ENERGY EFFICIENCY FIRST

#EE1ST SUMMIT

How to implement the Energy Efficiency First principle and boost Europe's Energy Security

MAY 31 - JUNE 1

In Brussels and online

sEEnergies

enefirst.

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How to implement the Energy Efficiency First principle and boost Europe's Energy Security

Time	Title	Speakers
11:00	Welcome: registrations and light lunch	
12:00	**sEEnergies energy efficiency 2050 results and 100% renewable energy systems for EU27 and the UK**	Brian Vad Mathiesen, Professor & David Maya-Drysdale, Assistant Professor, Aalborg University
	Scarcity as a new normal towards 2050	Antonella Battaglini, CEO, Renewables Grid Initiative
13:00	**Energy Efficiency Deep Dives**	
	• EE in Transport systems in sEEnergies	Morten Elle, Associate Professor & Hamza Abid, Research Assistant, Aalborg University
	• EE in Buildings in sEEnergies	Martin Jakob, Executive partner, TEP Energy
	• EE in Industry in sEEnergies	Katerina Kermeli, Researcher, Utrecht University & Rasmus Magni Johannsen, PhD Fellow, Aalborg University
	• Grids for Energy Efficient systems – electricity, district heating and gas grids	Dirk Saelens, Professor, KU Leuven & Bernd Möller, Professor, Europa-Universität Flensburg
	• Tool Box – Visualisation, Exploitable Tools and Data from sEEnergies	Bernd Möller, Professor, Europa-Universität Flensburg

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Time	Title	Speakers
15:15	Coffee break	
16:00	**REPowerEU 2030: EE1st Principle, Energy Security in the light of the Russia-Ukrainian War** • sEEnergies REPowerEU and 2030 policy take-aways	Brian Vad Mathiesen, Professor, Aalborg University
16:30	**REPowerEU – the EU Commission answer to energy security in Europe**	Hans Van Steen, Principal Adviser, EU DG Energy
	Round table: Is EU on track for harvesting energy efficiency first potentials in REPowerEU?	• Hans Van Steen, Principal Adviser, EU DG Energy • Michaela Holl, Senior Associate, Agora Energiewende • Jeppe Juul, Vice President, Transport & Environment • Wolfgang Eichhammer, Head, Competence Centre Energy Policy and Energy Markets, Fraunhofer ISI • Eline Blanchard, Senior Policy & Project Officer, EFIEES - European Federation of Intelligent Energy Efficiency Services • Brian Vad Mathiesen, Professor, Aalborg University
18:00	Wrap up and conclusions	

sEEnergies energy efficiency 2050 results and 100% renewable energy systems for EU27 and the UK

Energy Efficiency First SUMMIT, 31 May 2022

Brian Vad Mathiesen, David Maya-Drysdale,
Aalborg University

KU LEUVEN · SYNYO · Fraunhofer ISI · TEP · Utrecht University · Europa-Universität Flensburg · Halmstad University · Aalborg University Denmark · Norwegian University of Life Sciences

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Quantification of synergies between Energy Efficiency First Principle and renewable energy systems for 2050 decarbonisation

What is the challenge?

According to the European Climate Foundation the Energy Union EEFP can be explained as:

"Efficiency First is the fundamental principle around which EU's Energy System should be designed. It means considering the potential value of investing in efficiency (including energy savings and demand response) in all decisions about energy system development - be that in homes, offices, industry or mobility. Where efficiency improvements are shown to be most cost-effective or valuable, taking full account of their co-benefits, they should be prioritized over any investment in new power generation, grids or pipelines, and fuel supplies. In practice, Efficiency First means giving EE a fair chance in the models and impact assessments that policy-makers use to make decisions, strengthening those laws that already target efficiency, and integrating it into all other Energy Union policies. That includes funding decisions and infrastructure planning. Applying this principle will help to correct the persistent bias towards increasing supply over managing demand, a bias towards increasing supply over managing demand, a bias which has impeded Europe's ability to create a least-cost, jobs-rich, low-carbon energy system."

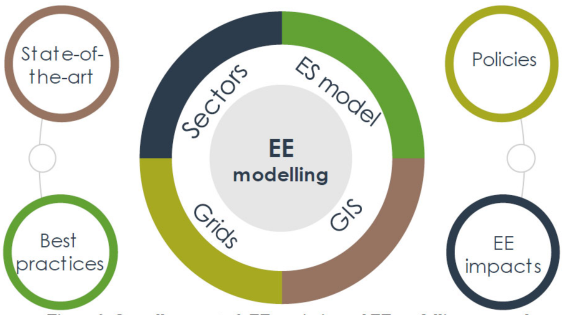

Figure 3. Overall concept of sEEnergies' novel EE modelling approach

Key questions:
- How do we prioritise energy efficiency measures today that also have an effect in the future?
- What are the supply chain effects of energy savings in future energy systems?
- What does the future look like?

