

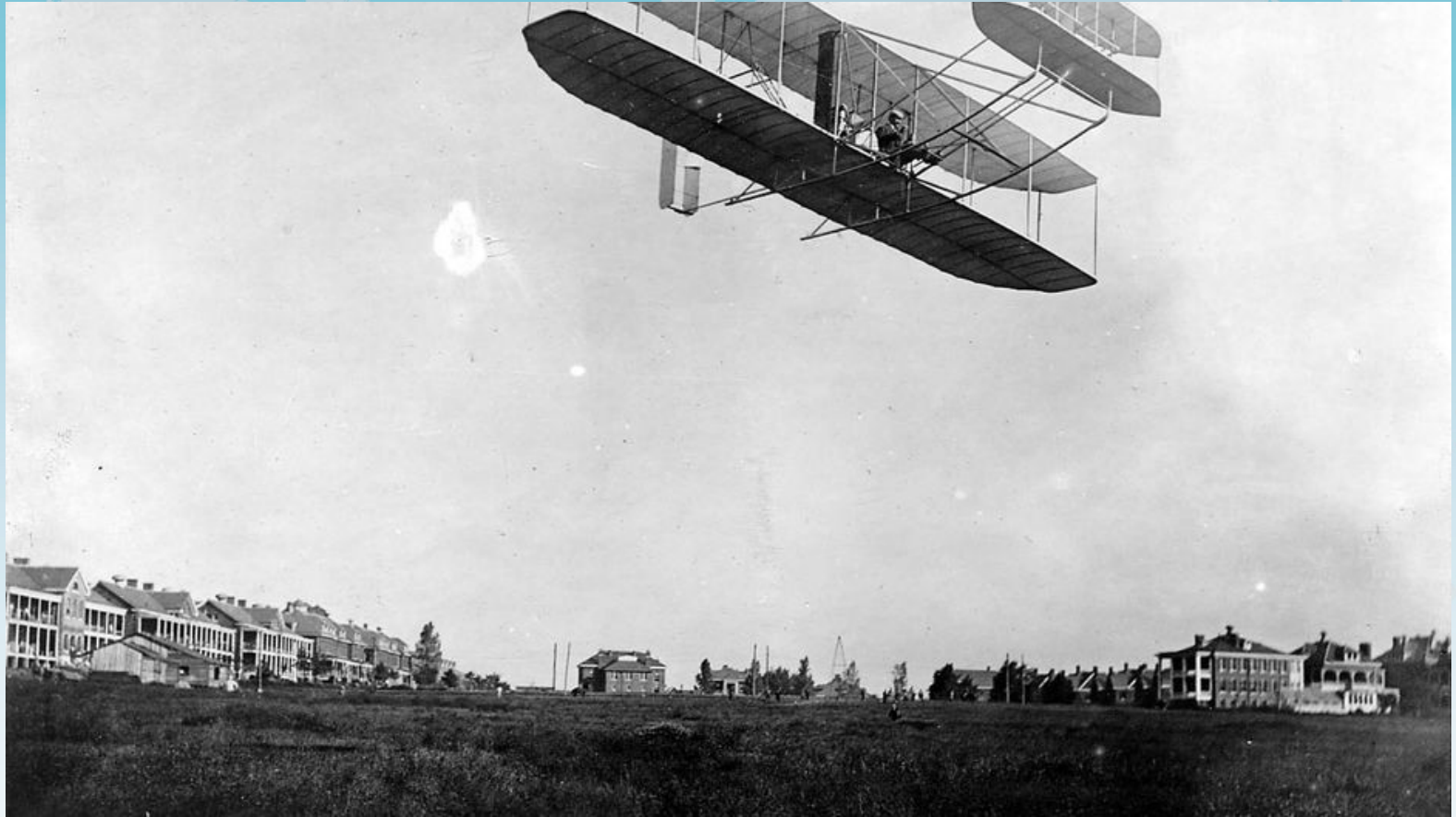


# Electricity networks as 'energy tech'

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2017 Churchill Fellow

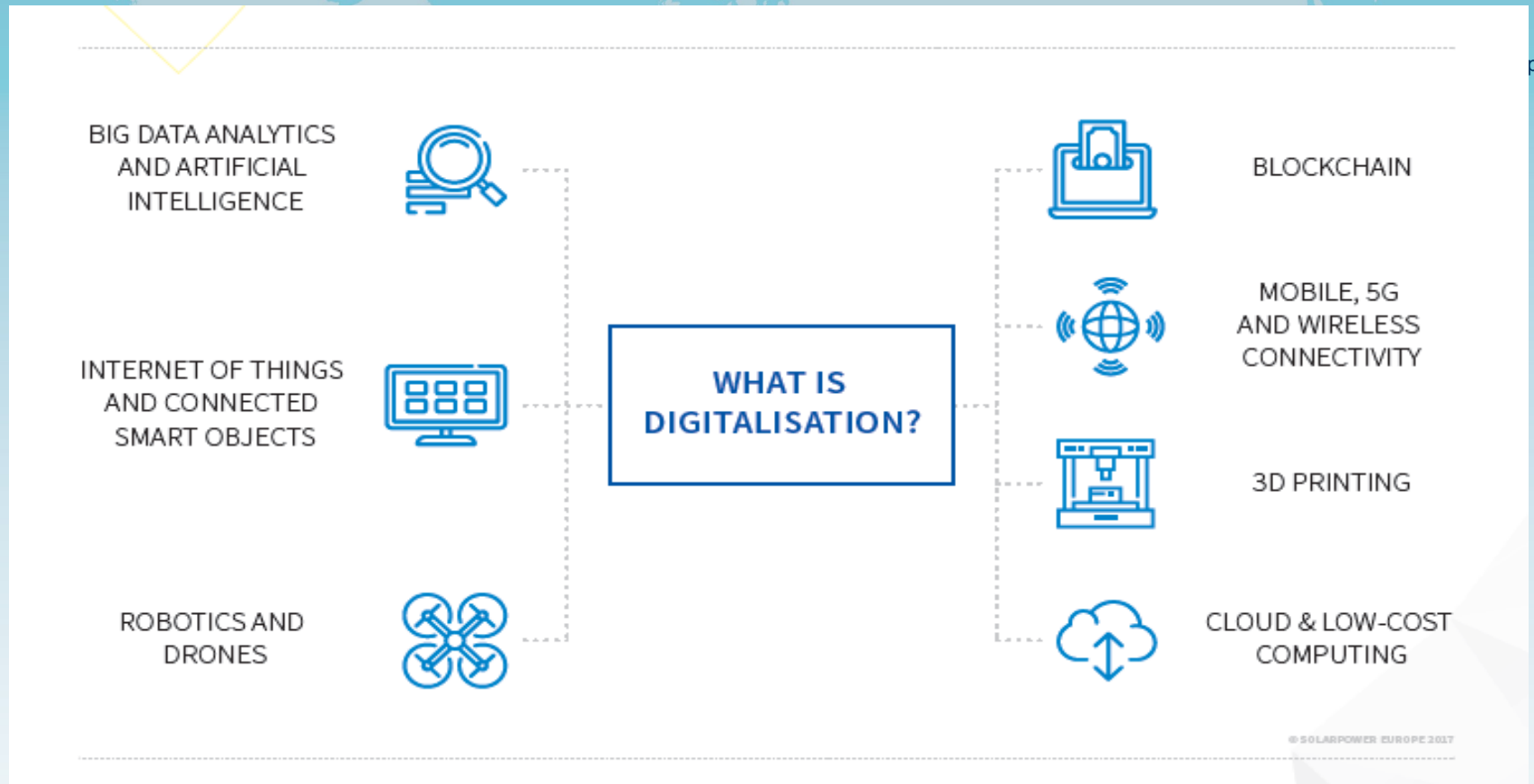
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# Fort Myer and the Wright Flyer: a technology parable



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# Digitalisation



