

VIRTUAL EDITION

IRENA INNOVATION WEEK²⁰²⁰

Session 2: Smart Electrification of End-Use Sectors – Implications for the Power System

Organised in partnership with EPRI

MONDAY, 05 OCTOBER 2020 • 17:00 - 20:00 (CEST)

#IVIW2020

EPRI | ELECTRIC POWER
RESEARCH INSTITUTE

 **IRENA**
International Renewable Energy Agency

VIRTUAL EDITION

IRENA INNOVATION WEEK²⁰²⁰



Please make sure to **mute** yourself during the session to avoid background noise



If you have questions for our panelists, please use the Q&A



If you encounter any technical issues, please write your issue to Cisco Webex Events



This session will be recorded and recording along with the slides will be available on the Innovation Week website

#IVIW2020

Session Overview

17:00 – 17:05

Setting the Scene

17:05 – 17:30

Panel I: Global Experience

17:30 – 18:20

Panel II: Smart Electrification at DSO Level

18:20 – 18:35

Digital Break

18:35 – 19:25

Panel III: Smart Electrification at the TSO Level

19:25 – 19:55

Panel IV: New Power Sector Dynamics with Smart Electrification

19:55 – 20:00

Closing Remarks

VIRTUAL EDITION

IRENA INNOVATION WEEK²⁰²⁰

Setting the Scene

#IVIW2020

Setting the scene



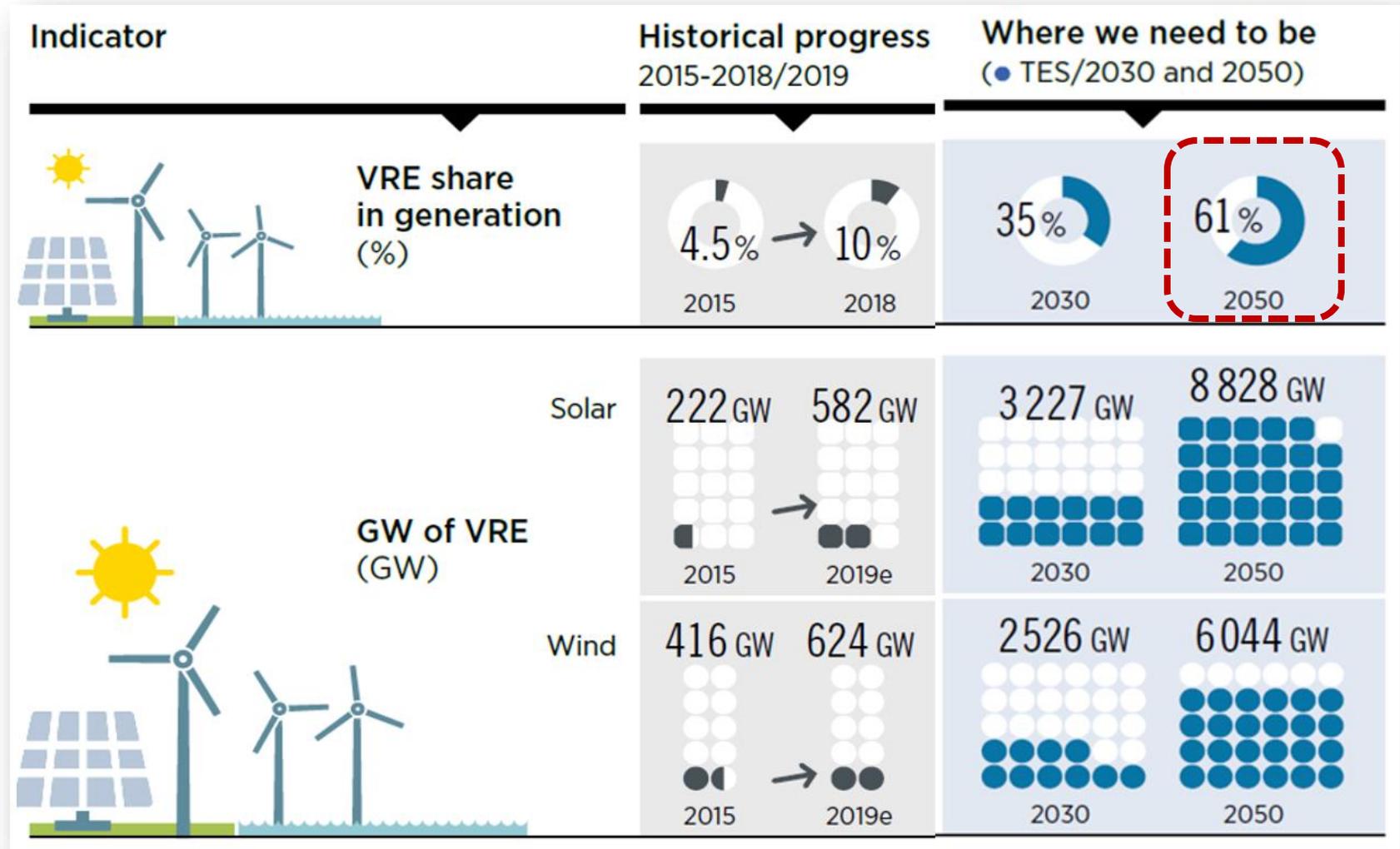
Francisco Boshell

Energy Analyst, Renewable Energy Technology Markets and Standards, IRENA Innovation and Technology Centre

Innovation Week 2018: Solutions for Power Systems Flexibility

Power sector:

- Next frontier – integrating very high shares of variable renewables
- Many innovative solutions are emerging



Outcome – IRENA’s Innovation Toolbox for Flexibility



ENABLING TECHNOLOGIES

- | | |
|----|--|
| 1 | Utility-scale batteries |
| 2 | Behind-the-meter batteries |
| 3 | Electric-vehicle smart charging |
| 4 | Renewable power-to-heat |
| 5 | Renewable power-to-hydrogen |
| 6 | Internet of things |
| 7 | Artificial intelligence and big data |
| 8 | Blockchain |
| 9 | Renewable mini-grids |
| 10 | Supergrids |
| 11 | Flexibility in conventional power plants |

BUSINESS MODELS

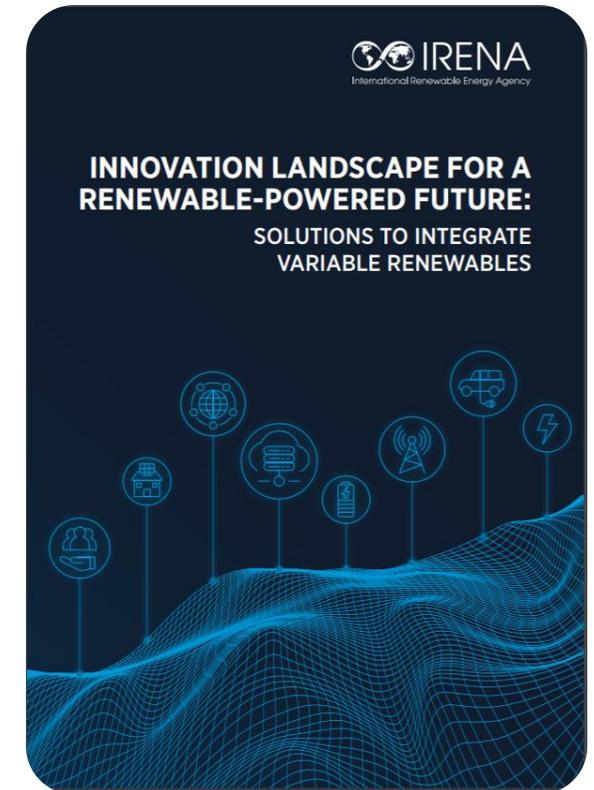
- | | |
|----|----------------------------------|
| 12 | Aggregators |
| 13 | Peer-to-peer electricity trading |
| 14 | Energy-as-a-service |
| 15 | Community-ownership models |
| 16 | Pay-as-you-go models |

