



IEA Bioenergy
Technology Collaboration Programme



Overview on the role of flexible bioenergy in renewable energy systems

Task 44 Flexible Bioenergy and System Integration

Elina Mäki, Task leader

IEA Bioenergy webinar, 18 March 2021

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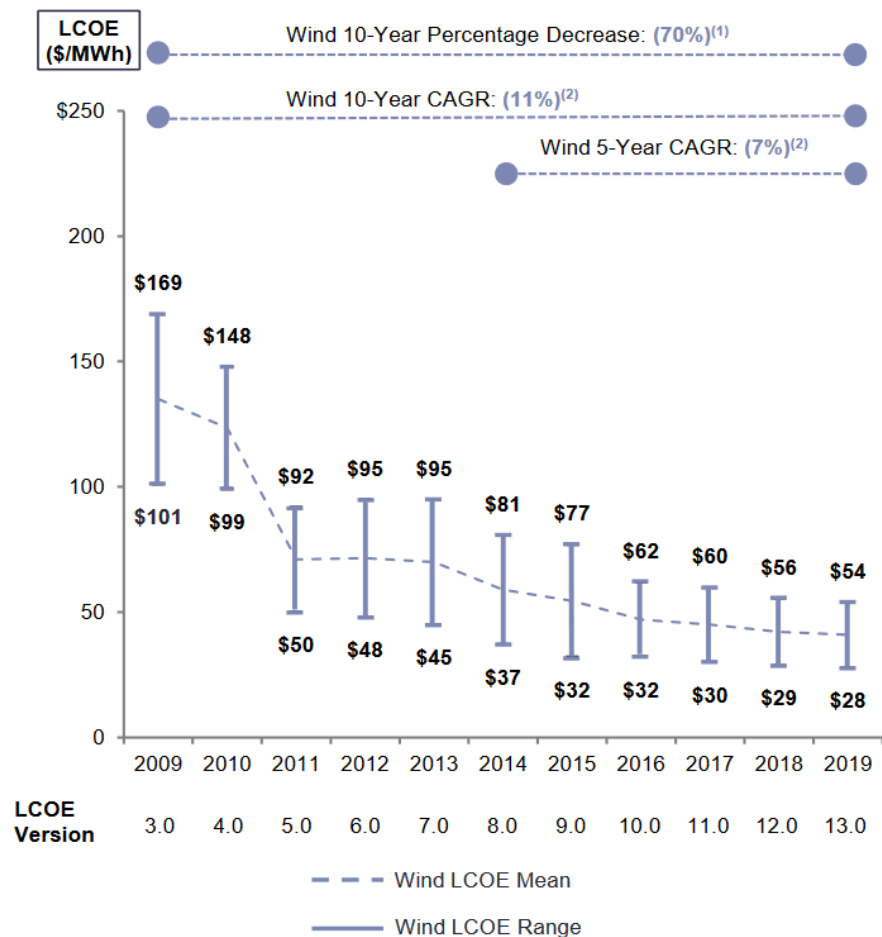
Outline

- Background - Why flexible bioenergy?
- Examples of flexible bioenergy concepts
- What is flexible bioenergy?
- IEA Bioenergy Task 44