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Source: Solar Power Europe

# Households and businesses are embracing 'energy tech'

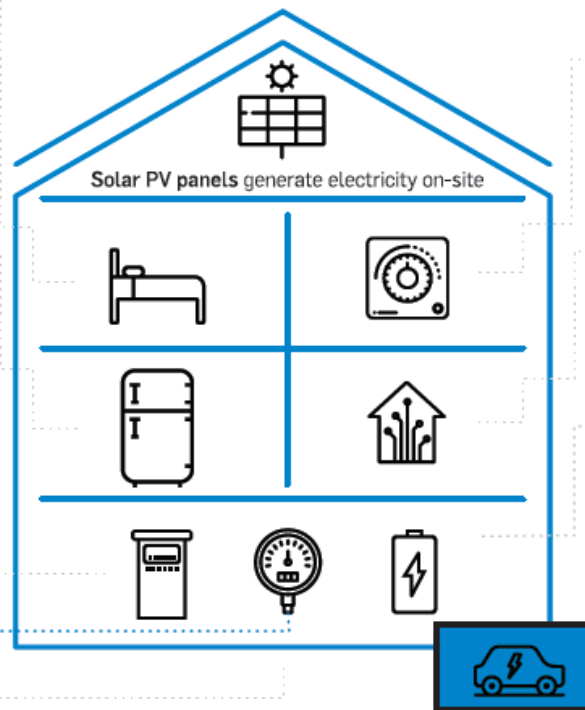
**Demand response** can increase solar self-consumption by increasing demand in the building at times of high solar generation and vice versa (known as local optimisation).

