going away...

UtilityWeek

Decentralisation and the blockchain: it is here, it is now and it can't be blocked

14/02/2017

Share:  Share  Tweet   Like 0  Share

“It is the emergence of the decentralised internet of value, **represented by blockchain and distributed ledger technology**, that will provide the platform for true disruption of business models globally, and the energy and utility industry will not be safe from this disruption...

Neil Pennington

ID2020 – Harnessing Digital Identity for the Global Community (United Nations)

London Business School

<https://www.linkedin.com/in/theneilpenners/>

He was formerly Director of Innovation for RWE npower, a large European Genterailer



Chiltern Power

September 2016: “Vector, and Australian blockchain energy company Power Ledger signed an MOU to deploy Power Ledger's energy trading platform, allowing people to buy and sell power without using a retailer...

NZ

A notable Block Chain development in energy

NOTE – a Block Chain development that retains networks companies in the value loop, in a DSO role

Much of the efforts to develop market models for blockchain, such as **LO3 Energy's Brooklyn microgrid in New York** and **Power Ledger's Ecochain in Australia**, have focused on **peer-to-peer energy trading**.

A new initiative, being pioneered by **Quantoz Technology in the Netherlands**, is focused on a **local energy market model**, such as those defined by a postal code area, using a distributed permissioned block chain solution.

The company behind this new concept is Rotterdam-based blockchain startup Quantoz Technology, **sponsored by E.ON's** corporate accelerator and incubator programme. This was launched in December 2016.

“... a new market model at local level will offer incentives for residential prosumers to share flexibility and maintain grid connectivity services...”



Some thoughts about “engagement”.... (i)

ENERGY NEWS

www.energynews.co.nz
Friday 10 March, 2017

Lost customer loyalty key sector risk - Underhill

Gavin Evans - Thu, 09 Mar 2017

The electricity sector has lost of the loyalty of many of its customers and is now at greater risk from new technologies and changing business models, Security and Reliability Council chair Mike Underhill says.

Energy supply in this country is undoubtedly more efficient and more reliable than before the reforms of the 1980s. Pricing is more accurate and the recent initiatives by the Electricity Authority have also improved the country's ability to manage dry-year risk, he told delegates at the New Zealand Downstream conference in Auckland yesterday.

But he says the sector has also failed to engage with its customers during the most recent reforms, compounding earlier periods in the sector's history when it either “turned its back” on customers or simply of them when dealing with the complexities of the reforms in the 1980's and 1990's.

“I think the biggest threat to this industry is that we have lost the loyalty of our customers.”



Wider trends to consider:

- BREXIT surprise?
- TRUMP surprise?
- The language of ‘post-truth’
- We’ve had enough of ‘experts’...
- There are no ‘facts’....
- Fake news
- Populism
- Appeals to emotion, not logic
- Social bots/Twitterbots
- Only accept evidence that supports your own narrative
- “cheerfully shoot the messenger” if new evidence is contradictory

There appears to be a rejection of intellect in favour of emotion – if people feel they cannot rely on *facts*, they process information through the right side of their brains when they really should be processing through the left.

NZ

Some thoughts about “engagement”.... (ii)

Sam Woolley of the Oxford Internet Institute's computational propaganda institute: “one third of all traffic on Twitter before the EU Brexit referendum was automated “bots” – accounts that are programmed to look like people, to act like people, and to change the conversation, to make selected topics trend”



If the ‘experts’ openly and diametrically disagree - and if experts views can be shown by events to be (apparently) wrong (at least in the short term) - then society can hardly be blamed for distrusting and ultimately rejecting expertise.

And it won't matter who is right or wrong: the fact that the experts can't agree means that probably none of them really know what they're talking about....

Two thoughts to take away:

1. ***As informed professionals*** are we keeping a sufficiently close eye on worrying trends involving manipulation of public thinking / public emotion and democratic processes, eg fake news and Bots, and ***using our influence for societal good?***
2. ***In our dealings as a sector***, interfacing with stakeholders and the wider public, ***do we need to raise our game?*** Our ‘facts’ and ‘engineering logic’ will be of diminishing value if in the public eye ‘experts’ appear contradictory and lack common ground.





“NZ energy policies are on the right track, but challenges remain” IEA says

New Zealand has the second-highest level of emissions per GDP unit of the 35 OECD countries and the fifth-highest emissions per capita

The 2017 IEA energy review on NZ



“To support sustainable growth in line with the Paris Agreement, the government should facilitate technology opportunities for renewable energy and energy efficiency, in buildings, industrial heat, transport and agriculture

NZ has the second-highest level of emissions per GDP unit in the OECD and the fifth-highest emissions per capita “... the farming industry strongly relies on coal use (domestic lignite) for process heat...

“The country has a flexible power system, but future growth requires fine-tuning of market rules in favour of even more flexibility, demand response, smart and effective electricity retail and distribution.

“The distribution sector has 29 separate businesses... with a range of ownership structures..... Concerns have been raised about the financial, technical and managerial capability of the sector to respond effectively to the challenges

“Implementing the Paris Agreement.... NZ has yet to adopt additional policies required for the investment in decarbonising the economy.... Current energy efficiency targets and carbon price policies are not sufficient.