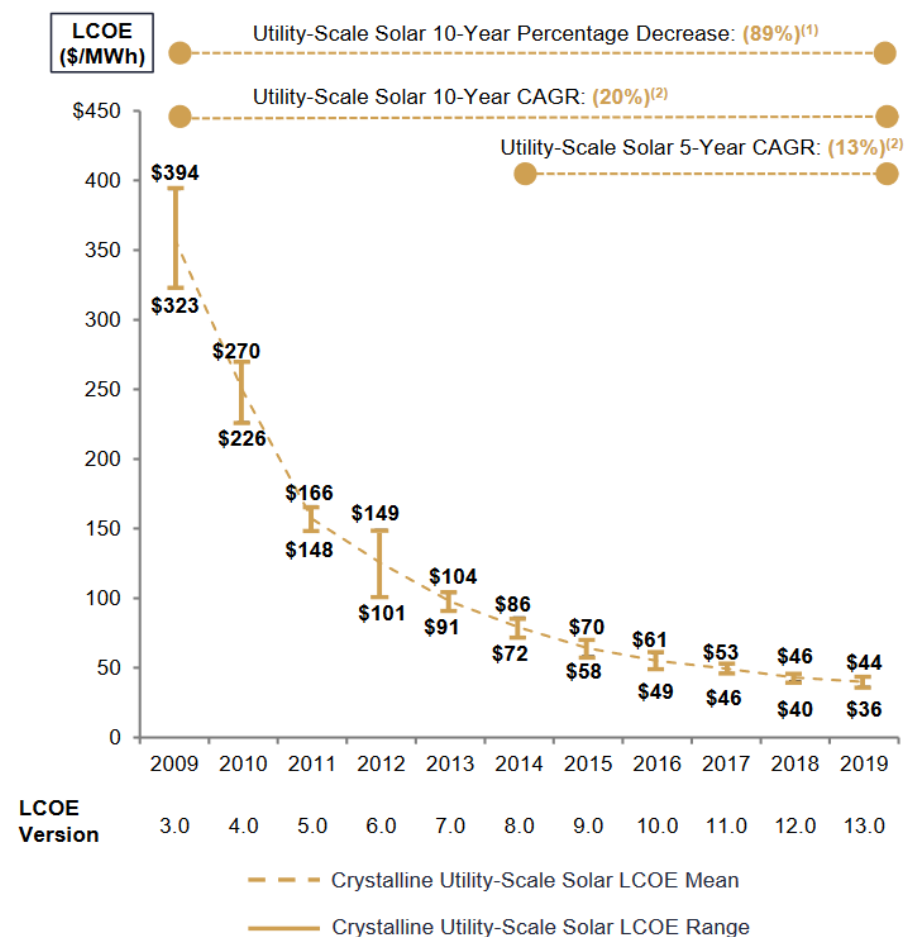


Cost of wind and solar has decreased drastically

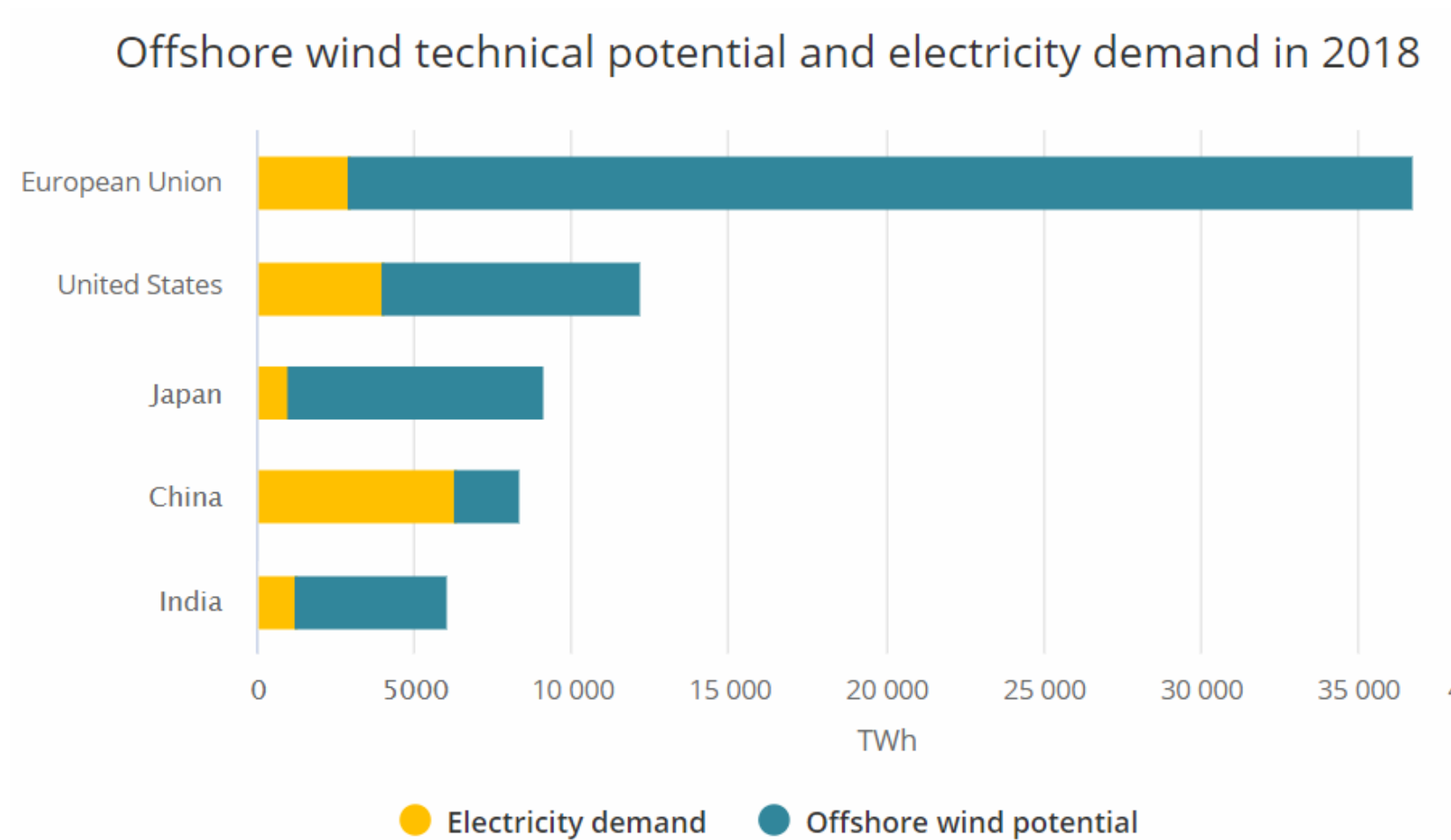
Unsubsidized Wind LCOE



Unsubsidized Solar PV LCOE

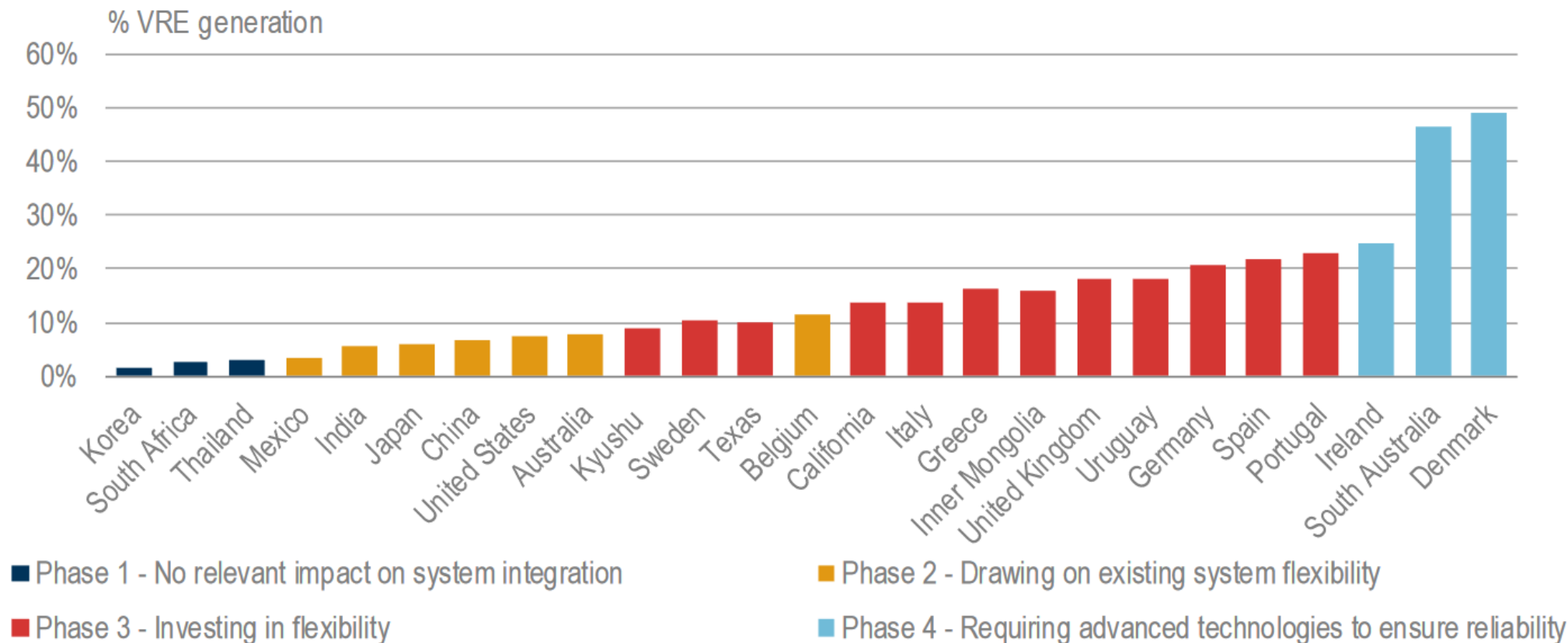


Offshore wind has massive potential



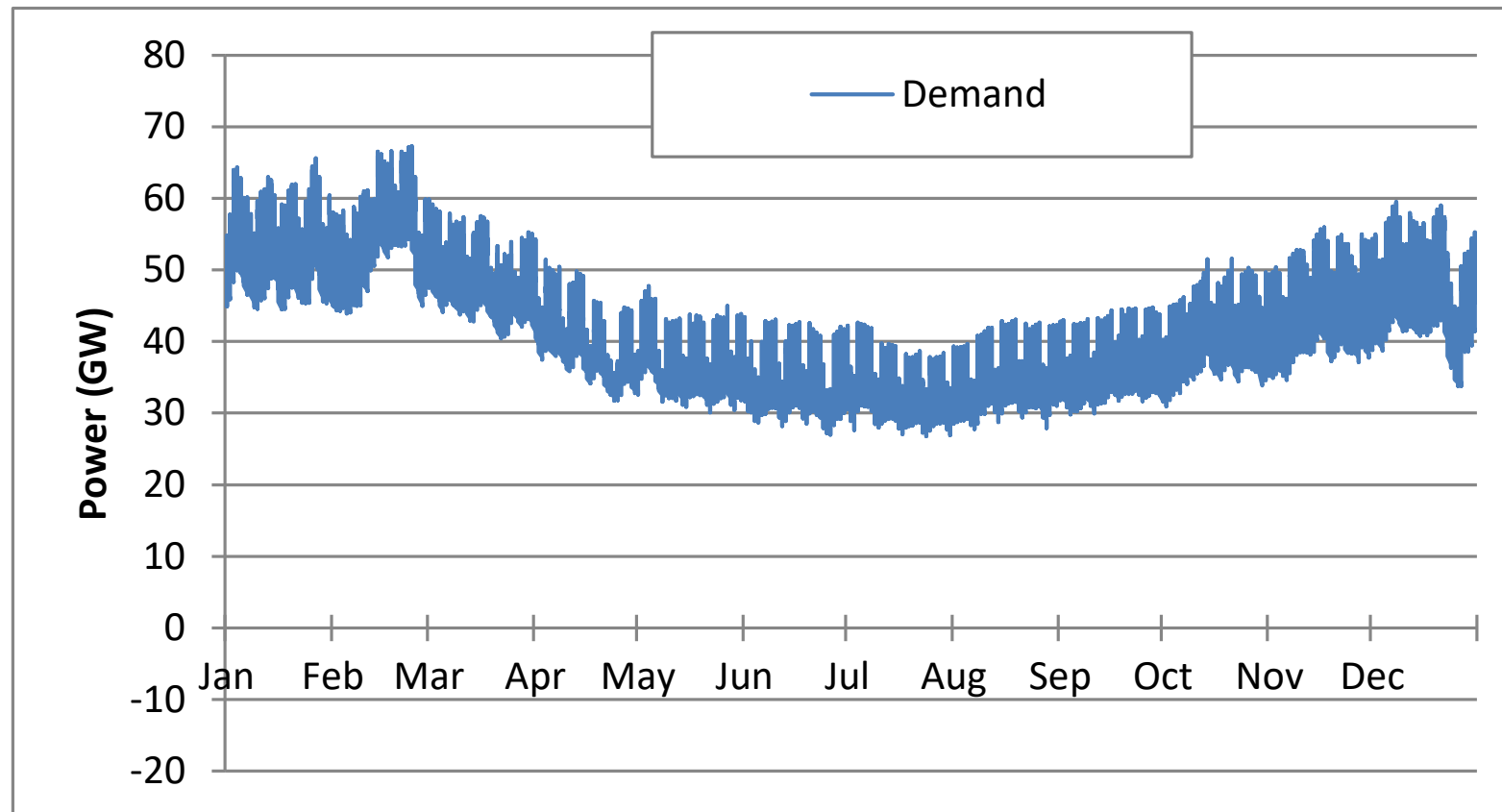