**Smart automated building appliances** such as fridges, tumble dryers, washing machines, dishwashers, motion-sensor lighting and blinds. Digital technology can remotely control and communicate with these appliances to adapt on-site demand.

**Heat pumps, heat storage batteries and air conditioning units** can be optimised with solar generation and be a way of using excess solar electricity as heat.

Electricity pylon/grid

**Smart meter data and disaggregation** can also be used to help identify the customers that are likeliest to have the highest self-consumption rates.



**Smart learning thermostats** that are internet connected can be combined with electric heating or cooling. Solar providers in the US are already offering customers free smart thermostats.

**Smart building energy management systems<sup>5</sup>**, which can also provide monitoring, are made possible with wireless communications, advanced data analytics and the Internet of Things.

**Battery storage** is a mutually reinforcing technology when combined with PV. Residential storage can increase solar PV self-consumption rates from approximately 30% to 70% with added system benefits of reducing network and system costs.

**Smart electric vehicle charging** in car parks and the PV4EV 'drive on sunshine' solution could significantly increase self-consumption rates for some households and businesses, especially when combined with storage.

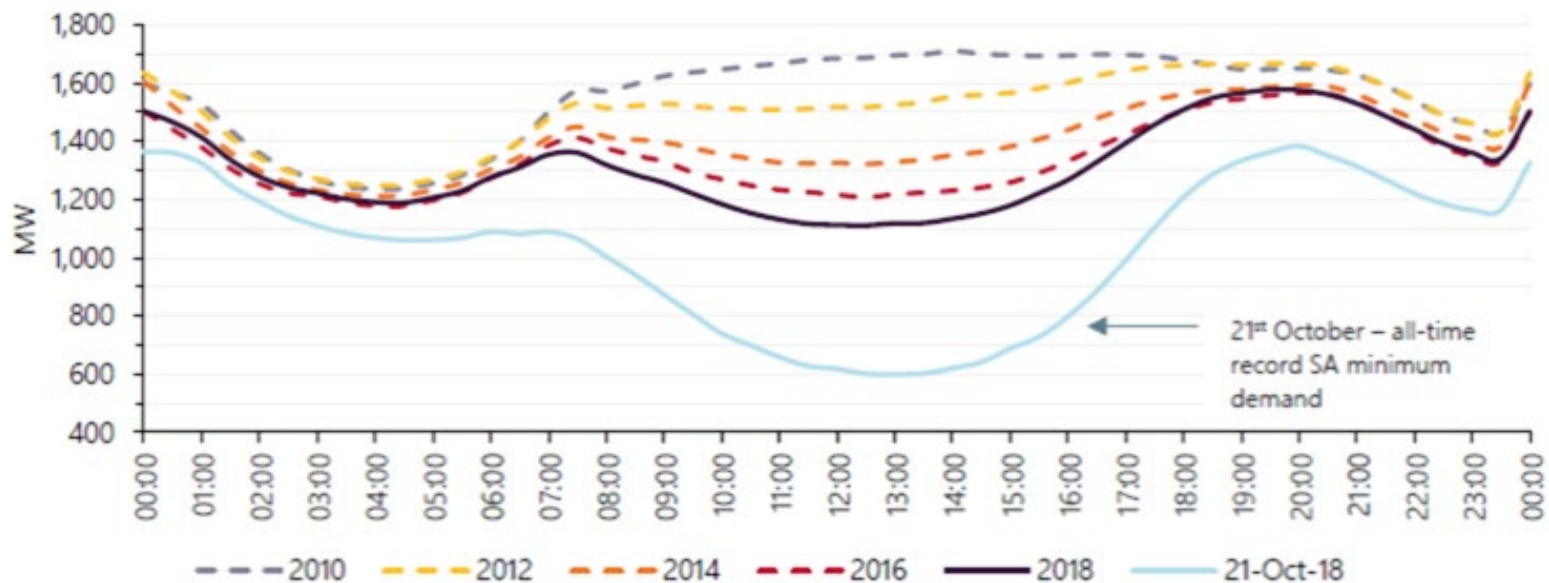
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Source: Solar Power Europe