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Why sEEnergies - objectives

- Clear need not only to define but also to operationalise the ENERGY EFFICIENCY PRINCIPLE both in qualitative and in quantitative terms – **sEEnergies pledges to combine and complement existing sector-dedicated models with temporal and spatial analyses** to develop a very analytical decision support tool.
- The bottom-up approach used in the sEEnergies project will have as starting point detailed analyses of EE matters in each sector. Consequently, besides providing a general overview of the EE potentials from an energy systems perspective, sEEnergies will also provide advances on the state-of-the-art of the understanding of EEFP consequences for each sector. This will enable policy makers and other target groups to easily find the results concerning the sector they are more interested on.

Objective 1
Develop a holistic temporal and spatial assessment of energy efficiency potentials by utilising energy systems synergies and in this way make the Energy Efficiency First Principle more operational.

Objective 2
Assess the energy-related impact of Energy Efficiency First Principle at the sector and energy system levels to quantify energy efficiency and make it comparable with investments on the supply side.

Objective 3
Assess the additional impact of energy efficiency measures in different sectors, as well as their impact on markets, in order to support policies, aiming at promoting and implementing the Energy Efficiency First Principle.

Objective 4
Develop an online GIS visualization platform to make Energy Efficiency First Principle more concrete in relation to energy demand and supply.

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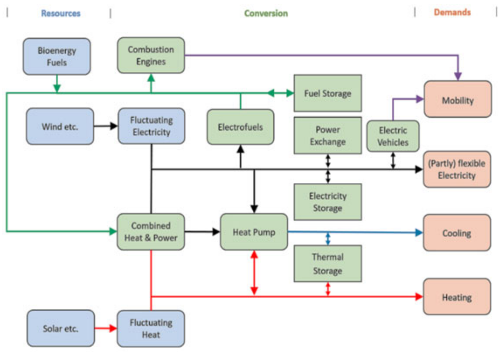
Energy efficiency in the supply chain

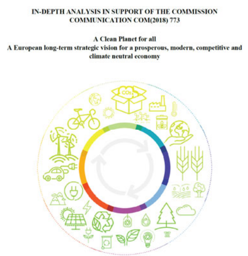
In sEEnergies the EEFP is (WP1-WP3):

- end savings
- conversion efficiency at the end consumer
- in products and electric vehicles

and further than that (WP4-WP6):

- supply chain effects of end use savings
- efficient energy system designs
- country based results





One common point of reference:

Analysing the EEFP in the entire supply chain in a future situation requires a consistent approach to future developments. In sEEnergies selected scenarios from "A Clean Planet for all" are used as a common reference across countries in Europe and across sectors in the energy sector.

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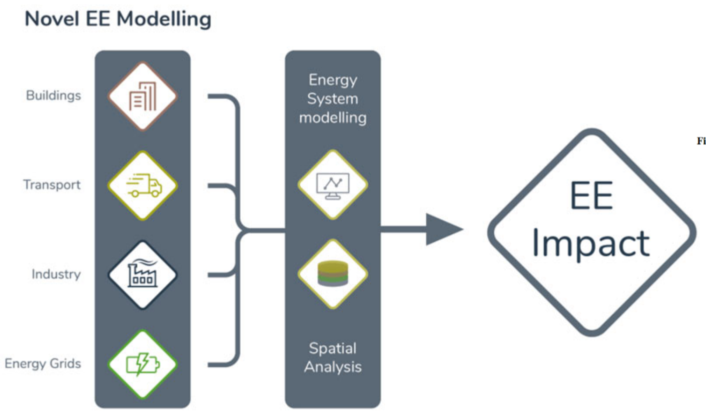
Overview of project setup and model approach

Quantification and operationalization of the potentials for energy efficiency in buildings, transport, and industry.



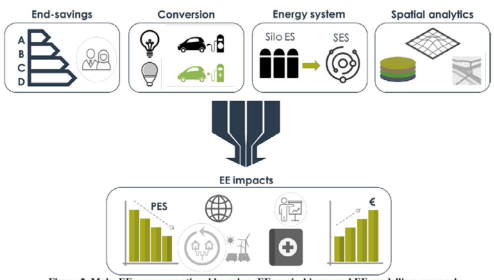


Figure 2. Make EE more operational by using sEEnergies' improved EE-modelling approach

The project combines sectorial bottom-up knowledge with hour-by-hour modeling of the energy systems and spatial analysis in the EU.

The project includes analysis of non-energy benefits of the energy efficiency first principle in the different demand sectors

Energy efficiency first principle and sEEnergies

EEFP: Systematically consider **energy efficiency and other demand-side resources** among the possible options when comparing, planning or deciding investments

In sEEnergies this meant:

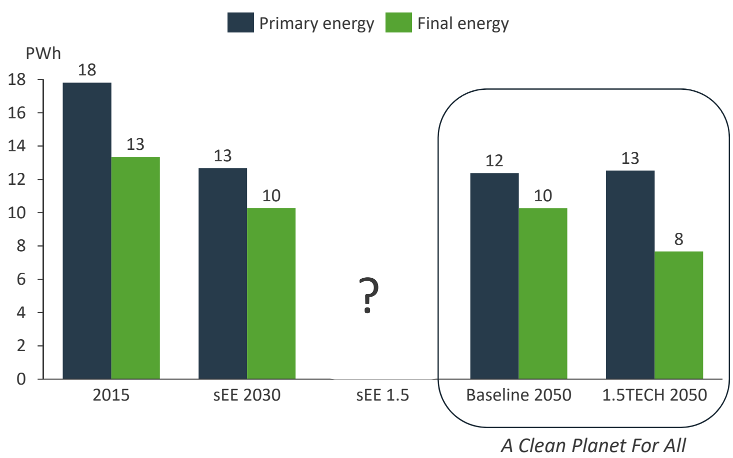
1. Detailed assessment of energy efficiency measures at sector level
2. Assessing the impact of the energy efficiency measures on the energy system (positive and negative)