VRE deployment phase in selected countries

Selected countries by integration phase and share of VRE, 2017

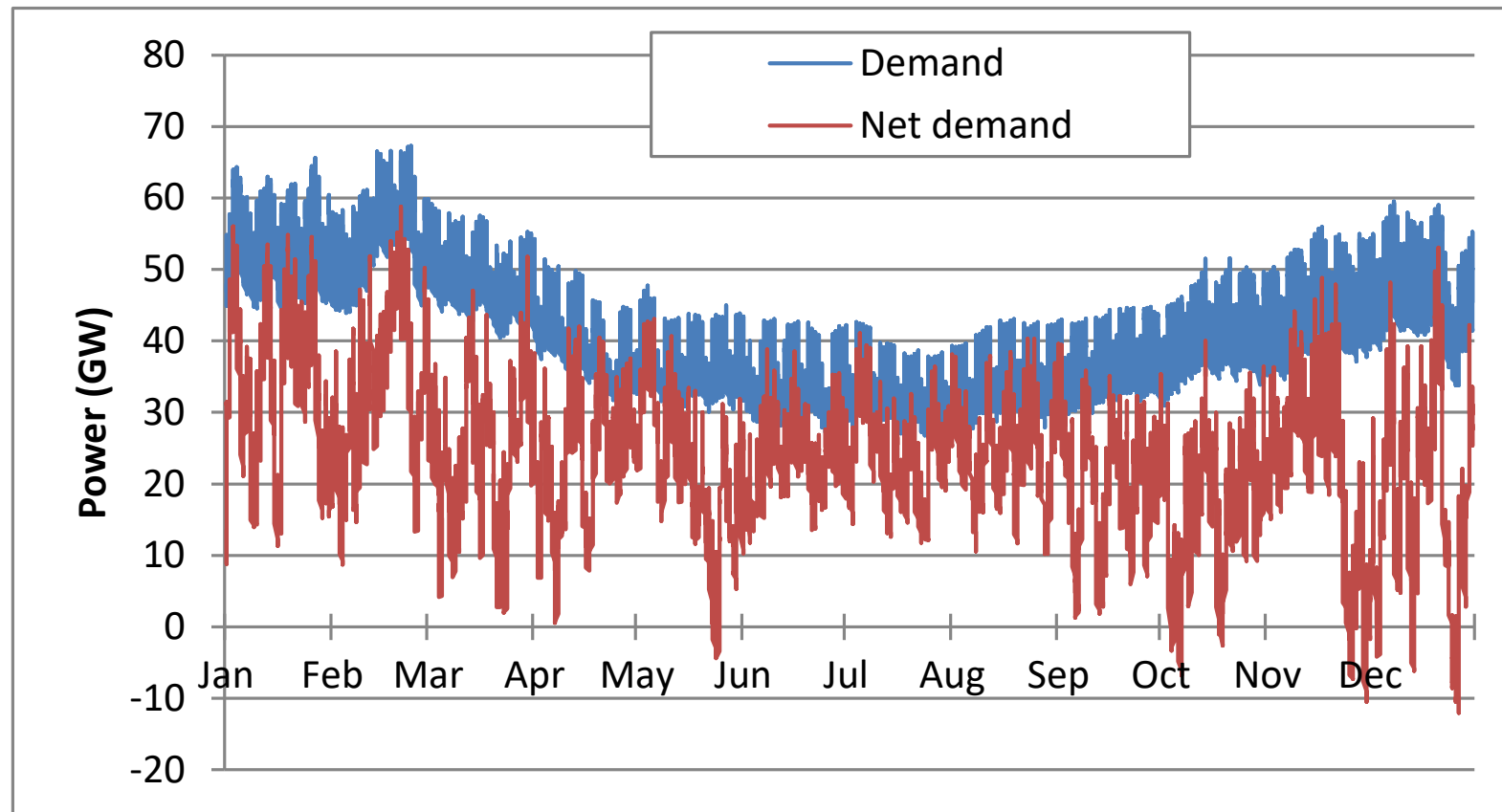


Phases are characterized by integration challenges related to technical, regulatory, market and institutional aspects.