# For networks: a system turned upside down

Figure 3 Average Q4 daily operational demand in South Australia

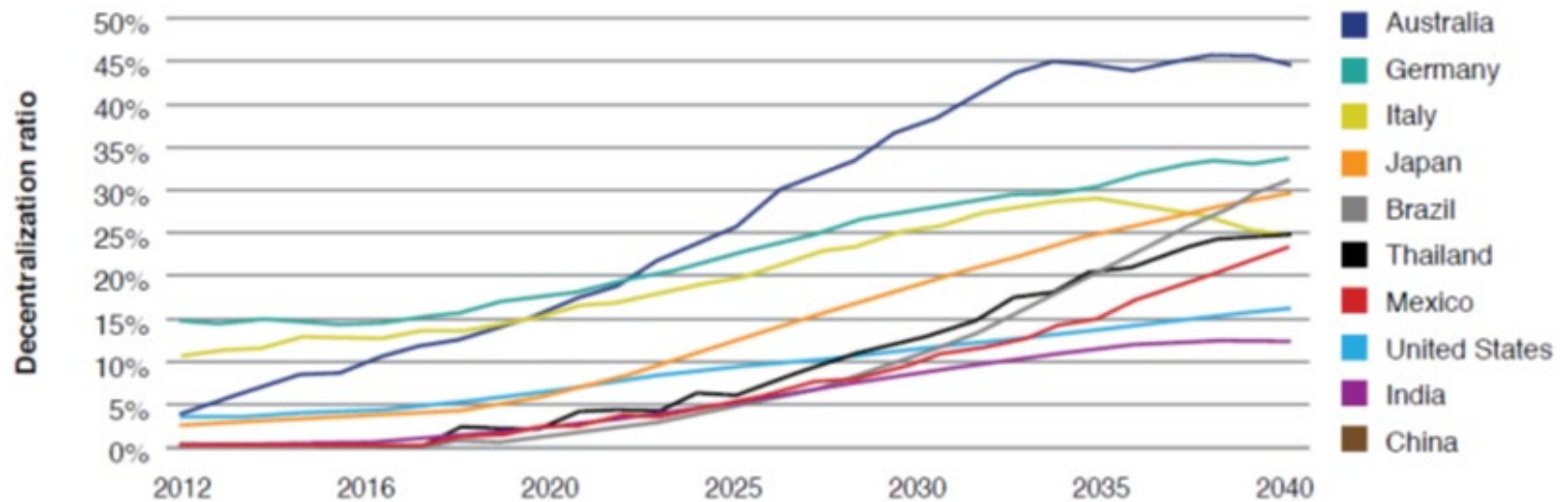


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Source: AEMO

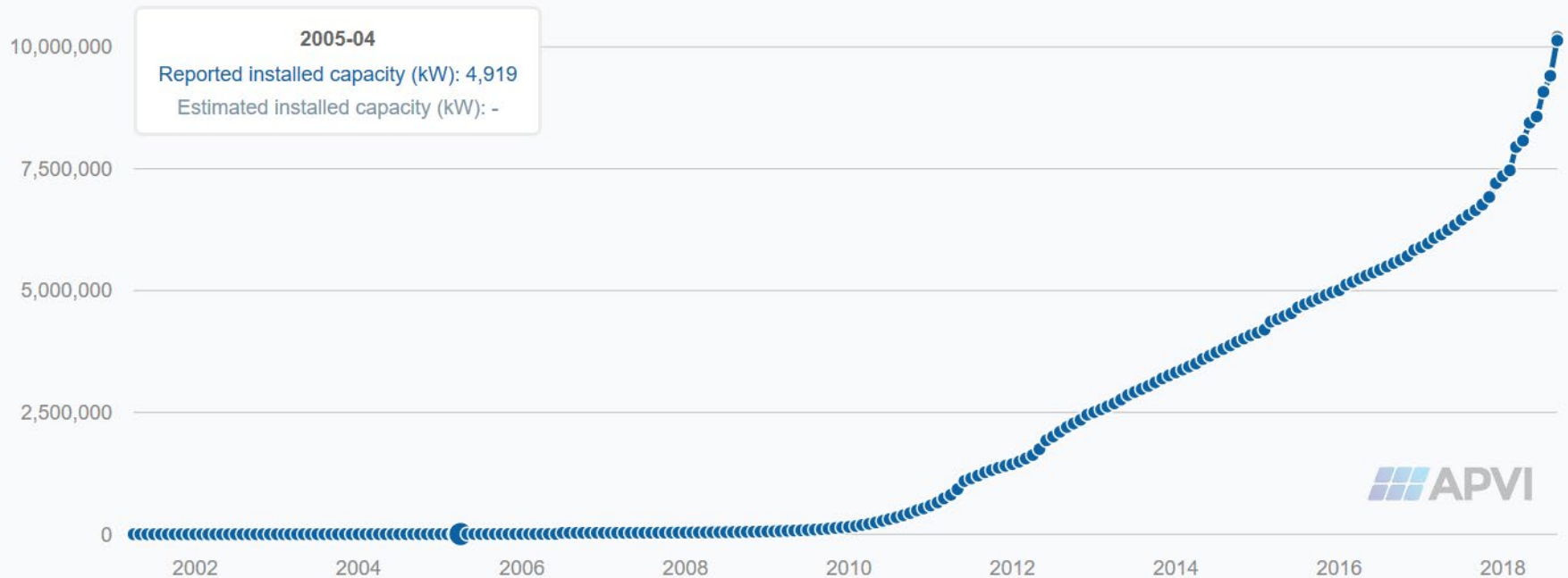
# For consumers: personal investment decisions

**Figure 3:** global rate of electricity market decentralisation



# Faster than?

Australian PV installations since April 2001: total capacity (kW)



<http://pv-map.apvi.org.au/animation>

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# So: need to think from the consumers future, backwards

*If you could start from there, what would you do?*

Three ideas:

1. Integrated planning
2. Performance-based regulation
3. DSOs







# Integrated Planning

## **California:**

Integrated Resource Planning at the large-scale generation and transmission level, then Distribution Resource Planning (reviewing utilities plans at the distribution level), then every three years, General Rate Cases (revenue determinations).

## **New York REV:**

the primary planning requirement is for utilities to prepare Distribution System Implementation Plans (DSIPs) every two years

## **UK:**

No requirements, but some flexibility platforms being trialled

## **Europe:**

Explicit consideration of 'non-wires alternatives' is a proposed requirement under the EU Clean Energy for All package

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# Performance Based Regulation

The clear need to realign the objectives of the network owners (investors or otherwise) with the objectives of society

## **New York REV:**

over 2014-2016 the NY-PSC developed 'a modern regulatory model' whereby conventional 'cost-of-service ratemaking was supplemented by earnings from:

- 1.alternatives (non-wires) that reduce utility capital spending and provide definitive consumer benefit,
- 2.earnings from market-facing platform activities and