MARKET DESIGN

- | | |
|----|---|
| 17 | Increasing time granularity in electricity markets |
| 18 | Increasing space granularity in electricity markets |
| 19 | Innovative ancillary services |
| 20 | Re-designing capacity markets |
| 21 | Regional markets |
| 22 | Time-of-use tariffs |
| 23 | Market integration of distributed energy resources |
| 24 | Net billing schemes |

SYSTEM OPERATION

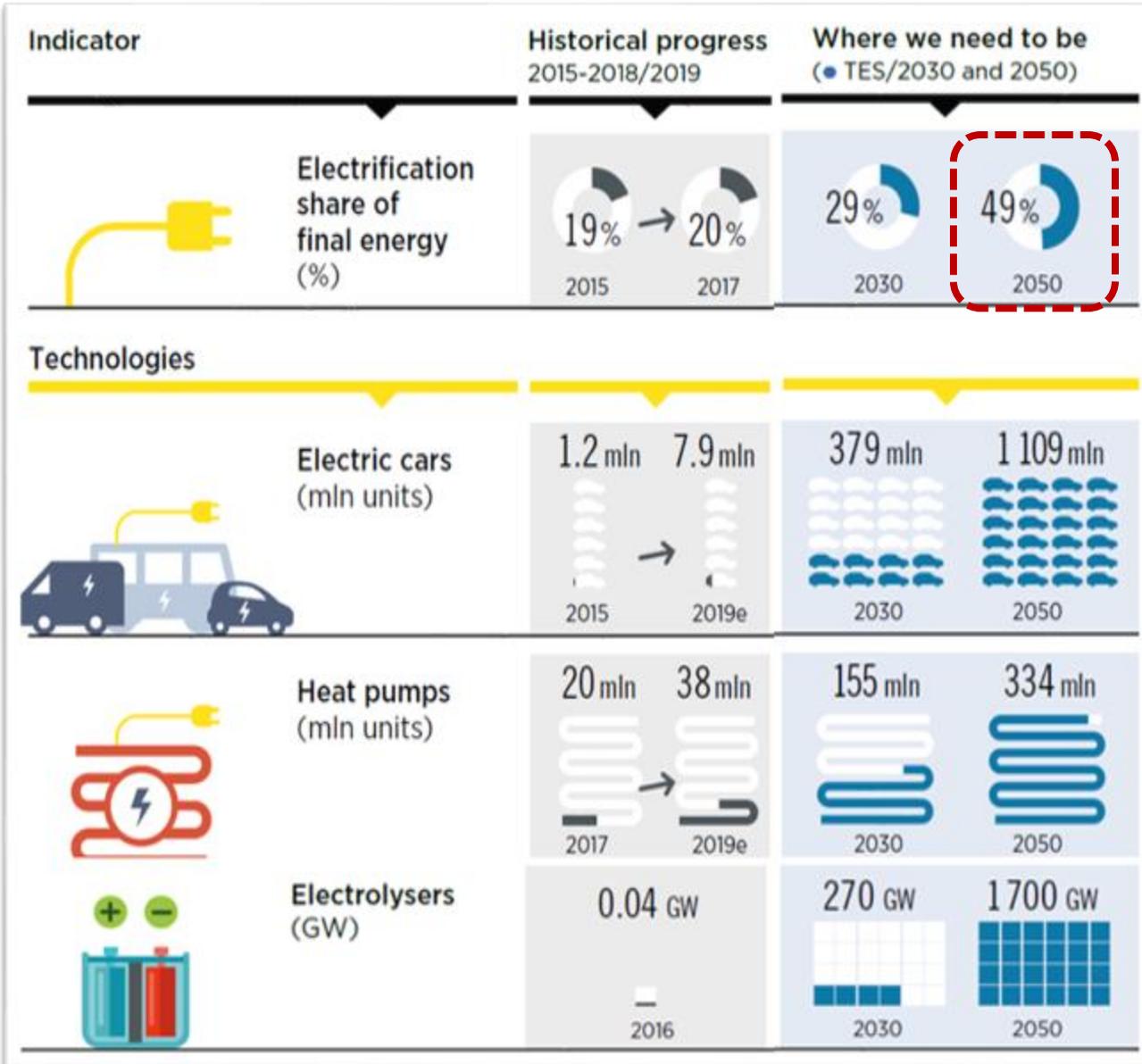
- | | |
|----|---|
| 25 | Future role of distribution system operators |
| 26 | Co-operation between transmission and distribution system operators |
| 27 | Advanced forecasting of variable renewable power generation |
| 28 | Innovative operation of pumped hydropower storage |
| 29 | Virtual power lines |
| 30 | Dynamic line rating |



Innovation Landscape Report

#IWIW2020

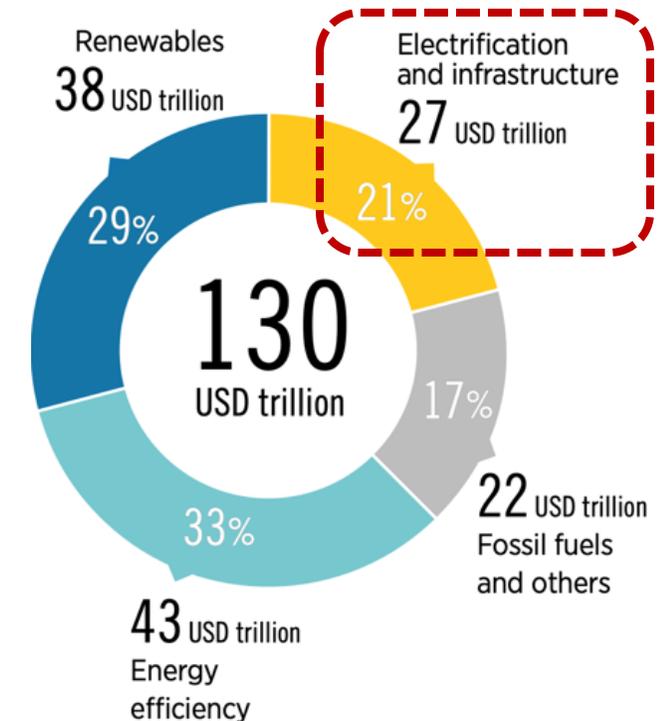
Electrification – key energy vector to decarbonize transport and industry sectors