Bottom up country analyses → Results: 28 countries (EU27+UK)

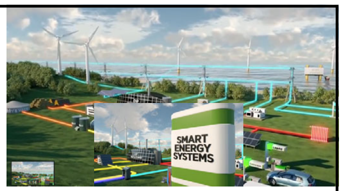
Sectors → System

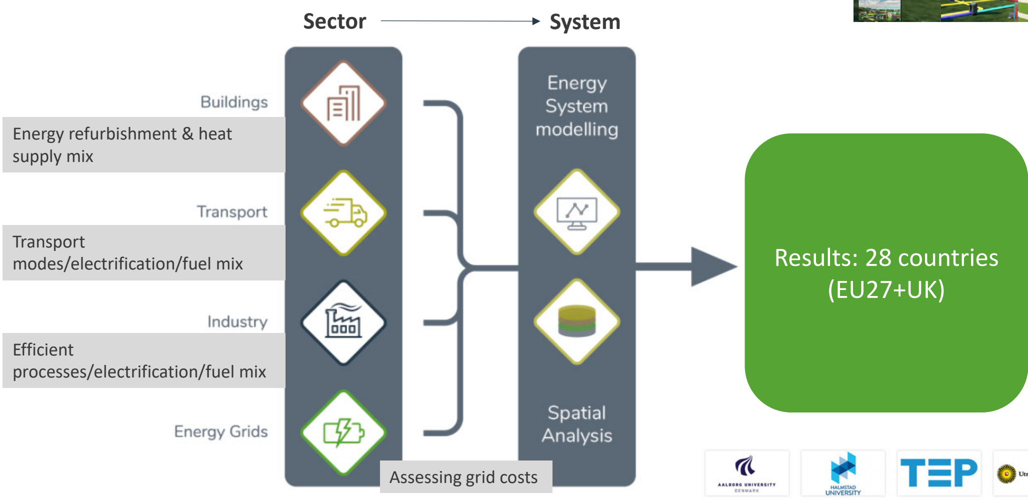
Novelty of sEEnergies

- Investigated energy efficiency in each sector independently in each country
- Investigated energy grid costs
- Combined the energy sector scenarios and grid costs within an energy system analysis for each EU27+UK country
- A final energy system configuration for each country was selected based on a performance assessment
- An EU27+UK energy system was created from each of the selected countries



Modelling platform





Sector scenarios and grid costs considered for each country

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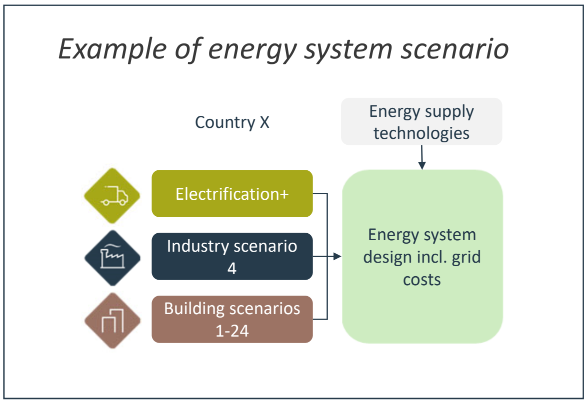
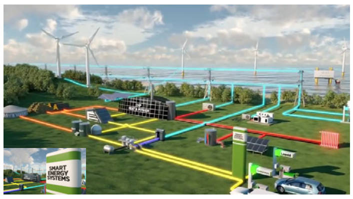
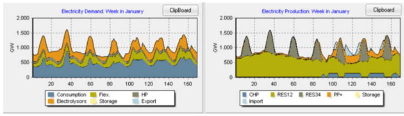


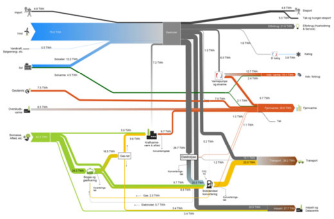
Energy system analysis for each country



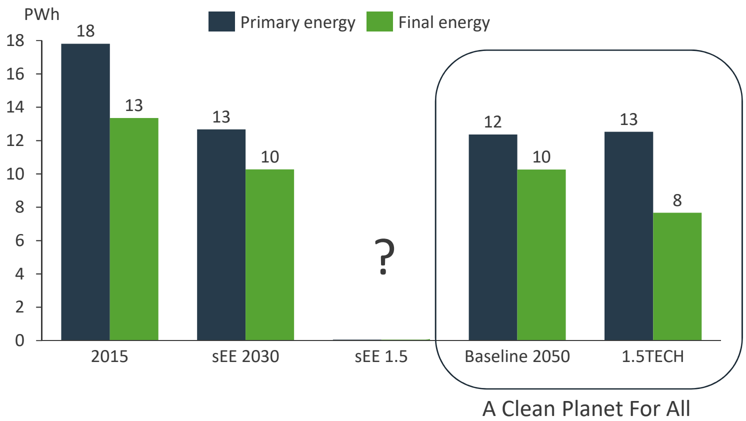
❖ The EnergyPLAN tool was used to analyse the energy system performance of each country hour-by-hour over one year