- 3.transitional outcome-based performance measures (Earned Adjustment Mechanisms, EAMs) – for system efficiency, energy efficiency, interconnection, consumer engagement.

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# Performance Based Regulation

## **UK:**

RIIO: Revenue set to deliver strong Incentives, Innovation, and Outputs

Revenue based on 'totex' (combined capex and opex)

RIIO sets six outcomes:

1. safety
2. environment
3. customer satisfaction
4. connections
5. social obligations and
6. reliability/availability.

with performance incentives (PIMs) of up to 200-250 basis points for excellent performance and similar penalties for poor performance for each outcome

No requirements, but some flexibility platforms being trialled

## **Europe:**

Explicit consideration of 'non-wires alternatives' is a proposed requirement under the new EU Clean Energy for All package

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# A Distribution System Operator (DSO) to coordinate and optimise DER

'DSO' being used to describe three different roles:

1. managing the network using DER
2. managing a 'local' market platform trading capacity, ancillary services and grid support (such as fault response) using DER
3. planning using DER as 'non wires' alternatives, which could include a 'flexibility' platform as a place where DER can bid in alternatives to network replacement or upgrades.

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No one knows how the energy tech story will end ...



Source: NASA

A light blue world map is centered in the background of the slide. The map shows the continents in a lighter shade of blue against a slightly darker blue background. The map is partially obscured by the text and other elements.

# Report on Churchill Fellowship:

The report investigated regulation of clean, smart, customer-centric energy networks - USA, UK, Belgium, France, Germany

<https://www.churchilltrust.com.au/fellows/detail/4254/Gabrielle+Kuiper>

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