Variability is normal

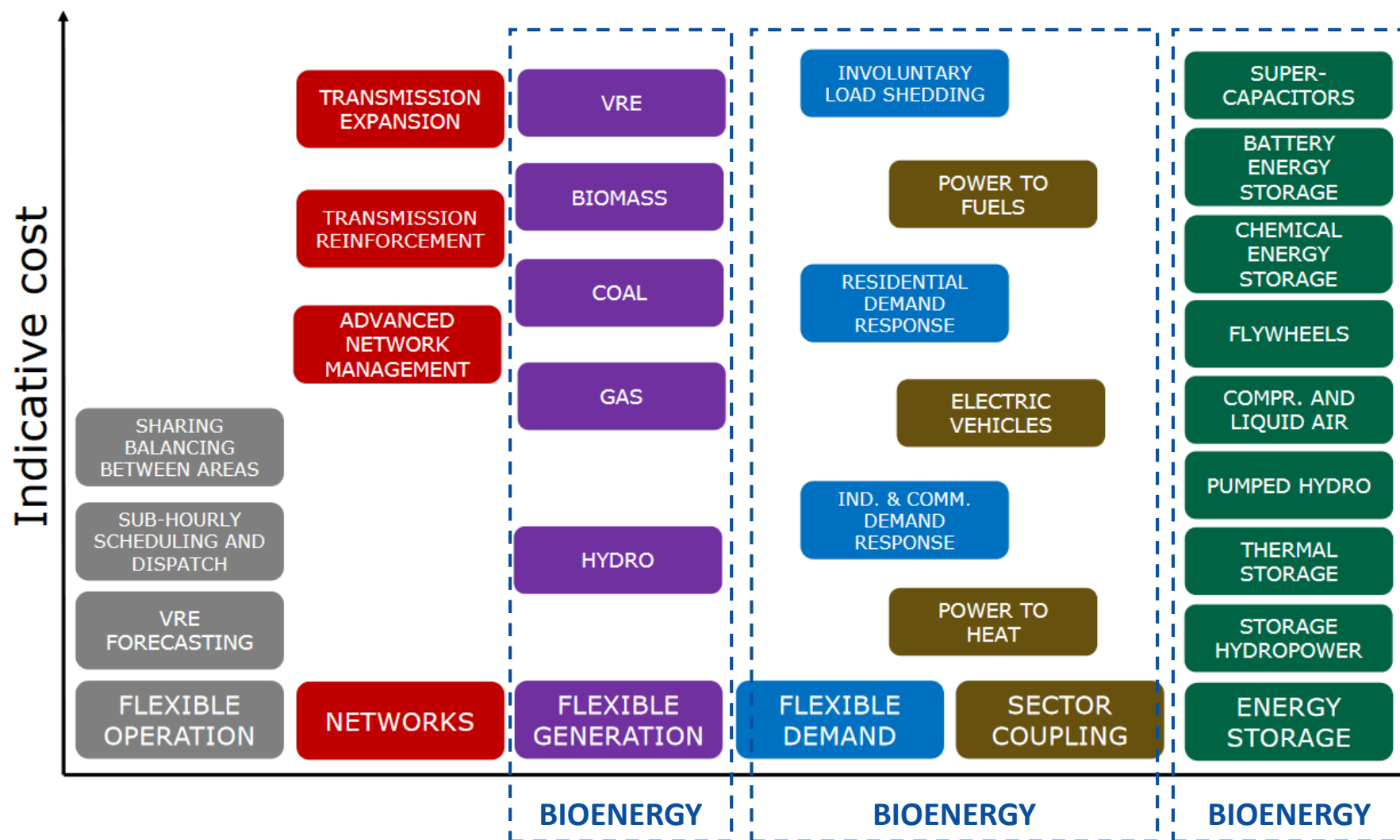


But variability increases with more VRE



When 40% of electricity demand covered by wind power in an example system

Categorisation of relevant flexibility options



Options and associated costs are system dependent and evolving over time.