❖ Energy system performance was assessed based on
  - ❖Socio-economic cost of the energy system
  - ❖Renewable electricity capacity
  - ❖Level of electricity exchange with surrounding countries
  - ❖Balancing district heat production and demand
  - ❖Biomass consumption

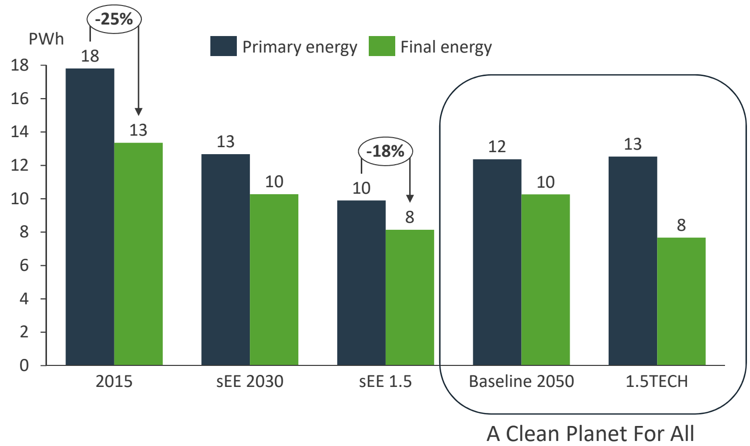


sEEnergies results



Primary and final energy comparison

- Similar final energy as 1.5TECH
- 1.5TECH has a higher primary energy
- Compared to today there is a smaller difference between primary energy and final energy



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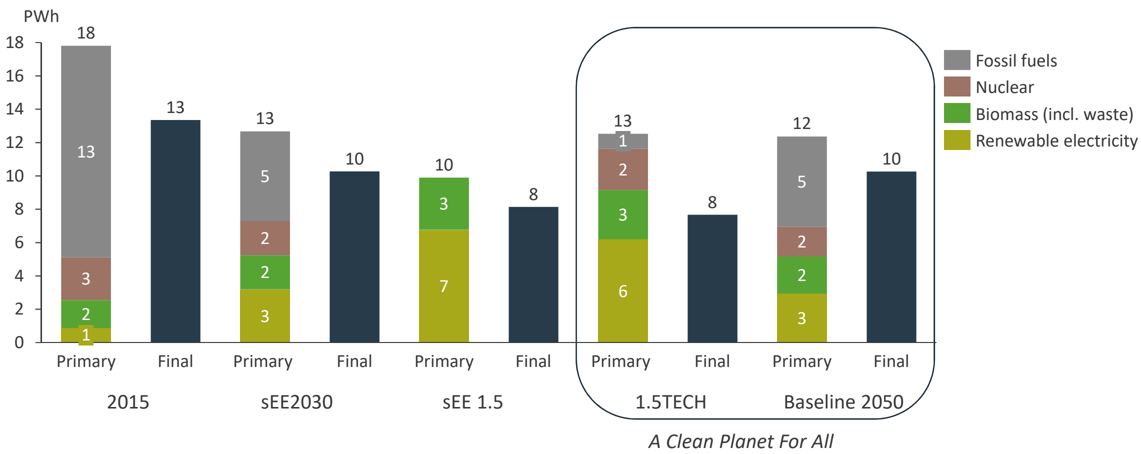
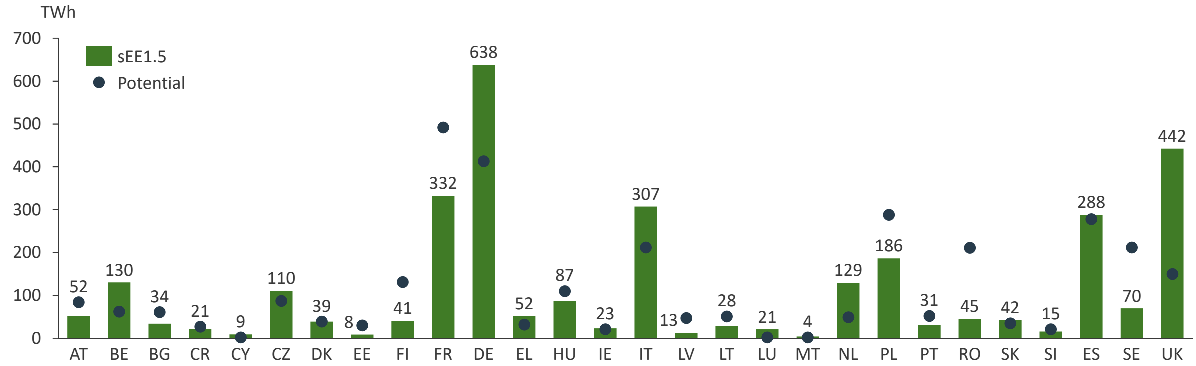


