



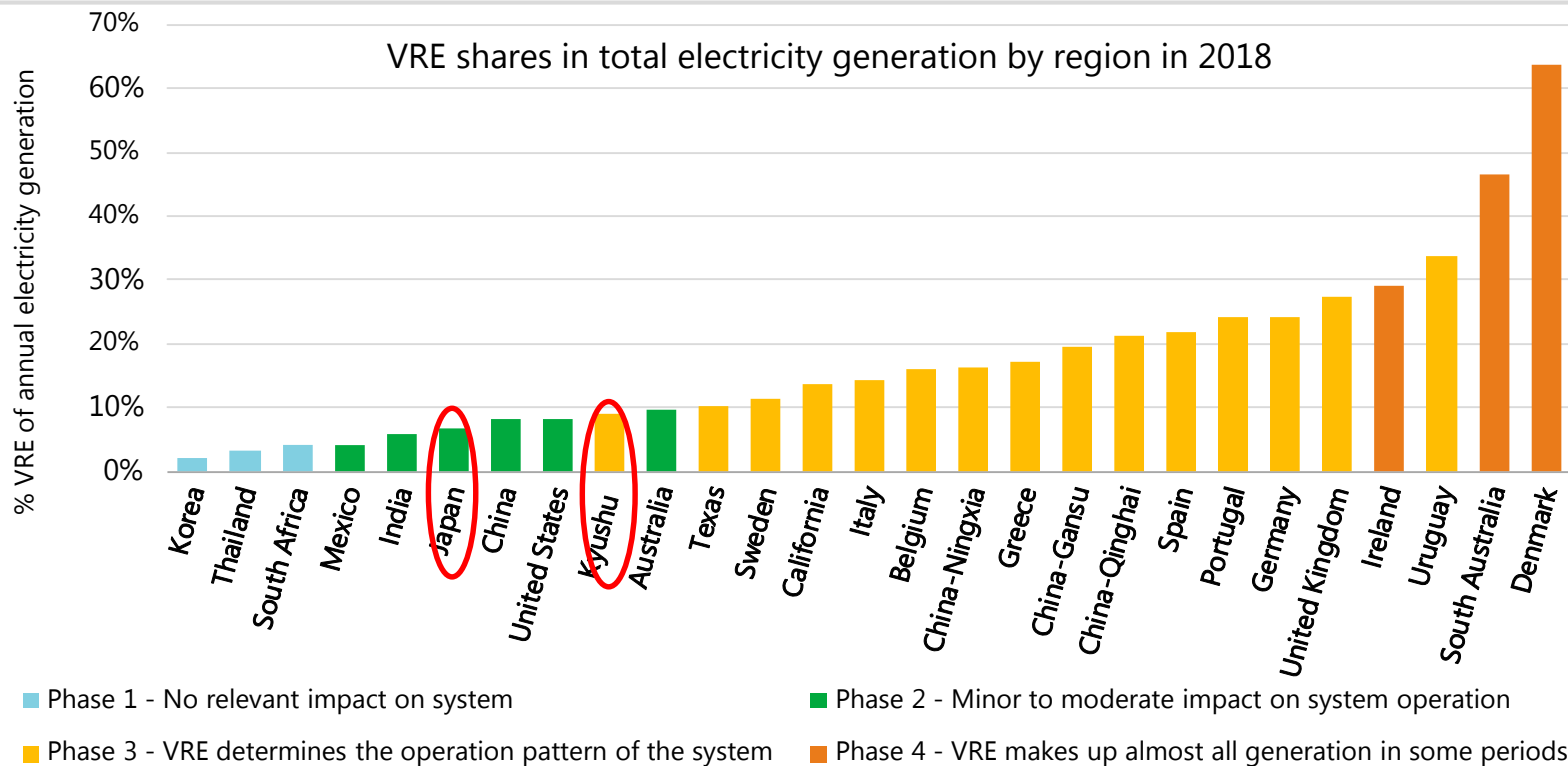
Power System Flexibility Campaign

Paolo Frankl, Head of the Renewable Energy Division, IEA

IEEJ, Tokyo, 11 June 2019



System integration: different phases

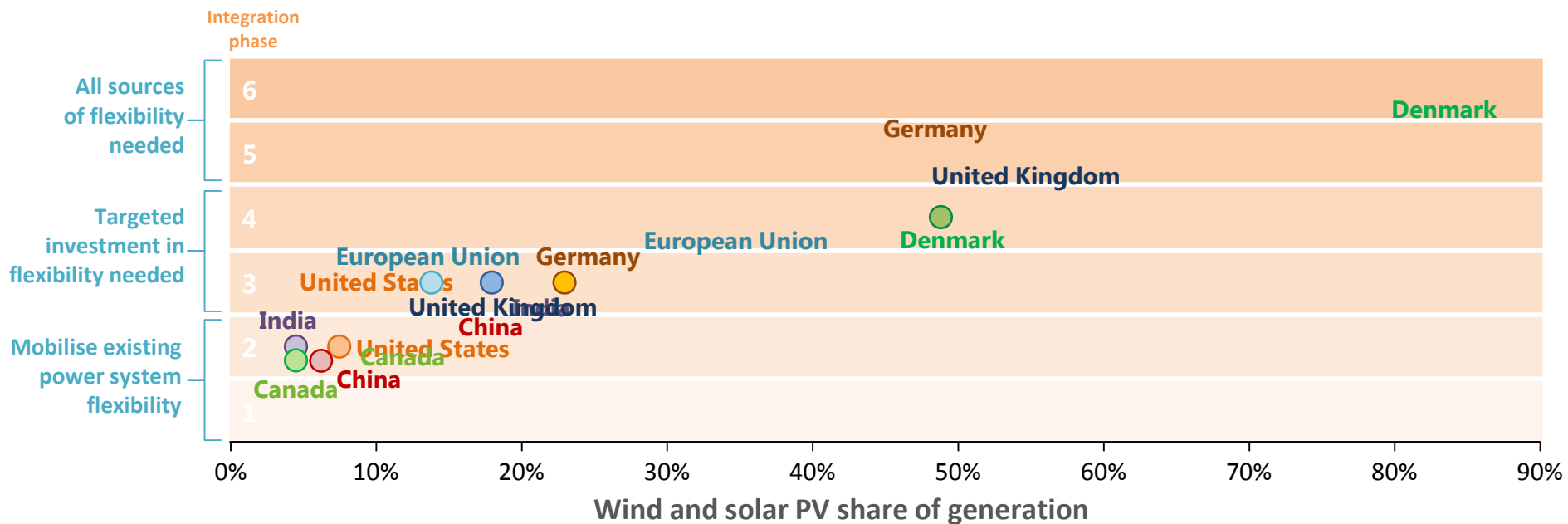


Specific power system regions can be at higher VRE integration phases due to limited interconnection and VRE penetration. This can require market reforms to meet increased flexibility requirements

Flexibility is the cornerstone of tomorrow's power systems



Phases of integration with variable renewables share, 2017 to 2030



Very high shares of wind & solar PV require reforms to attract investment at unprecedented level in grids & interconnections, flexible power plants, affordable storage & demand-side response

The PSF Campaign Network



Co-leads



CEM Members



Non-government members



Campaign brings together a broad spectrum of actors and experiences from across the globe

More than 2 years of continuous work on power plant and system flexibility



Work on the campaign has been key to elevate innovative technical solutions to high-level policy discussions