Figure modified from Figure 7 of Flexibility in 21st Century Power Systems

Increasing the flexibility of biomass boilers

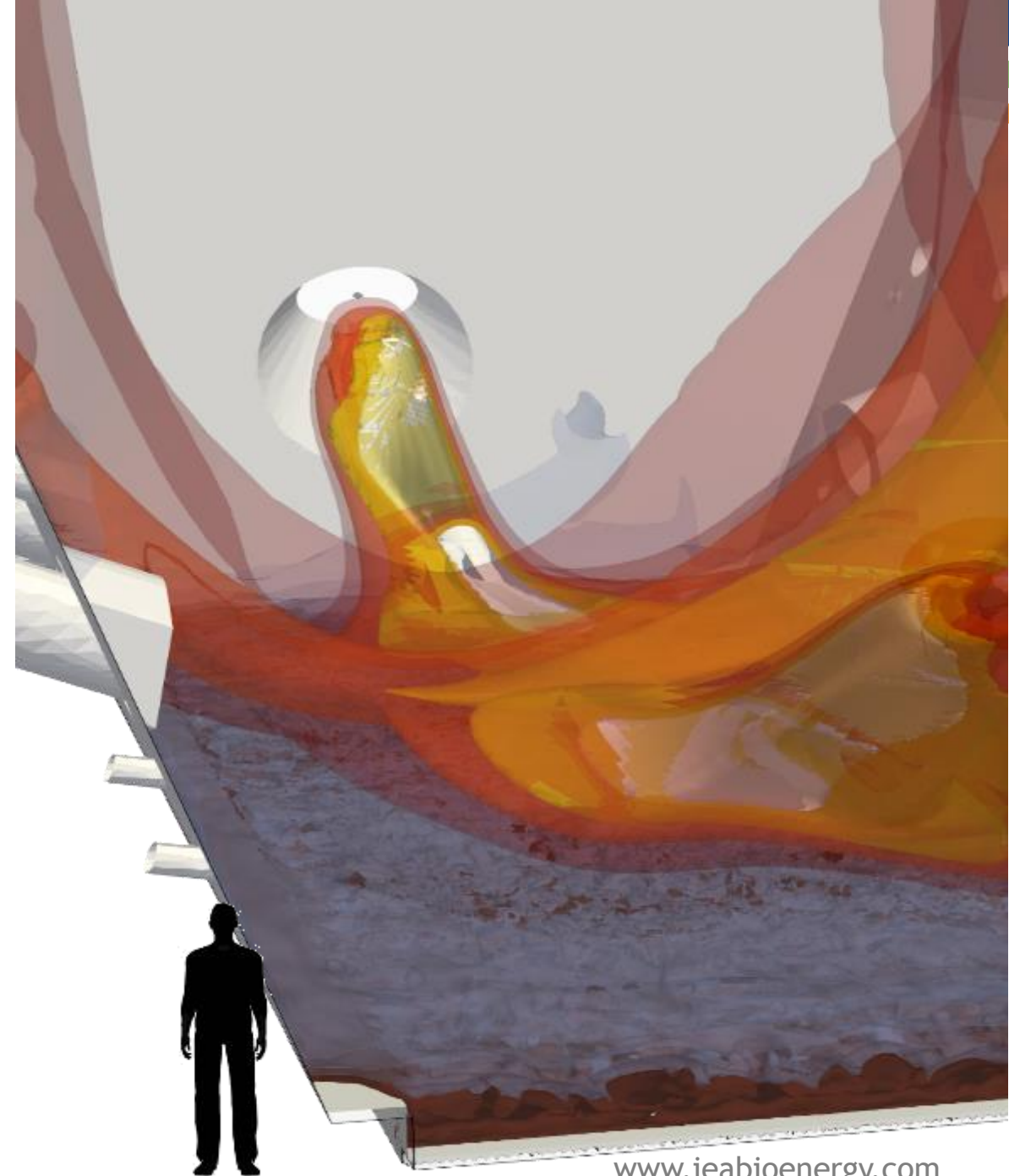
1. Faster cold start up

- Thermal loads on refractories and pressure vessel
- Heat transfer to bed mass

2. Increased speed of load change

3. Wider operational range

- Lower minimum load (30%, 20%, 15%...)
- Emission performance
- Efficiency, steam properties



Bioenergy has unique features

1. Co-generation with flexible output ratios

- Heat + Power
- Fuels + Power
- Fuels + Heat + Power

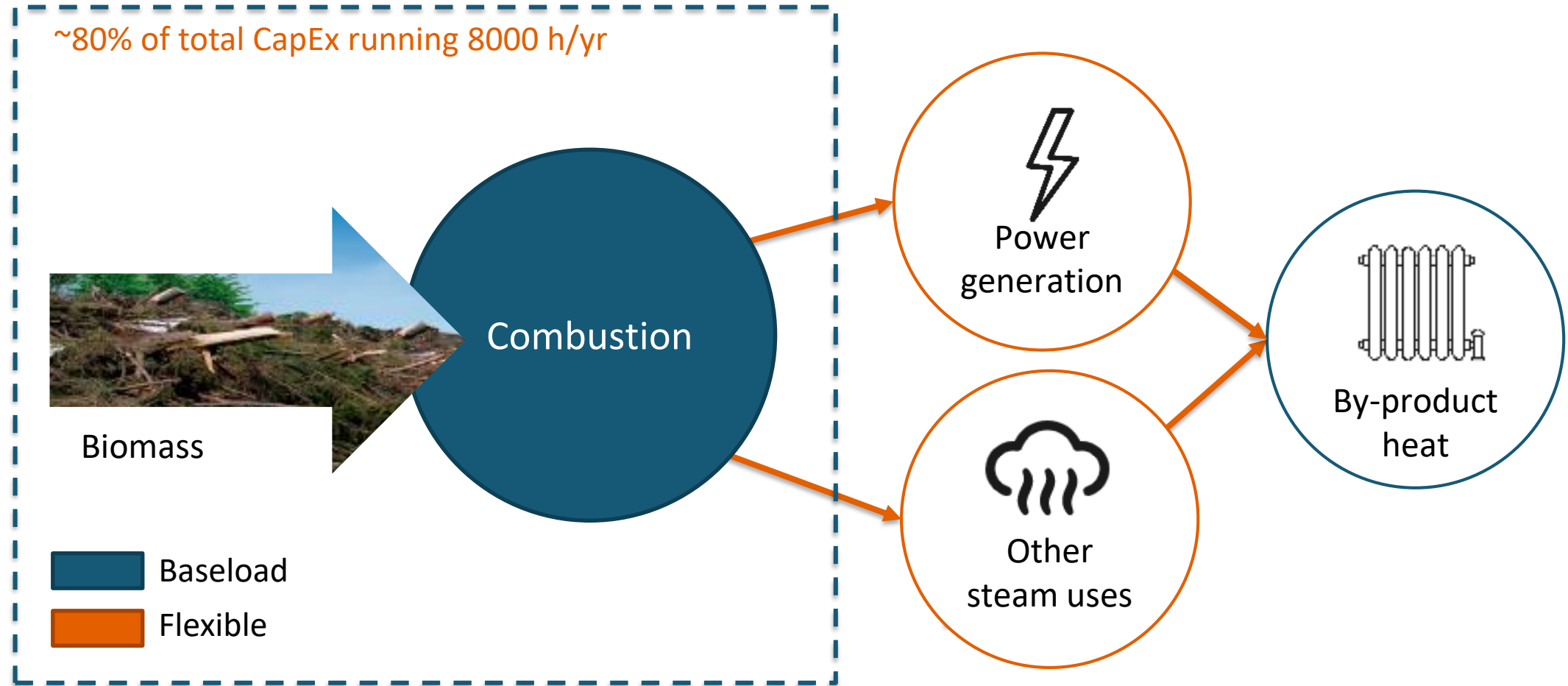
2. Only chemical energy source in a non-fossil energy system