Bioenergy demand and potential in each country

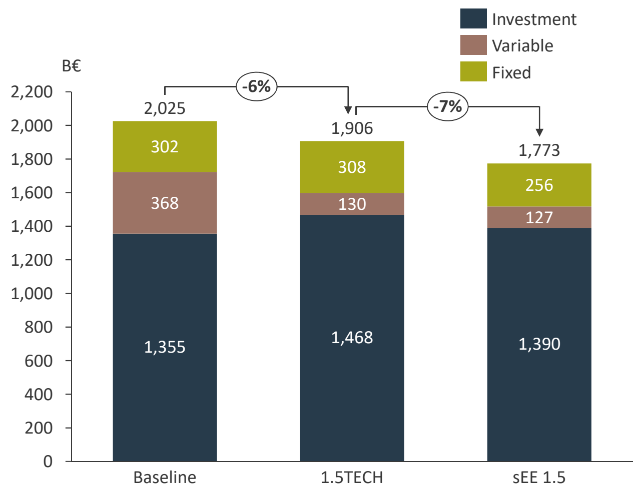


❖ sEE1.5 is within limit of the reference biomass potential from the JRC ENSPRESO (2019) project ≈ 3200 TWh biomass feedstock

Annualised costs

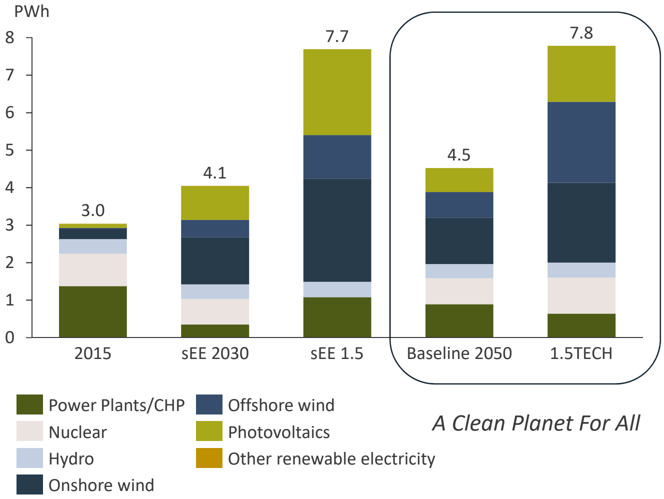
❖sEE1.5 is more cost effective compared to 1.5TECH

❖ In the heating sector sEE1.5 has less energy savings and better synergies due to district heat and use of excess heat



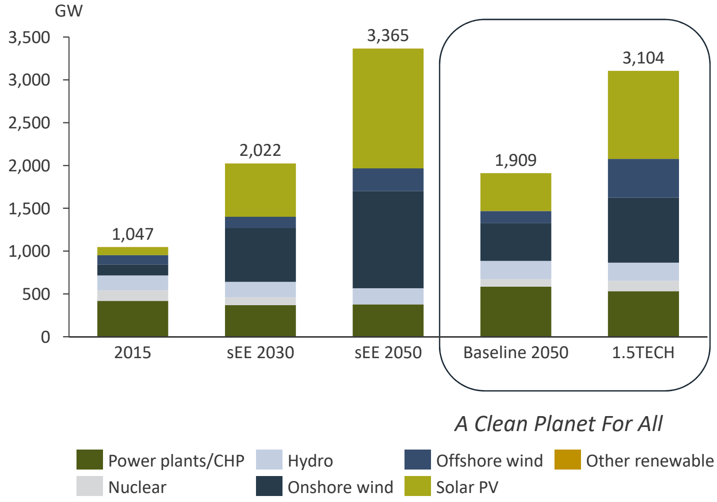
Electricity production

- ❖ No nuclear therefore larger share of PV and onshore wind
- ❖ Less offshore due the potentials shown in each country
- ❖ Cheaper energy system due to more onshore wind and PV