New loads

- System integration aspect
- Investment aspect

Deeper Decarbonisation Perspective "zero" and TES cumulative investments between 2016 and 2050 (USD trillion)



Smart technology resulting in smart solutions

Example of smart charging for electric vehicles

Study	Scenario	Uncontrolled charging	Smart charging	
IRENA	50% penetration in an isolated system with 27% solar share	↑9% increase in peak load 0.5% solar curtailment	↑5% increase in peak load (V2G) Down to 0% curtailment	
RMI, 2016	23% penetration US (California, Hawaii, Minnesota, New York, Texas)	↑11% increase in peak load	↑1.3% increase in peak load (VIG)	
Taljegard, 2017	100% penetration Denmark, Germany, Norway & Sweden	↑20% increase in peak load	↓7% decrease in peak load (V2G)	
McKenzie, 2016	50% penetration in Island of Oahu, Hawaii, US 23% VRE share	10-23% VRE curtailment without EVs	8-13% VRE curtailment with smart charging EVs	
Chen and Wu, 2018	1 MILLION EVs in Guanzhou region, China	↑15% increase in peak load	↓43-50% reduction in valley/peak difference	

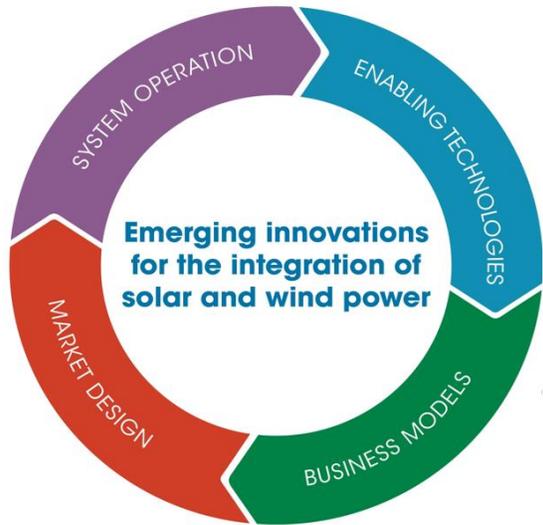
● Peak load with uncontrolled charging ● Curtailment in no EVs scenario
● Peak load with smart charging ● Curtailment with smart charging EVs

What is smart electrification?

- adapting the load profiles to the needs of consumers (demand) as well as to the conditions of the power system (supply)

Source: IRENA (2019) Innovation Outlook: Smart charging for Electric Vehicles

Systemic innovation for smart electrification



Enabling technologies

- Behind-the-meter batteries
- Electric-vehicle smart charging
- Renewable power-to-heat (residential)
- Internet of things
- Artificial intelligence and big data
- Blockchain

Business models

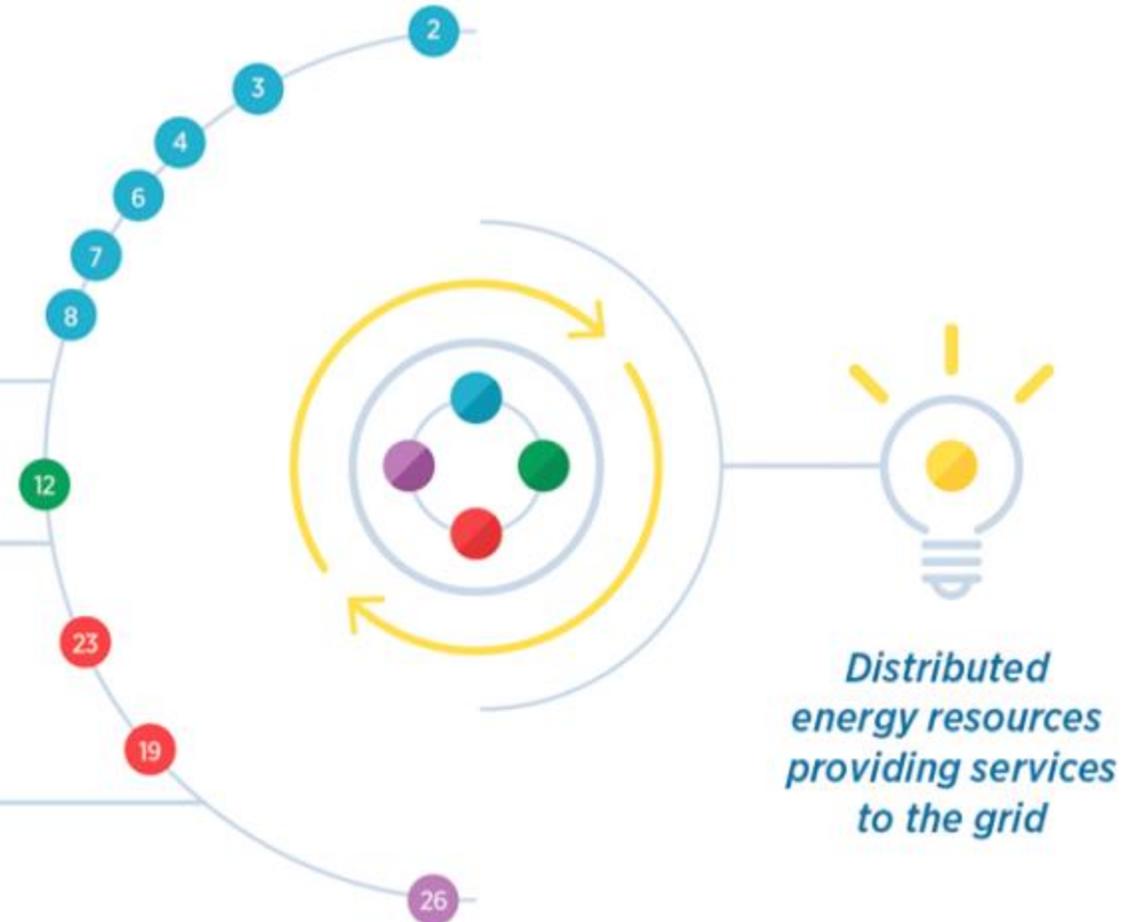
- Aggregators

Market design

- Market integration of distributed energy resources
- Innovative ancillary services

System operation

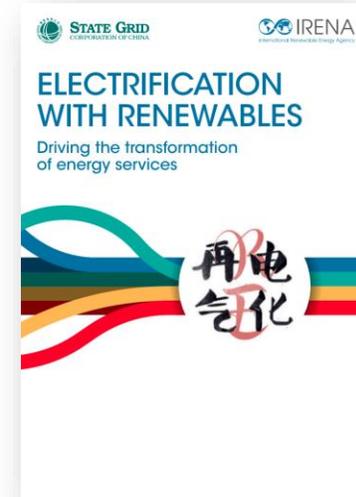
- Co-operation between transmission and distribution system operators



Upcoming work on smart electrification

2020 Electrification with Renewables

- Best practices in using renewable power for the electrification of end-use sectors



2021 Innovation Landscape on Smart Electrification

- Systemic innovation for smart electrification of the transport, industry and buildings sector
- Toolbox for policy-makers