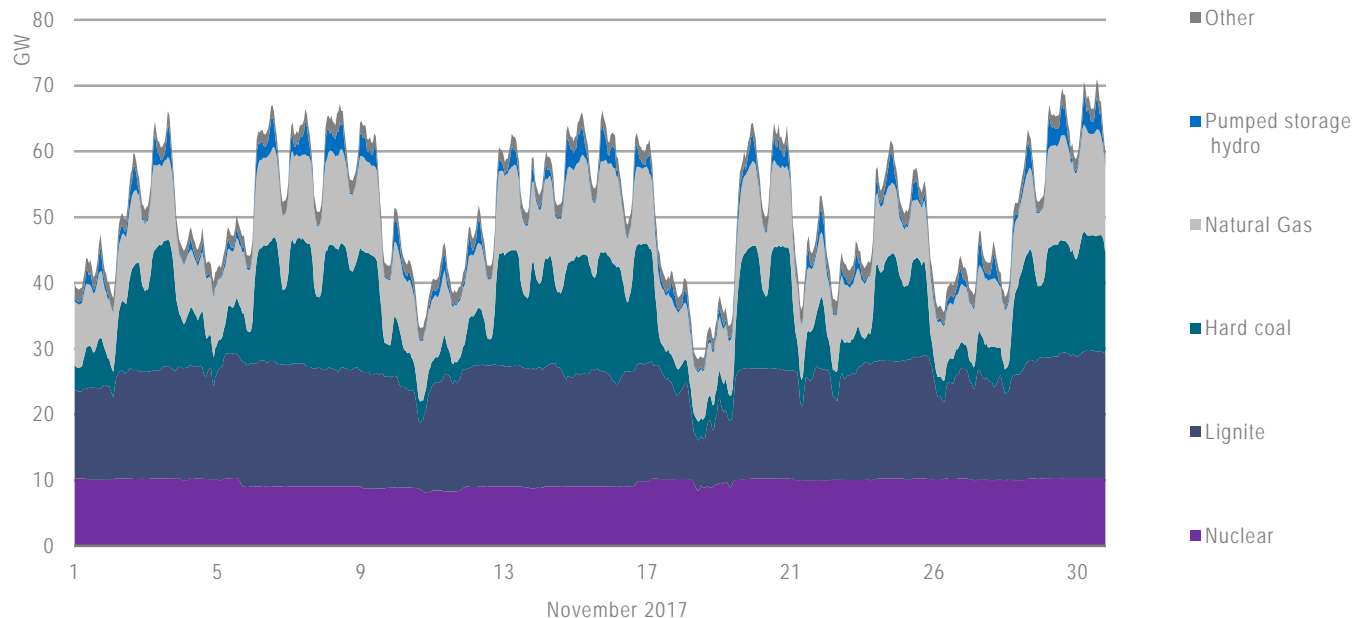
Power plants remain the largest source of flexibility

Advanced Power Flexibility

- Clean Energy Ministerial Campaign, 14 partner countries and 14 industry and NGO partners
- Results published at CEM9
- Continued with broader scope: Power System Flexibility



Conventional electricity generation in Germany in November 2017



Significant system flexibility lies latent in many power plants; a range of strategies are available to unlock low-cost flexibility, many are non-technical solutions.

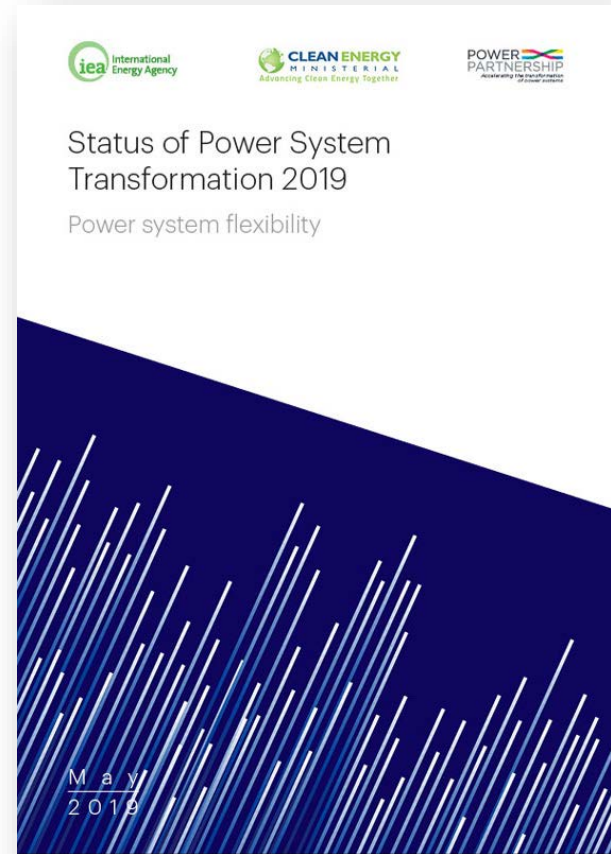
Focus on: Power System Flexibility

Co-authored by:

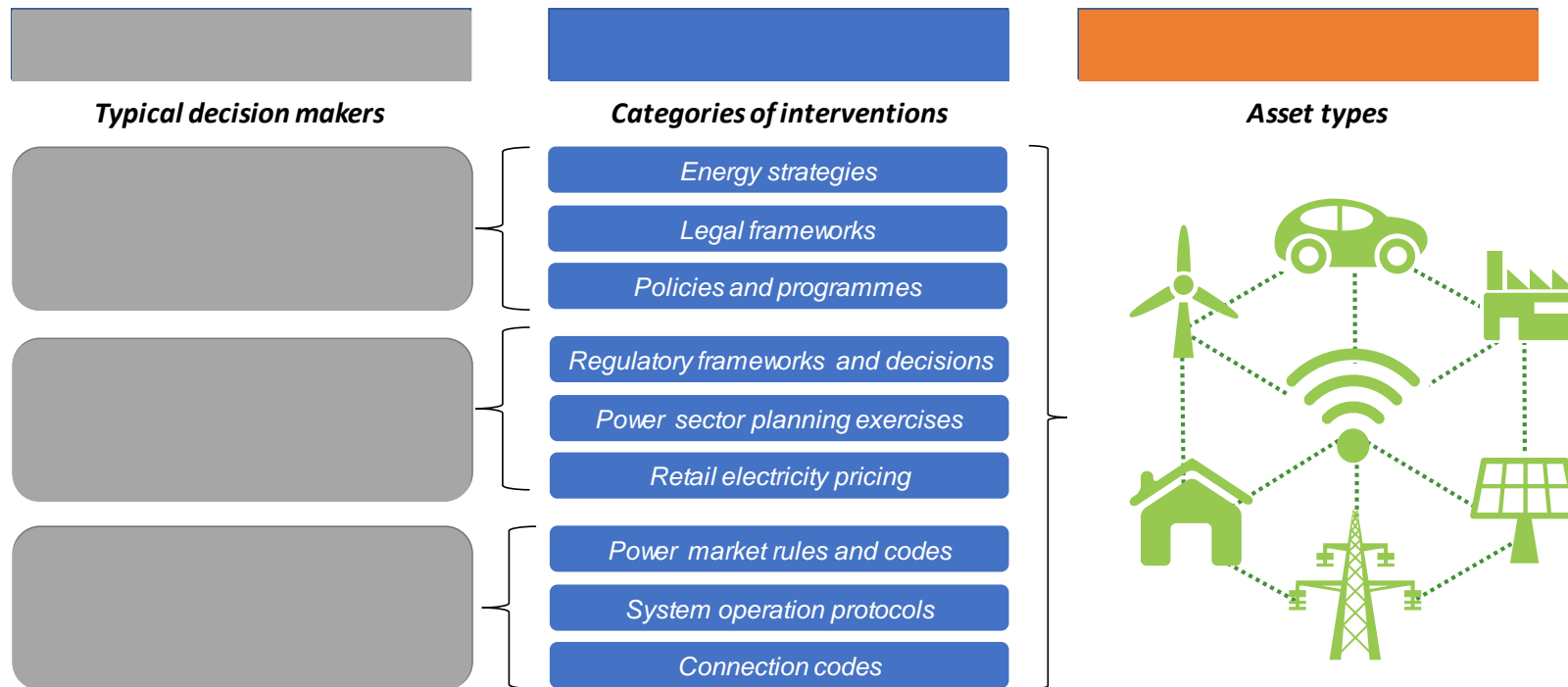


Available at:

<https://webstore.iea.org/status-of-power-system-transformation-2019>



Identifying and engaging with the right actor at each level is key

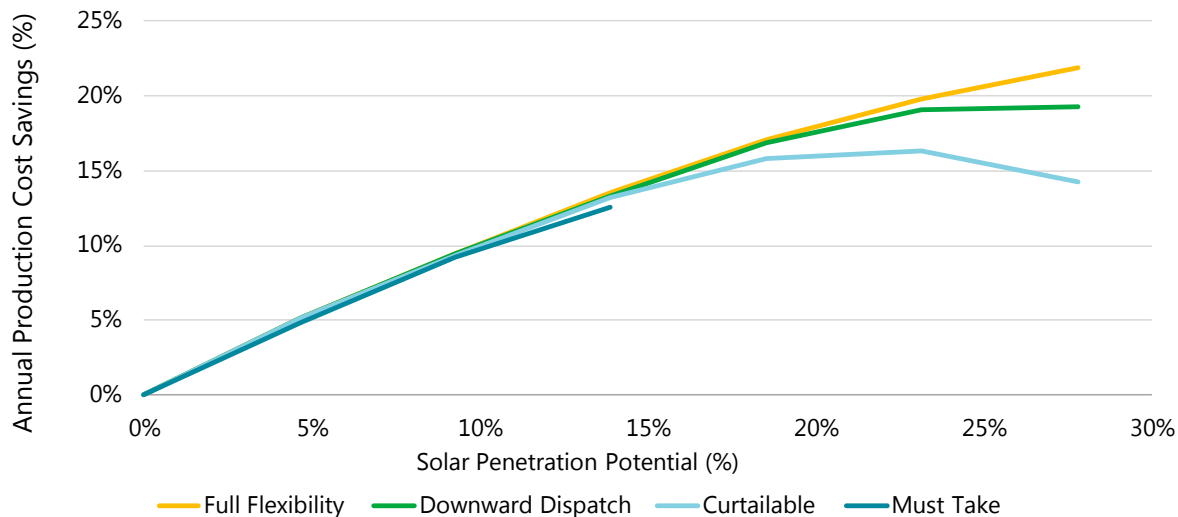


The institutional context defines the set of instruments available to boost power system flexibility. Enabling new services and roles may also require rethinking the institutional framework.

All power system assets can provide flexibility, including VRE



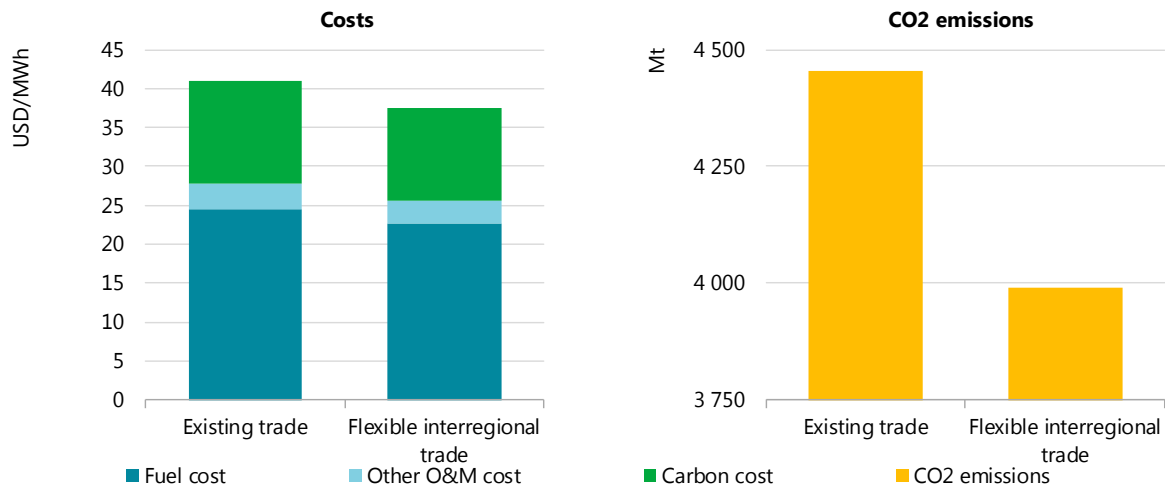
- Appropriate policy, market and regulatory frameworks can enable participation from a broad range of power system assets.
 - *Example: Tampa Electric Company (USA) study on system integration of PV*



Redefining grid codes, ancillary service prequalification requirements and remuneration schemes are needed to tap into the flexibility potential from VRE. This strongly depends on the institutional framework.