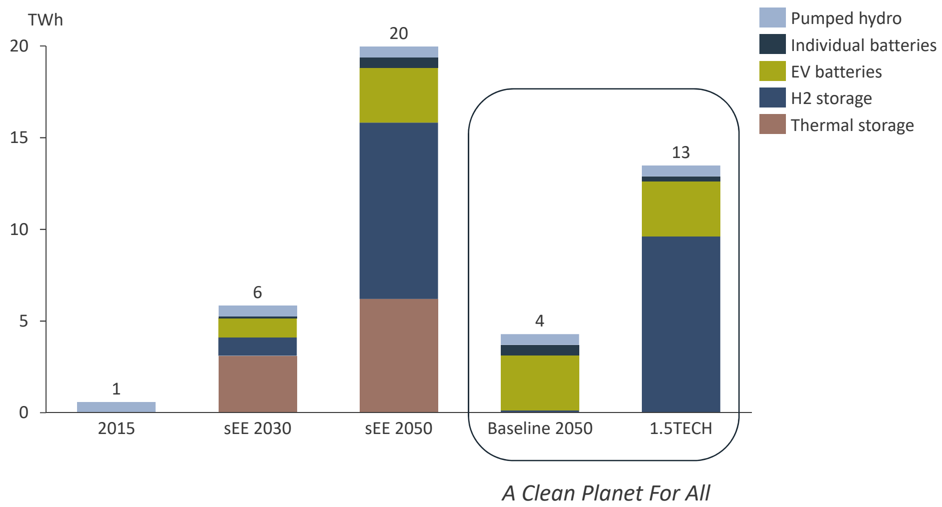


Electricity capacities

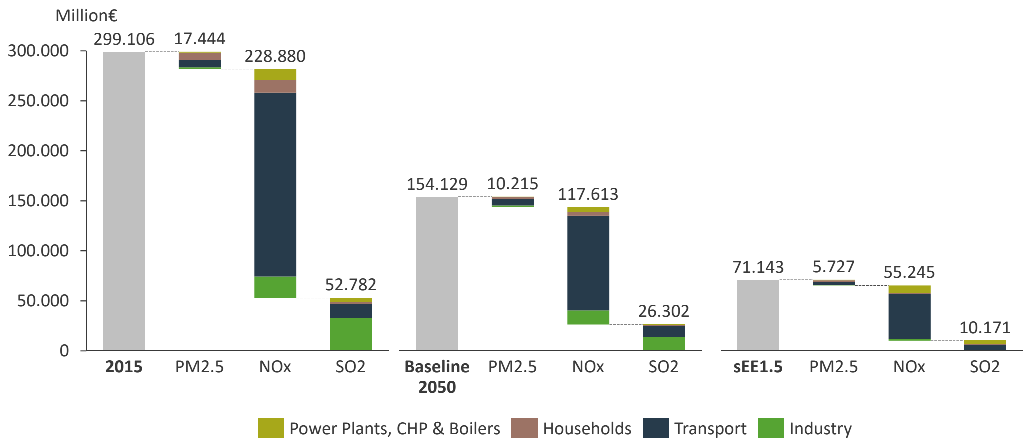
- ❖ No nuclear therefore larger share of PV and onshore wind
- ❖ Less offshore due the potentials shown in each country
- ❖ Cheaper energy system due to more onshore wind and PV



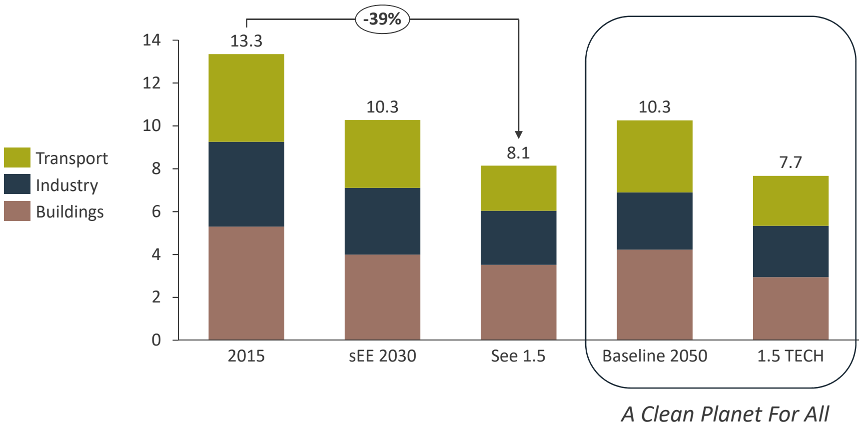
Energy storage



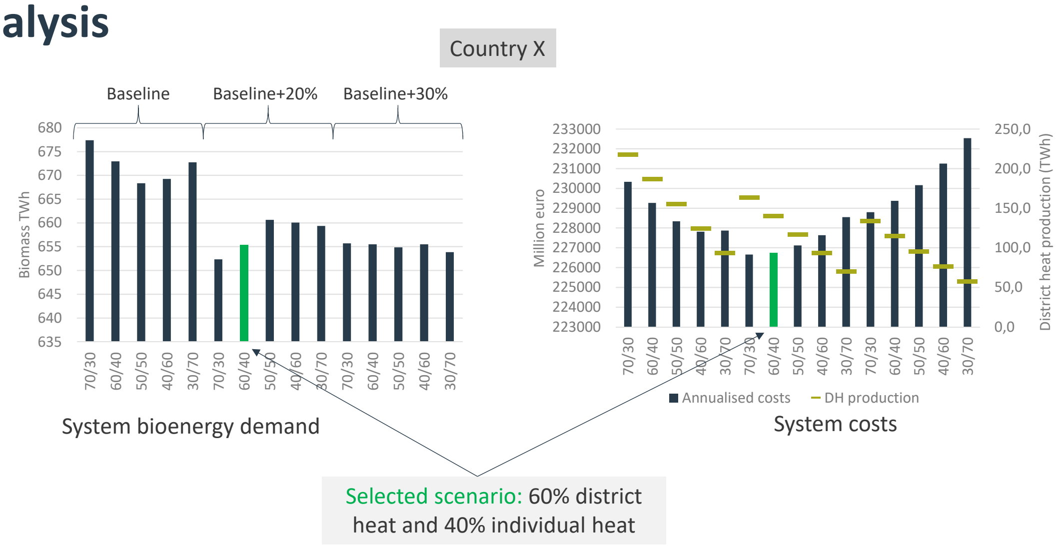
Aggregated Health Cost per Pollutant and Sector