VIRTUAL EDITION

IRENA INNOVATION WEEK ²⁰²⁰

Panel I: Global Experience

#IVIW2020

Moderator



Francisco Boshell

Energy Analyst

IRENA

Panelists



Robert Chapman

Vice President of Electrification
& Sustainable Energy Strategy

EPRI



Kristian Ruby

Secretary General

EURELECTRIC



Dr Koshichi Nemoto

Vice President

CRIEPI

VIRTUAL EDITION

IRENA INNOVATION WEEK²⁰²⁰

Panel II: Smart Electrification at DSO Level

#IVIW2020

Moderator



Kristian Ruby

Secretary General

EURELECTRIC

Panelists



Bastian Pfarrherr

Head of Innovation
Management

Stromnetz Hamburg



Katie Sloan

Director of eMobility and
Building Electrification

Southern California Edison



Gregory Poilasne

Co-founder & CEO

Nuvve

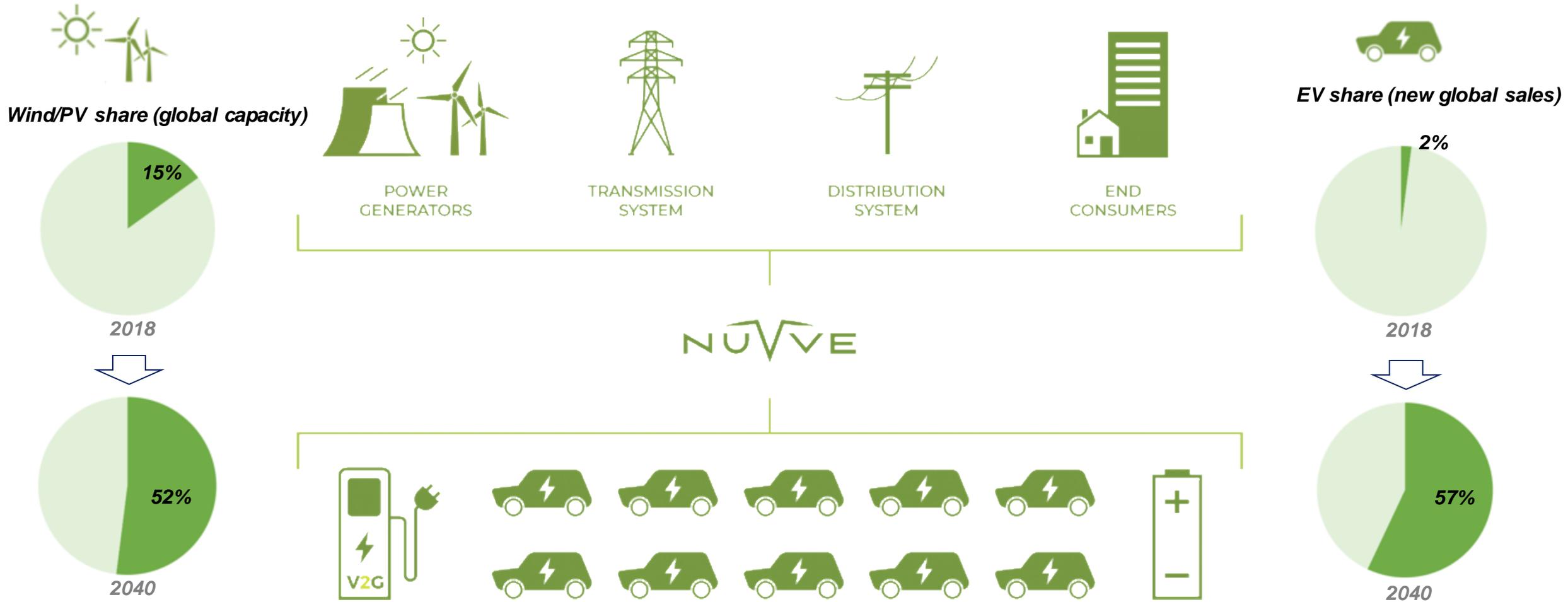


Sandra Trittin

Co-Founder & CSO

Tiko Energy Solutions

Our Mission



Source : BNEF

Nuvve's Platform and Services



Transforms electric vehicles from unreliable resources into reliable, dispatchable and monetizable assets.



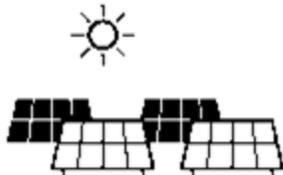
Reduces the cost of EV ownership, encourages EV adoption



Stabilizes the grid



Guarantees vehicle use for transportation



Enables increased renewable penetration



Optimizes and protects the vehicle battery

Moderator



Kristian Ruby

Secretary General

EURELECTRIC

Panelists



Bastian Pfarrherr

Head of Innovation
Management

Stromnetz Hamburg



Katie Sloan

Director of eMobility and
Building Electrification

Southern California Edison



Gregory Poilasne

Co-founder & CEO

Nuvve



Sandra Trittin

Co-Founder & CSO

Tiko Energy Solutions

VIRTUAL EDITION

IRENA INNOVATION WEEK²⁰²⁰



Digital Break

Coming up next:

Panel III - Smart Electrification at TSO Level

#IVIW2020

VIRTUAL EDITION

IRENA INNOVATION WEEK²⁰²⁰

Panel III: Smart Electrification at TSO Level

18:40 –19:30 (CEST)