Electricity networks remain a critical enabler of system flexibility

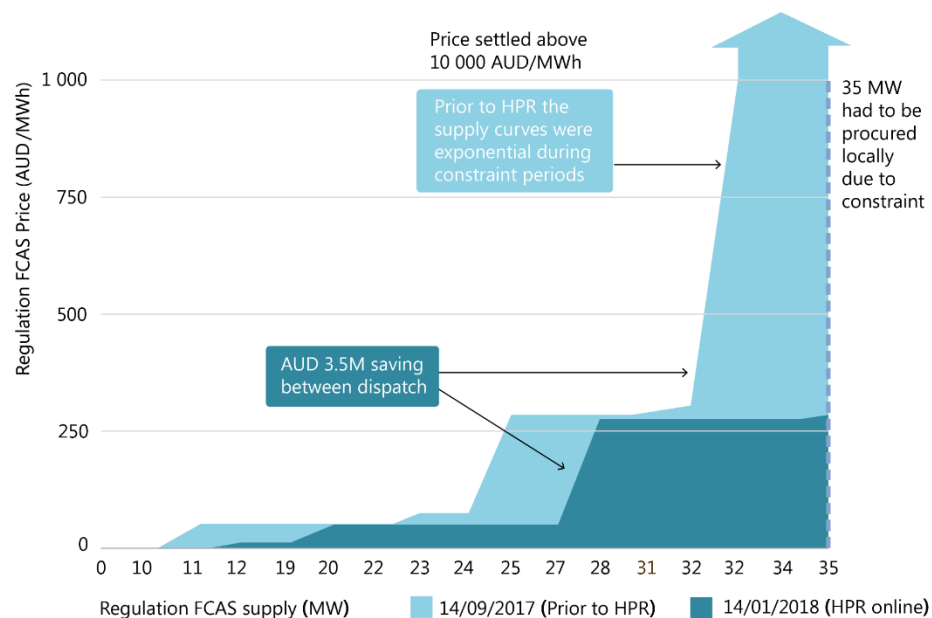
- Inter-regional and international coordination can yield significant economic benefits
 - *Example: IEA China Power System Transformation study (NPS scenario, 2035)*
Potential for yearly 36 bn USD system cost reduction (9%) with economic dispatch



Enhanced trade across regions can bring substantial cost savings and emission reductions by sharing flexibility resources more widely.

Batteries are becoming a cost-competitive flexibility provider

- Changes to connection codes and market rules **enable participation** by energy storage resources.
- Regulatory innovation is needed to **unlock multiple benefit streams** for storage resources in a system-effective manner.
- *Example: Hornsdale Power Reserve participates in regulation, contingency reserve and energy markets in South Australia*



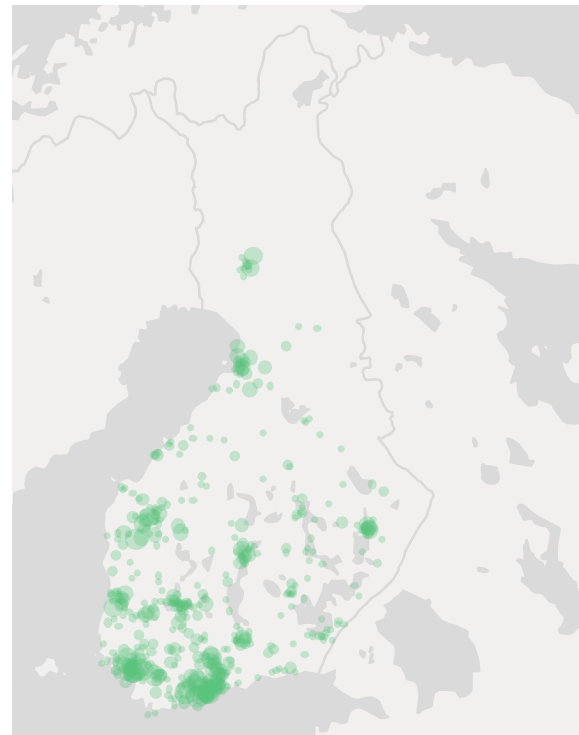
FCAS: Frequency control ancillary services

Prequalification requirements and the design of flexibility services are key to enable battery storage in flexibility services. Benefit stacking can increase financial viability but requires further regulatory review.