3. Naturally easily storable as

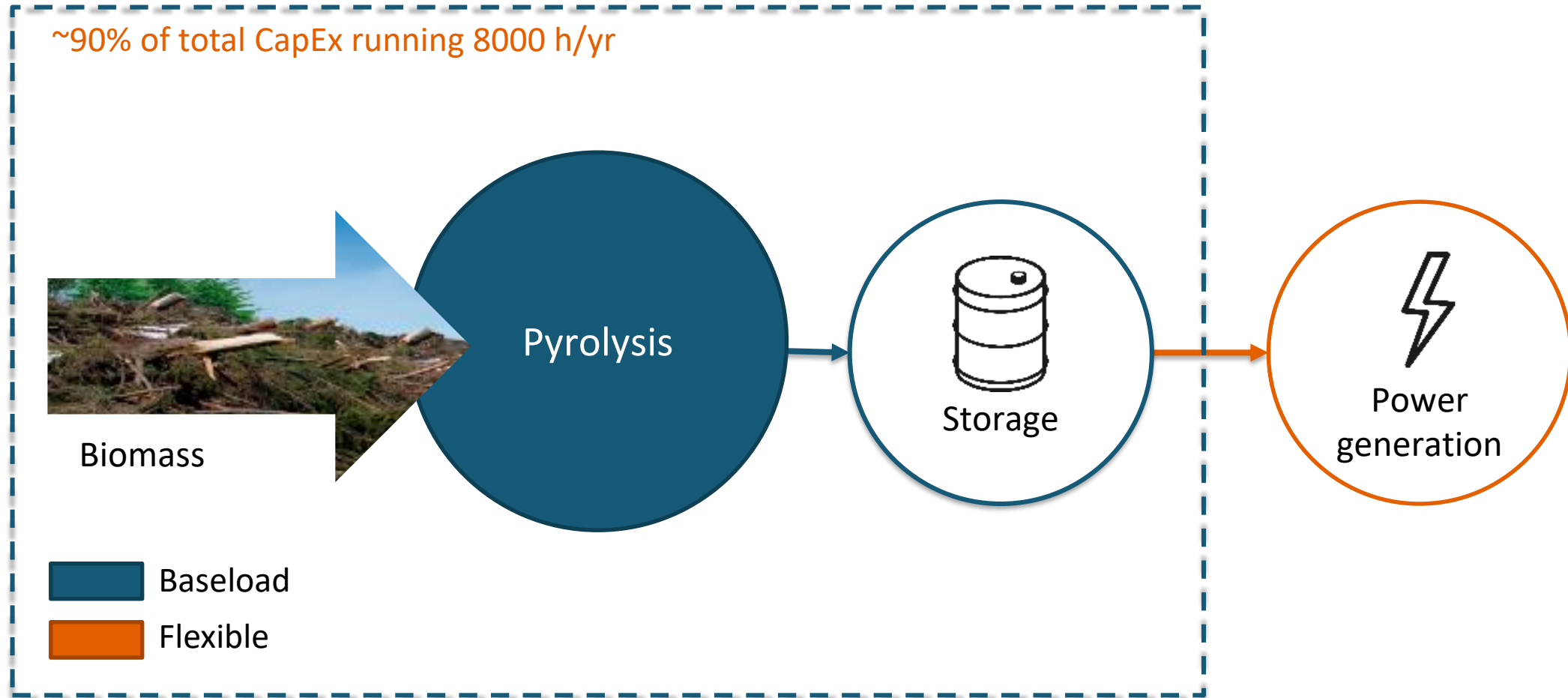
- Solid
- Liquid



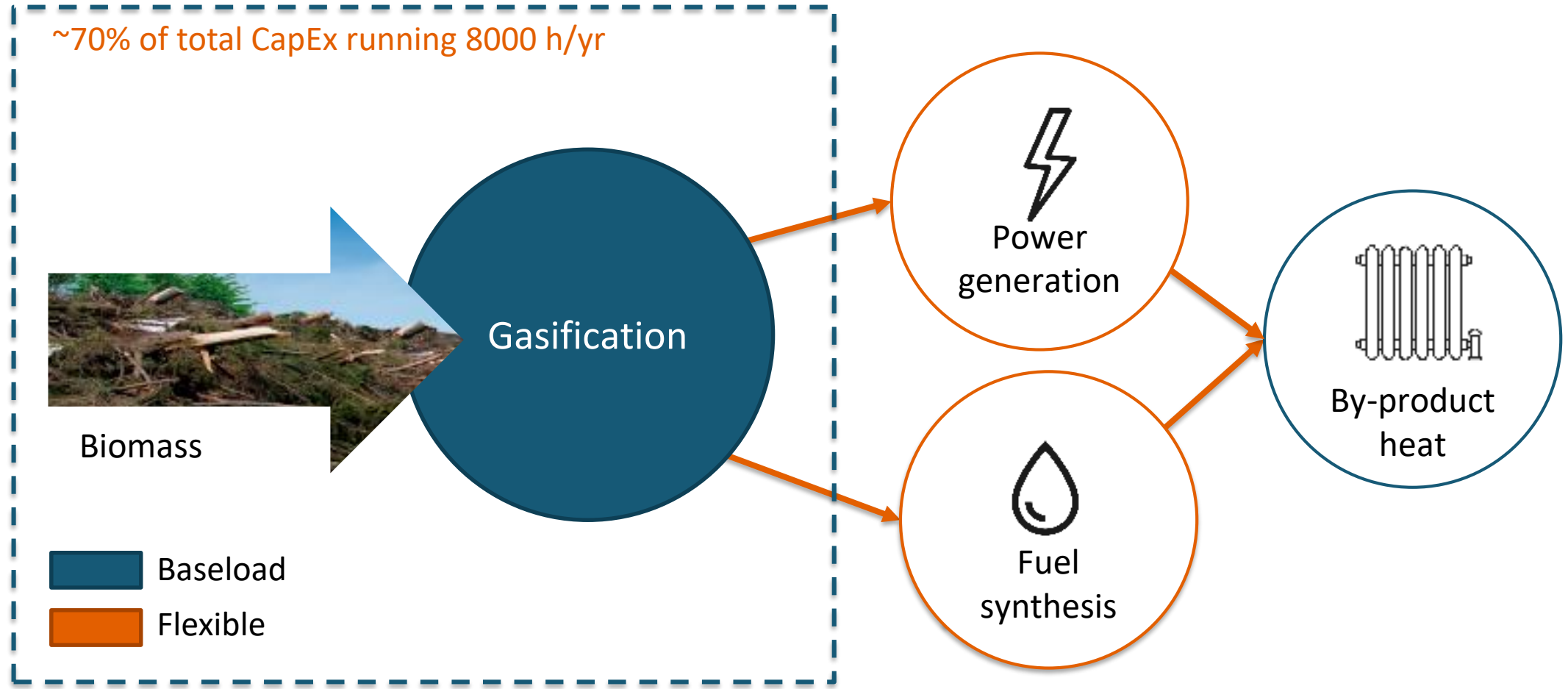
Co-production of power, steam and heat?