#IVIW2020

Moderator



Norela Constantinescu

Manager for Research &
Innovation

ENTSO-E

Panelists



Anders Bavnhøj Hansen

Chief Engineer

Energinet Denmark



Pablo Mosto

Planning & Environment
Manager

UTE Uruguay



Christopher Greiner

CTO

EnergyNest



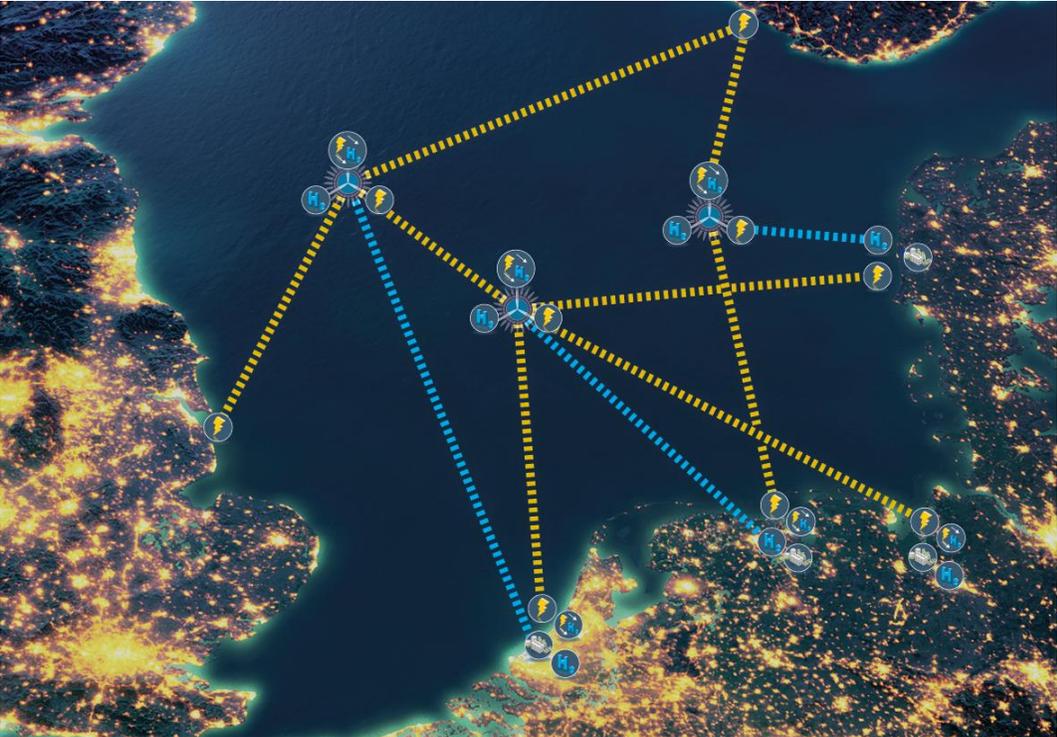
Adele Lidderdale

Hydrogen Project Manager

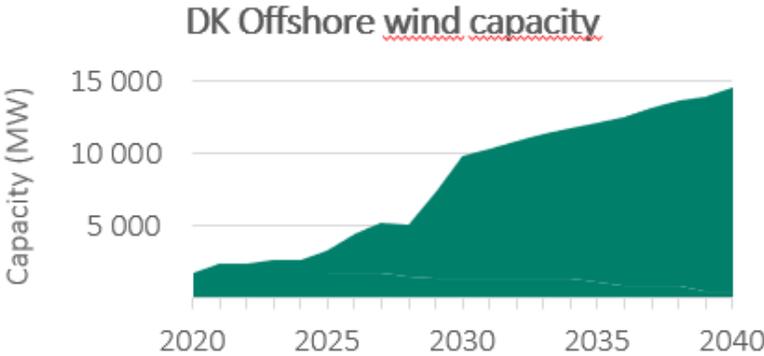
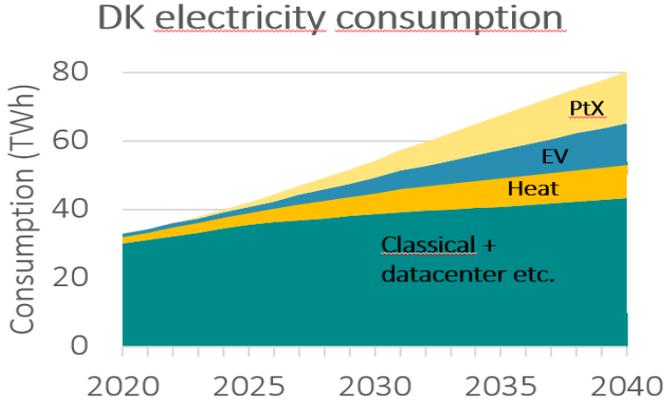
EMEC

DK a part in northsea windpower visions

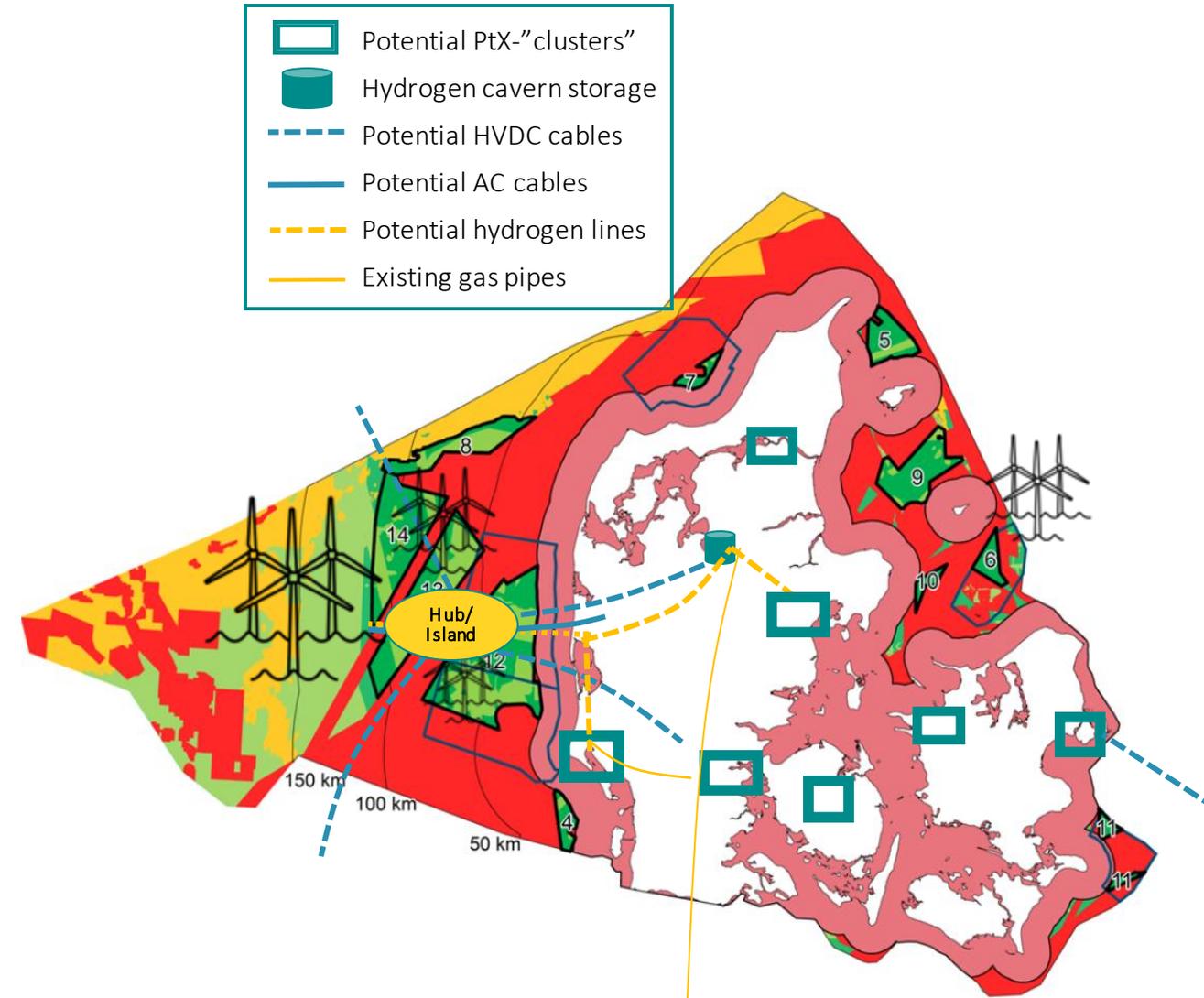
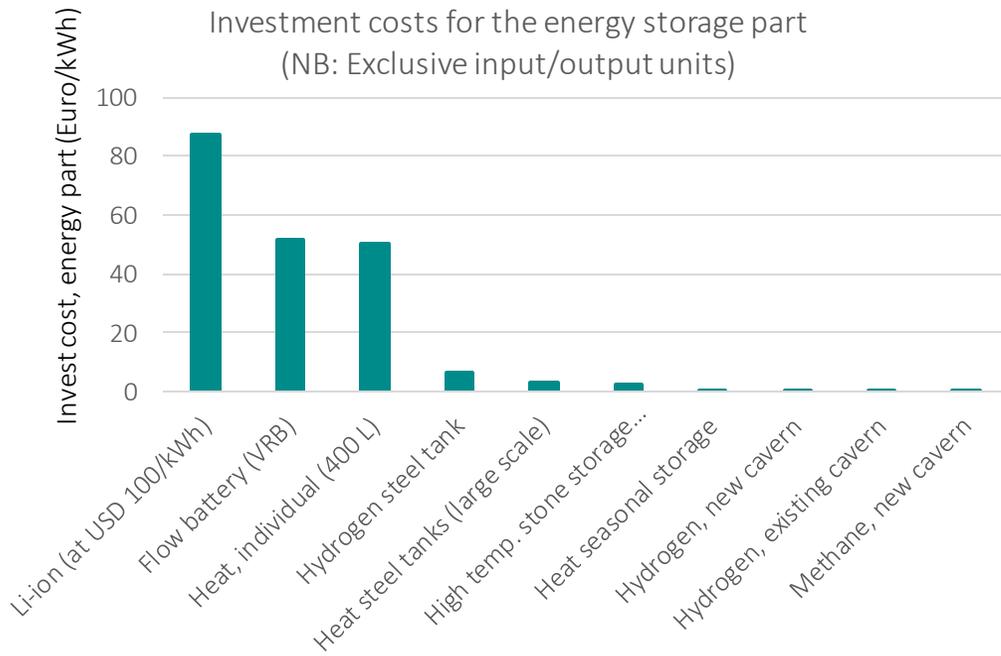
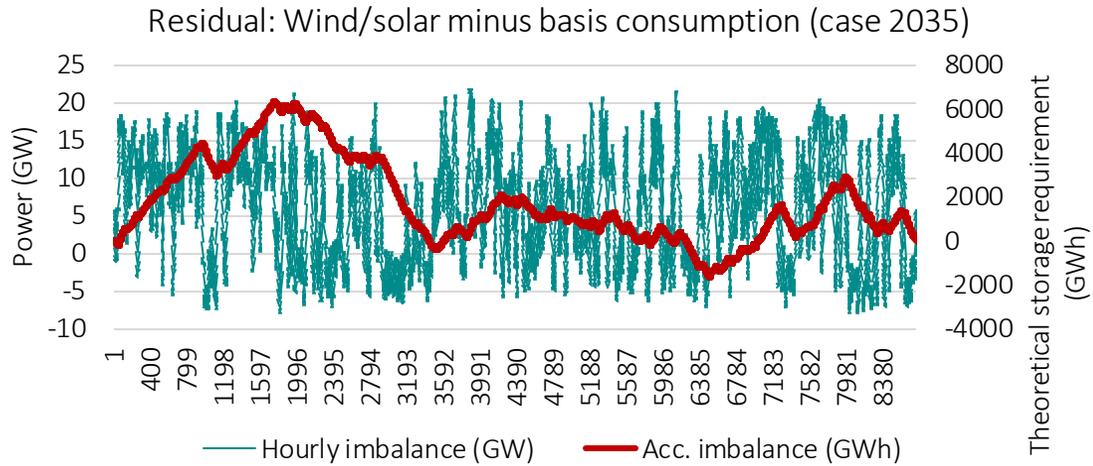
North Sea Wind Power Hub scenarios investigated