Distributed energy resources offer significant flexibility potential



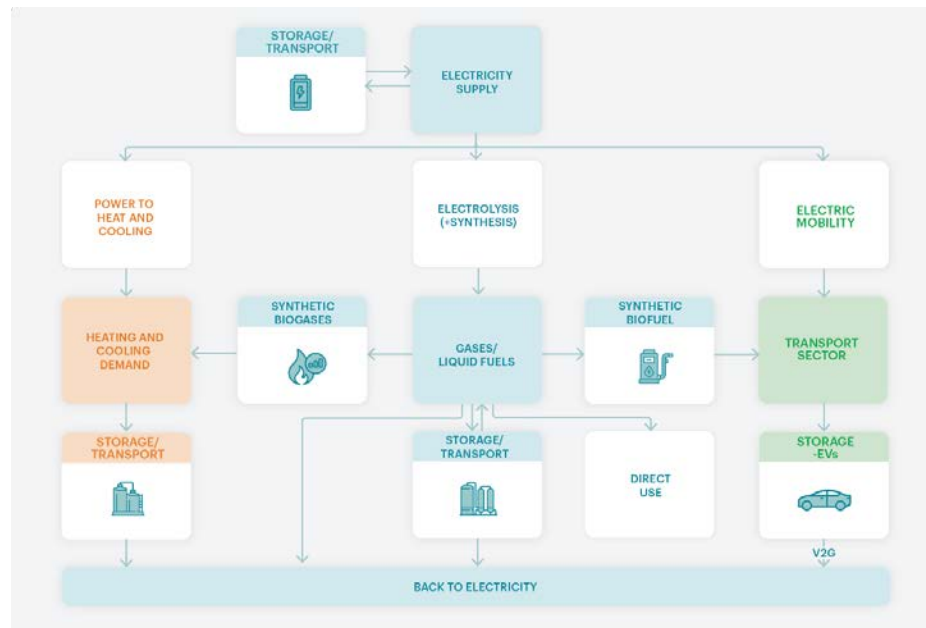
- Realising benefits from distributed energy resources depends on a variety of market rules and regulations that enable their participation
- Allowing the aggregation of loads is a typical measure, allowing distributed energy resource access to ancillary services
 - *Example: **Fortum Spring Virtual Battery** in Finland, aggregating loads of electric water heaters*



Allowing the aggregation of loads to meet market entry requirements, defining the role of an independent aggregators, and clarifying balancing responsibilities are key measures for DER contribution to system flexibility

Sector Coupling addresses wider energy system decarbonisation

- Sector coupling efforts have the potential to enroll new flexible loads at scale to enhance power system flexibility.
- As all energy sectors are impacted there is a need for coordination of economic policies beyond the power system.
- Interlinkage of taxes and tariffs between various sectors of electricity, fuels, gas and bioenergy should not become barriers for wider system decarbonization



A new Clean Energy Ministerial horizontal accelerator focused on sector coupling will be considered in 2019 to broaden understanding and share experiences of this trend.

- Policy maker engagement with actors across the power system is a priority to unlock latent flexibility potential and de-risk investments.
- Regulatory innovation is essential to integrate new system resources for flexibility such as VRE, grids, storage and DER.
- Market reforms to provide clear price signals and new revenue streams are key to ensure flexible operation of existing assets and investment in flexible resources.
- In regulated contexts, regulatory innovations are key to recognise the value of flexible operations and new system resources as alternatives to conventional investments.
- The PSF campaign will push ahead in three areas of significant opportunity:

Digitalisation - Market design – Sector coupling



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