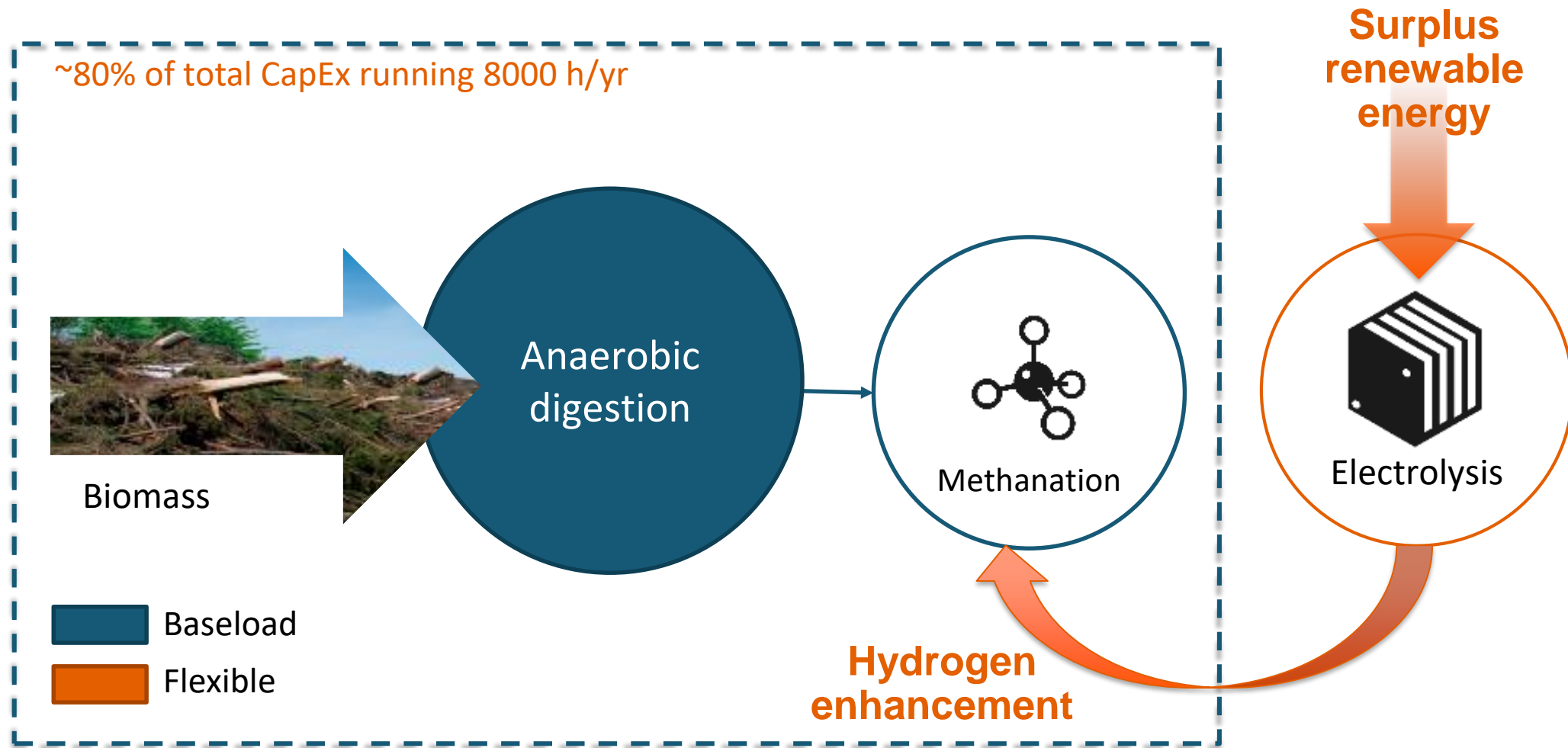
Liquid fuels for peaker plants?



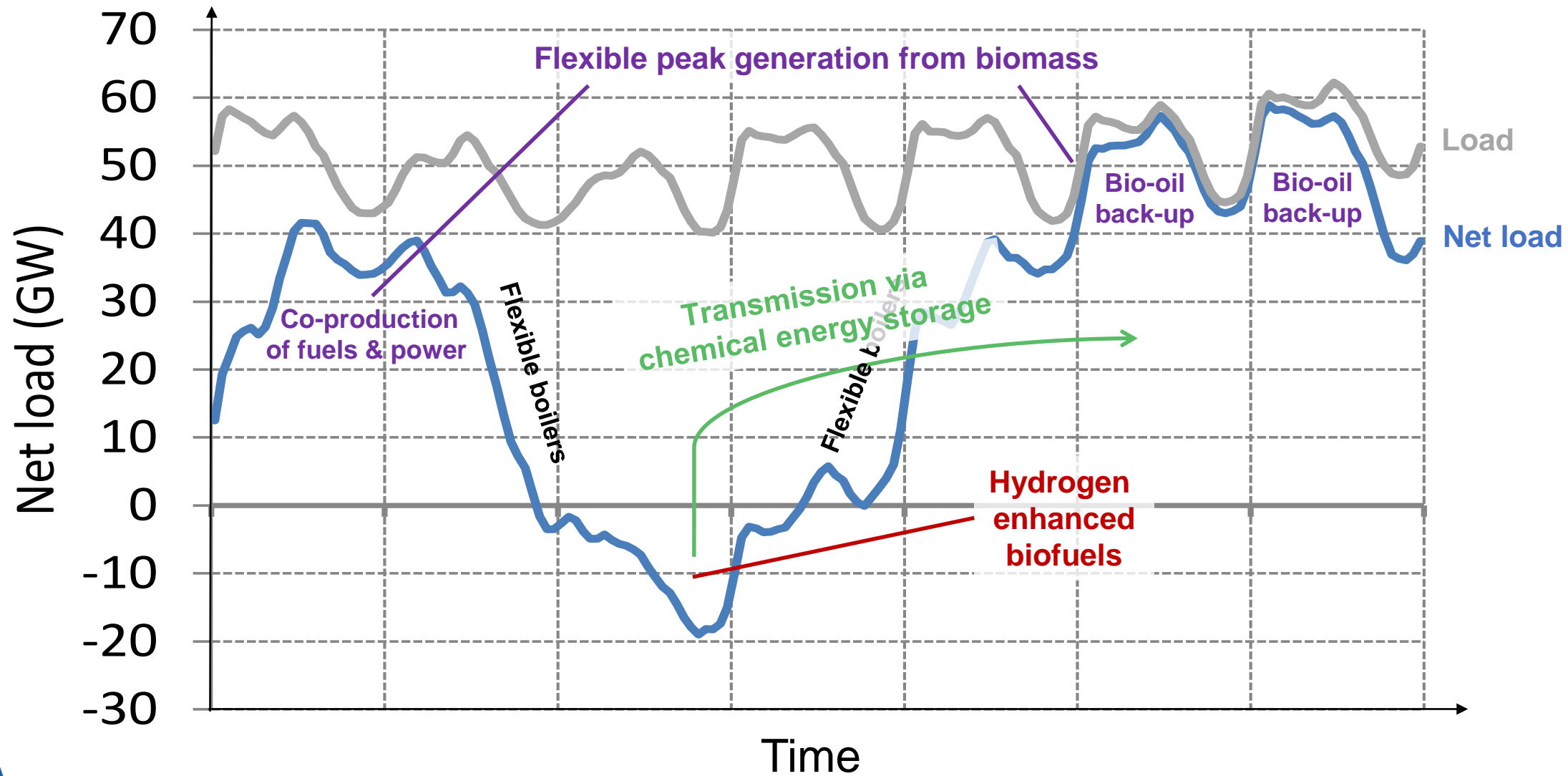
Co-production of fuels, power and heat?