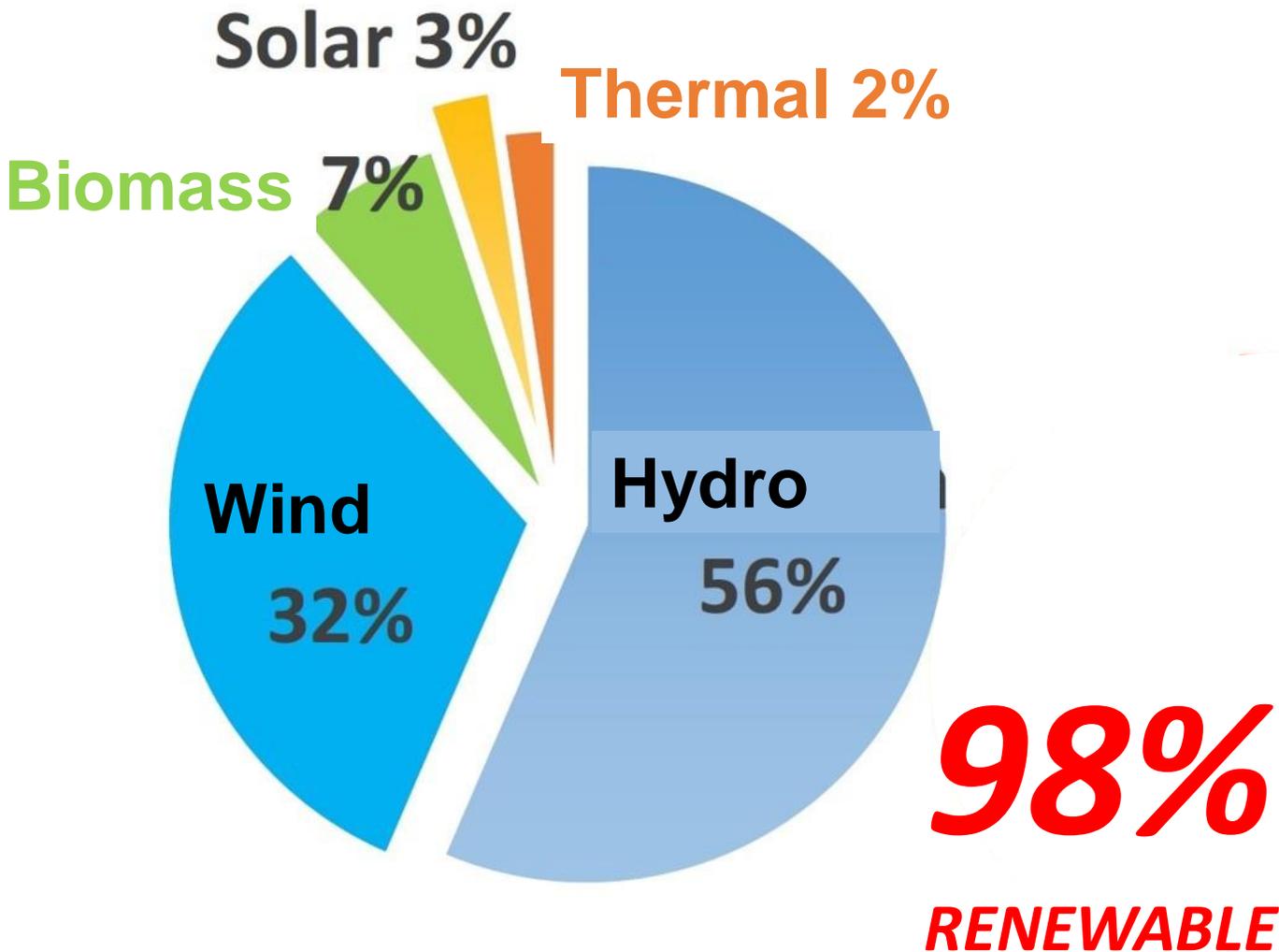
Electrication needed in DK to reach national 70% climate gas reduction towards 2030 (base)