“Concerns... about the governance and decision-making capability of the distributors and their capacity to manage this potentially complex transition in an efficient and timely mannerto realise the potential benefits for consumers

“The government should encourage the development of more efficient structural arrangements...





“The government should encourage the development of more efficient structural arrangements...

ENERGY NEWS
www.energynews.co.nz
Wednesday 15 March, 2017

At the Downstream Conference, Trustpower chief executive Vince Hawksworth acknowledged

“the elephant is still in the room” in regards to the number of lines companies in this country and how well the smaller firms will adapt to change.

This is not an ‘economies of scale’ argument...

... and not necessarily about ‘ownership change’

Suitable structural arrangements are needed if there is to be effective delivery of new kinds of role for EDBs/DNOs. The IEA report offers:

- 1. *The Value Adding Services model***
- 2. *The Platform for Services model, “neutral facilitators?”***

Note this is *not* ‘no change’. CEER in Europe favours this, but... note their “grey” areas such as demand response, energy efficiency, distributed generation, storage and data management.

Could new services and better outcomes for customers be delivered and new value created for companies? An opportunity to move away from the death spiral and social inequity issues associated with DER and volumetric pricing?

These changes bring significant new complexity & requirements for entirely new skills.





Don't get lost in 'the 29' issues. Can these be resolved as a catalyst to creating new value & service?

Would 'sensible collaboration' between the 29 ELBs be a simpler solution here?

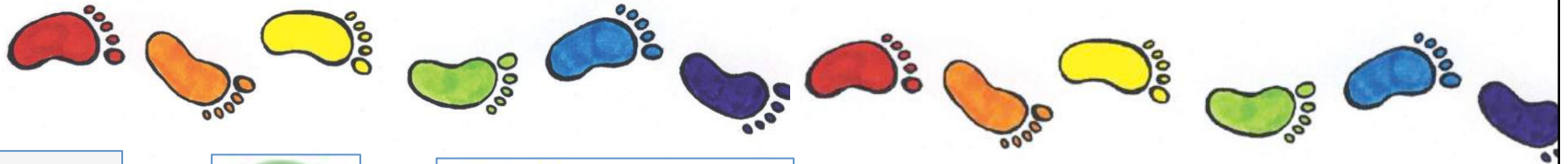
I suggest it's unlikely, just try these tests for new functionality such as providing data transfers that cross ownership boundaries while maintaining privacy & cyber security:

- **Who is accountable, who keeps it working into the future, who is responsible when service isn't delivered or adverse interactions cause a security problem?**
- **Where data is involved, who owns the analytics? Data usually has financial value: with \$\$ involved there can't be woolly boundaries or fudged ownership**
- **Be wary, ad hoc is unlikely to be good enough (and it tends to exclude SMEs)**

That said, once accountabilities are clear, **compared to today a much more nuanced form of collaboration will be key to success.** See how the mobile phone sector **cooperates** (through GSMA), e.g on new standards, yet **competes** vigorously for customers.

Who promotes nuanced cooperation? In Telco it's the companies, not the regulator.





TECHNOLOGY DEVELOPMENTS

ENVIRONMENTAL CONCERNS

CONSUMER ATTITUDES



These recent reports carry consistent messages for New Zealand

Might ignoring this opportunity for change... *consign companies to decline?*

... no visible leadership (they're dinosaurs)... too little too late (nice but missed the boat)... 3rd party actions relegate networks to 'insurance role'

Are we close to a decision point that's not to be missed, especially for the Networks sector...?



Don't end up in the sidings...

If so, who leads?
Are YOU the person to mobilise this?

A Go Hard, or Go Home moment?



Chiltern Power

<http://www.oecd.org/environment/environmental-pressures-rising-in-new-zealand.htm>
<http://www.vivideconomics.com/publications/net-zero-in-new-zealand>

NZ


In
summary

The drivers for making change:

- Global trends in energy & regulation
- Government energy policies, inc transport
- Improving technologies, and falling costs
- New products / services for customers
- Declining public & customer trust
- Rising customer expectations for service
- New 3rd parties, many 'beyond the meter'
- Peer-2-Peer is now easy with Apps
- IoT, Smart Cities, Community Energy
- DSO could create new value for DNO
- Off-grid decline, volumetric spiral-down

Barriers to a timely response:

- Networks tend to move slowly:
 - good reasons (safety, security...)
 - poor reasons (inertia, skills...)
- New sector functionality is needed
- Technical *and* commercial changes
- Change processes not agile
- Regulatory changes needed
- Power grid operation is changing
- Whole-system issues to address
- Data and its security are key issues
- ... and the conundrum of 'the 29'



Don't end
up in the
sidings...



NZ

And, lastly, at a practical level

- 1. Nothing beats first-hand practical experience:** small scale network trials let you understand local conditions, build knowledge in house, and gain evidence for management decisions & regulatory submissions. It also ensures your early mistakes are small ones!
- 2. It's high risk to parachute-in power network solutions:** be very wary of the promises of a 'fast follower' approach, especially if in truth you're close to a standing start.

And... it's an amazing & challenging time to be in energy:
Fundamental new thinking for society, new business opportunities... & new jobs.
But we need to tune-in to how society is changing, especially for communications and the worrying shifts from *facts* towards *emotions*.



No change? It's all change!

for power networks ... their users...
and for whole-system coordination & governance

Thank you for your attention



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