Bioenergy with demand side flexibility?



Flexibility from bioenergy



What is flexible bioenergy?

“Flexible bioenergy is defined as a bioenergy system than can provide multiple services and benefits to the energy system under varying operating conditions and/or loads.

Examples of flexible bioenergy include:

- technologies and concepts providing grid stability for a power system with large amounts of variable wind and solar energy;*
- dispatchable production of energy and other products according to market demand;*
- integrated polygeneration systems combining the production of heat, power, fuels and/or chemicals;*
- long-term storage options such as biofuels and biochemicals; or*
- ancillary services to support system reliability.”*

Source: IEA Bioenergy Task 44 - Flexible bioenergy and system integration

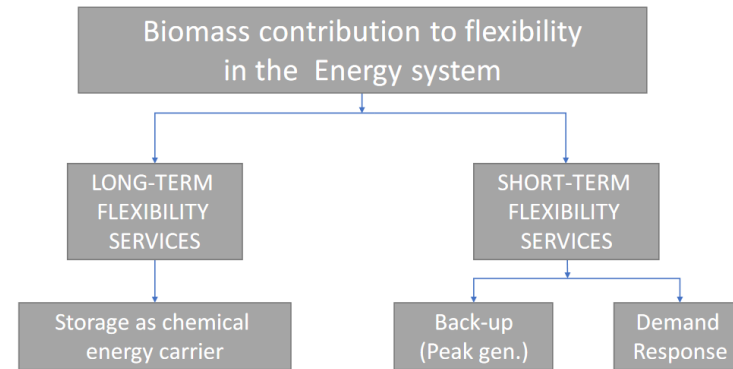
IEA Bioenergy Task 44: Flexible Bioenergy and System Integration

Our key topics

- Flexible bioenergy **concepts** for supporting low-carbon energy systems
- Acceleration of **implementation**
- **System requirements** for bioenergy concepts

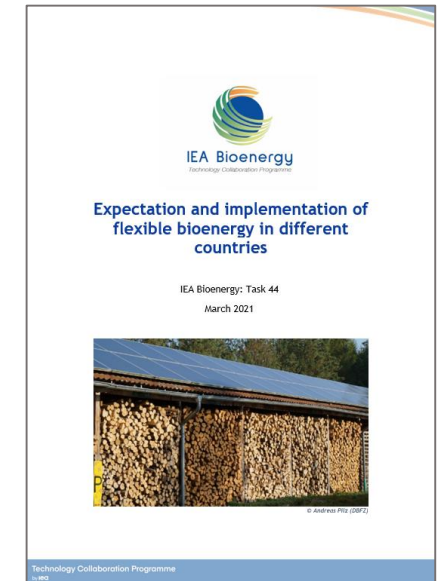
Member states

- Australia, Austria, Finland, Germany, Ireland, The Netherlands, Sweden, Switzerland, USA

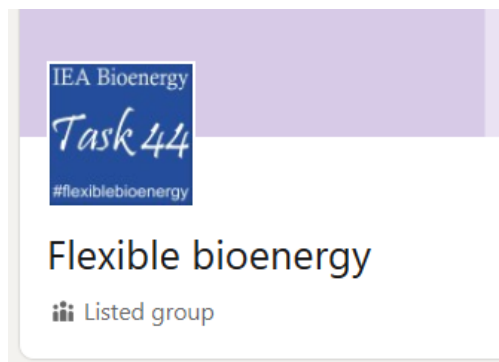


*Flexible bioenergy –
Technical options*

*Expectation and
implementation of
flexible bioenergy in
different countries*



Our website & LinkedIn group



<https://www.linkedin.com/groups/13682476/>



Task 44: Flexible Bioenergy and System Integration

The ongoing energy transition is mainly driven by reductions in the cost of wind and solar energy, and political efforts to reduce greenhouse gas emissions. Although substantial deployment of variable renewable energy (VRE) is an important part of the overall transformation, rapid changes in the energy mix may pose challenges to the resilience of the electricity grid, particularly in times of weather-related stress. As fossil generation capacity is being retired and replaced by VRE generation, it raises the important question of how to maintain the stability and reliability of future energy supply.

Although climate and energy policies are still largely focussed on electricity, most of the energy is used for heating, cooling, and transport. These sectors have remained deeply reliant on fossil fuels and significant decarbonisation efforts are needed to ensure that the overall emission pledges of the Paris Accord can be met. In addition to sector-specific measures, it is essential to recognise the links between electricity, heat and transport and exploit synergies so that these sectors will support each other's in the effort to decarbonise.

The task is based on the work done in IEA Bioenergy Task 41 special projects during 2016-17: Project 5: Bio-CCUS in climate change mitigation and extended use of biomass raw material, Project 6: Bioenergy in balancing the grid & providing storage options and Project 7: Bioenergy RES hybrids. As a common conclusion from these projects, bioenergy has some unique properties that can address many of the problems related to the rapid transition to a low-carbon energy system. Three different development pathways identified in Project 6 have been further developed for the purpose of this task: When sustainably sourced and used, bioenergy can

- I. operate as a key element in the coupling of different energy sectors;
- II. provide low-carbon energy to complement wind and solar (residual load and grid stabilisation);
- III. store electricity chemically into fuels to enable more efficient use of wind and solar;
- IV. provide sustainable fuels for sectors where other decarbonisation options are not available or exceedingly expensive;
- V. provide high temperature heat to industry, and low temperature heat for buildings (and sanitary water) during dark and cold seasons;
- VI. coproduce heat, electricity, fuels and other products in a single high-efficiency processing plant.

<https://task44.ieabioenergy.com/>



Value-optimised use of biomass
in a flexible energy infrastructure

ERA-Net VaBiSys project: **Webinar on Flexible bioenergy**,
12 April 2021, 12-15 CEST

[Link to register](#)

Thank you for your interest!

Elina Mäki

VTT Technical Research Centre of Finland Ltd

elina.maki@vtt.fi



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