Balancing the Danish power system



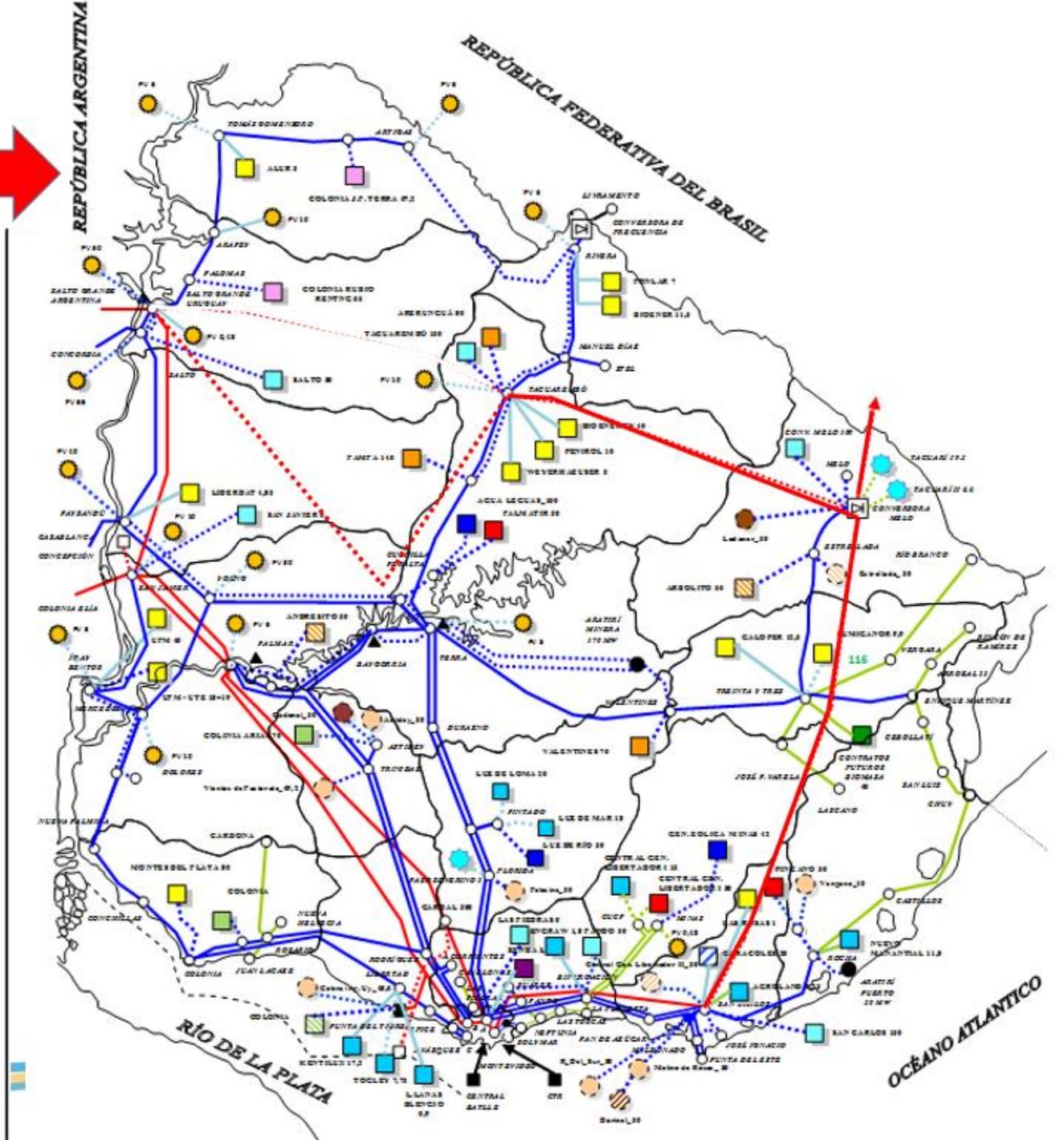
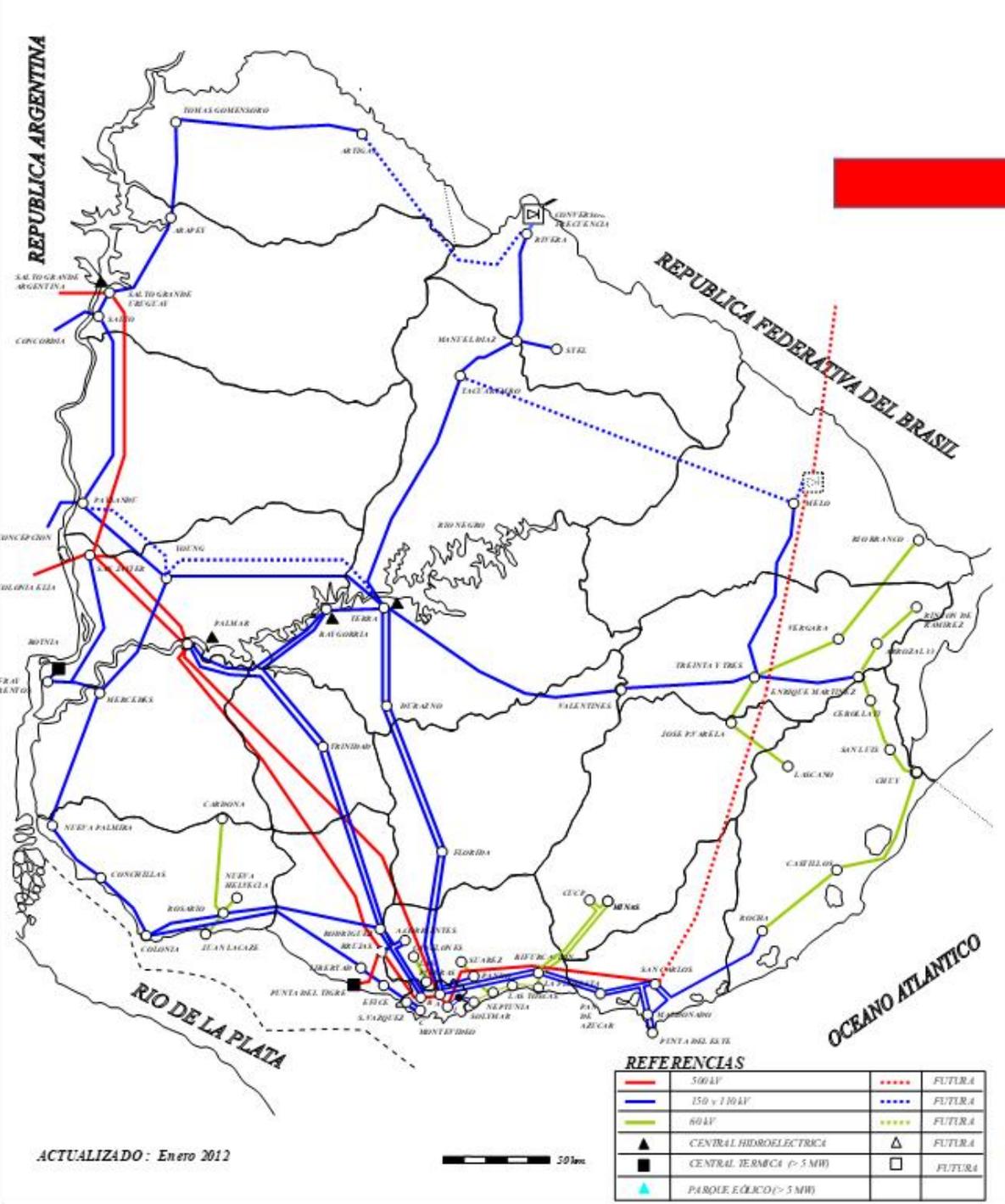
Further information at: <http://www.energinet.dk/Sys35>
Or E-mail: abh@energinet.dk