Final energy demand in the sectors



Heating supply in buildings based on scenario analysis



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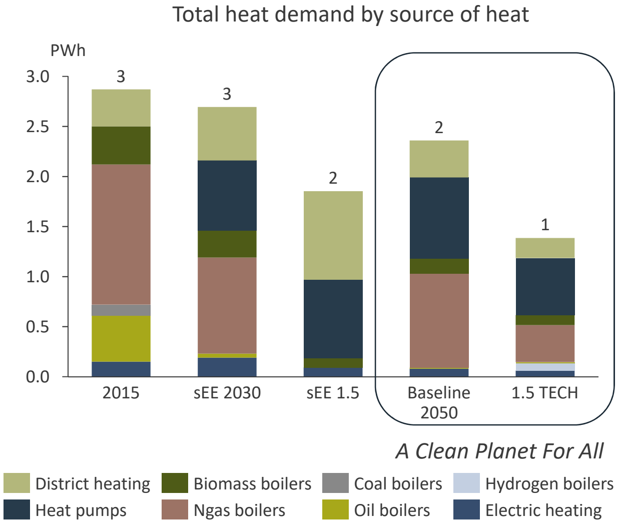
Heating supply

❖Heat demand in existing buildings should be reduced by approximately 40%

❖ If 50% of heat is supplied with district heating significant amount of excess heat can be integrated

❖ Total excess + low temp heat utilised: 630 TWh or about 1/2 of the total production



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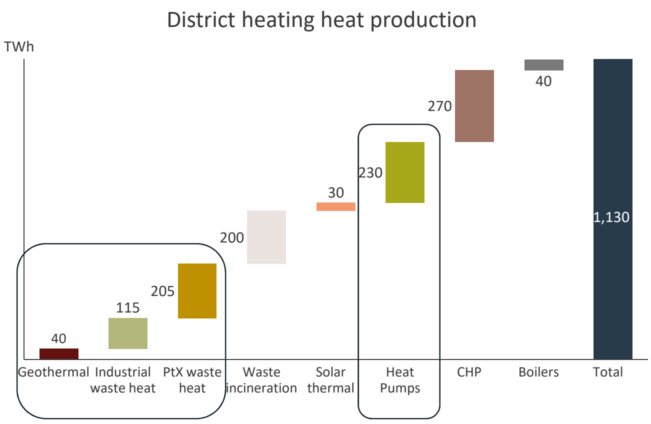
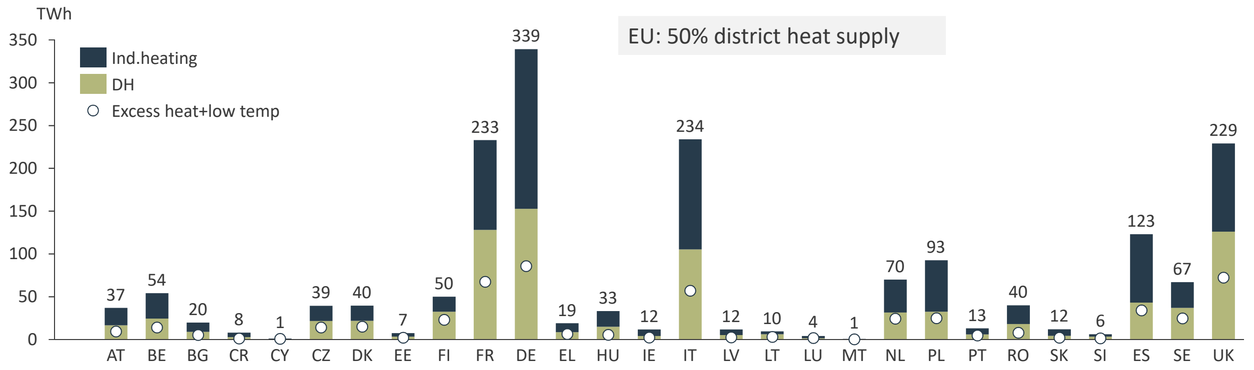
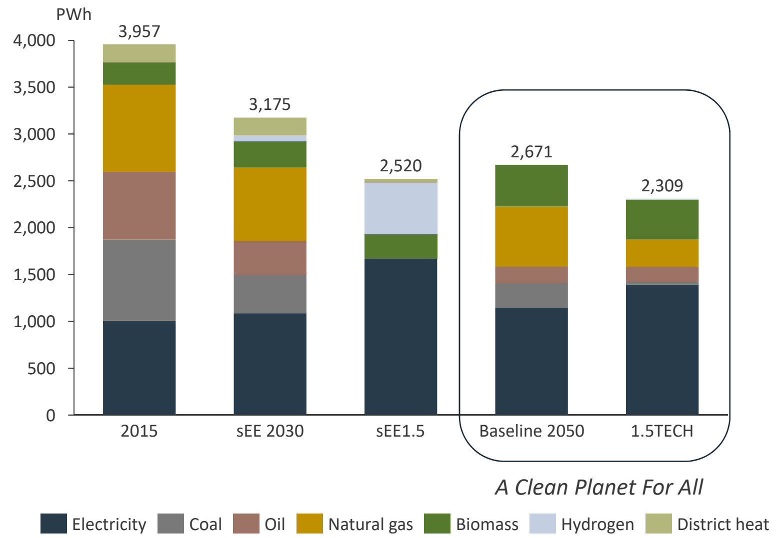


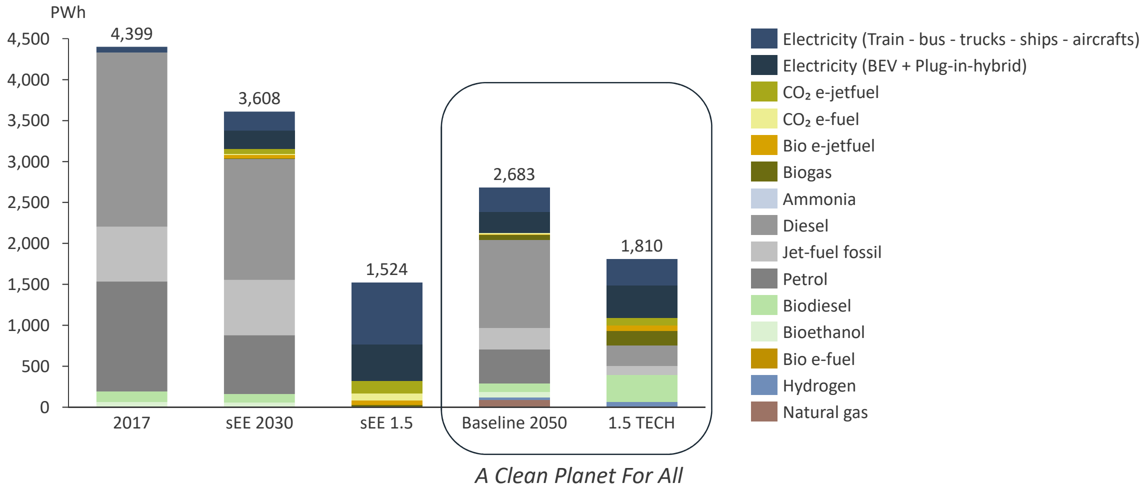
Heat supply in different countries



Industry final energy demand



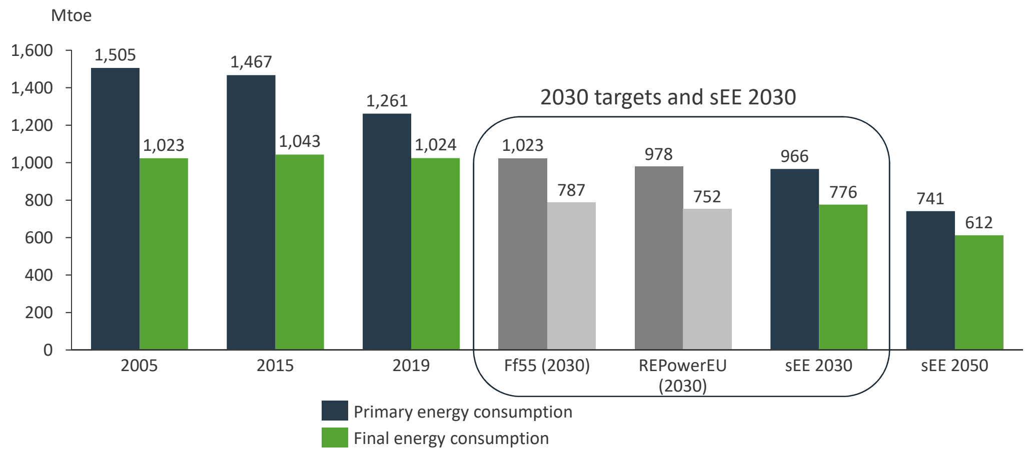
Transport final energy demand



Policy analysis: Backcasting to 2030

52 transition curves in total

Primary and final energy consumption EU27



Conclusions about sEE1.5 2050

- We developed bottom-up country level analysis with high level resolution on each energy sector
- The impact of energy efficiency measures at sector and system level show similar results but deeper understanding of the supply-side is gained through system analysis
- Compared with 1.5TECH, the sEE 2050 energy system has better energy and cost efficiency with similar biomass demands
- We must focus on making the transport sector more energy efficient by urban densification, investing in better transport infrastructure
- In transport its most beneficial to implement the highest level of electrification including e-roads
- In industry its most beneficial to implement highest level of BAT and innovative energy efficiency measures and electrification
- Moderate heat demand savings are required in existing buildings reduced by approximately 40% by 2050
- Large share of district heating is required with waste heat integration and heat pumps

Thank you

Energy Efficiency First SUMMIT, 31 May 2022

Brian Vad Mathiesen, David Maya-Drysdale, Aalborg University