Before 2010: 2.100 MW installed

2017: + 2.200 MW of NCRE

- Considering the variation on NCRE, it is economical to have a surplus (in average, near 10%).
- How to manage that resources... and their effect on the grids...



Ways to manage the grids

And pass the benefits to end users

Introducing **more technology** in the operation: Automatic reconfiguration, dynamic capacity.

Developing a **new business model** for a reconfiguration of the market, towards a more flexible demand (coordinated with the supply availability).

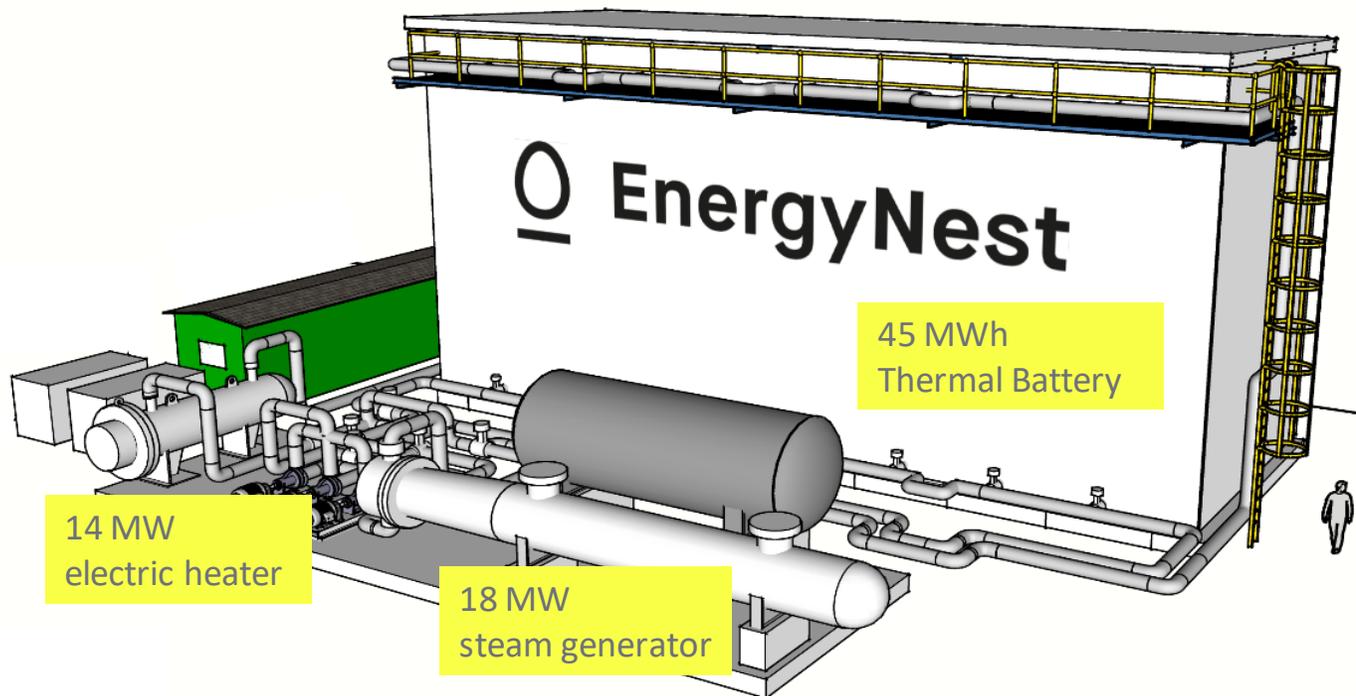
Targets (using increasing Smart grids):

- Better comfort for households (new commercial options)
- Increased competitiveness for productive sectors
- Attraction of investments (energy price levels)
- Better international interchanges rules
- Contribute to the Decarbonization in sectors like transport, heating, industries (processes of energy substitution).



Power grid flexibility with Thermal Batteries

Example system solution for industrial steam consumer



- Steam accounts for almost 40 % of global final manufacturing energy use; almost 10% of global final energy consumption*
- Thermal Battery system is an electric steam boiler with added energy storage capacity
- Response time: seconds
- Operating range: 0 – 100+%
- Installed power: 10 MW +/- per use-case
- Up to 10+ hours of storage capacity
- Scalable up to 100's of MW and GWh's
- Commercially available technology

BIG HIT Project



Moderator



Norela Constantinescu

Manager for Research &
Innovation

ENTSO-E

Panelists



Anders Bavnhøj Hansen

Chief Engineer

Energinet Denmark



Pablo Mosto

Planning & Environment
Manager

UTE Uruguay



Christopher Greiner

CTO

EnergyNest



Adele Lidderdale

Hydrogen Project Manager

EMEC

VIRTUAL EDITION

IRENA INNOVATION WEEK²⁰²⁰

Panel IV: New Power Sector Dynamics with Smart Electrification

#IVIW2020

Moderator



Robert Chapman

Vice President of Electrific. &
Sus. Energy Strategy

EPRI

Panelists



Katie Sloan

Director of eMobility and
Building Electrification

Southern California Edison



Bastian Pfarrherr

Head of Innovation
Management

Stromnetz Hamburg



Anders Bavnhøj Hansen

Chief Engineer

Energinet Denmark



Pablo Mosto

Planning & Environment
Manager

UTE Uruguay

VIRTUAL EDITION

IRENA INNOVATION WEEK 2020

Closing Remarks

#IVIW2020

Closing remarks



Robert Chapman

Vice President of Electrification & Sustainable Energy Strategy,
Electric Power Research Institute (EPRI)

VIRTUAL EDITION

IRENA INNOVATION WEEK²⁰²⁰

Thank you!

Coming up next:

Session 3:

Green Hydrogen: Electrolysis, Ammonia and other E-Fuels

tomorrow at 8 am (CEST)

Register at

<https://innovationweek.irena.org/>

#IVIW2020