

Joint Programme on Energy System Integration (ESI)

CITIES, Copenhagen
26th May, 2015

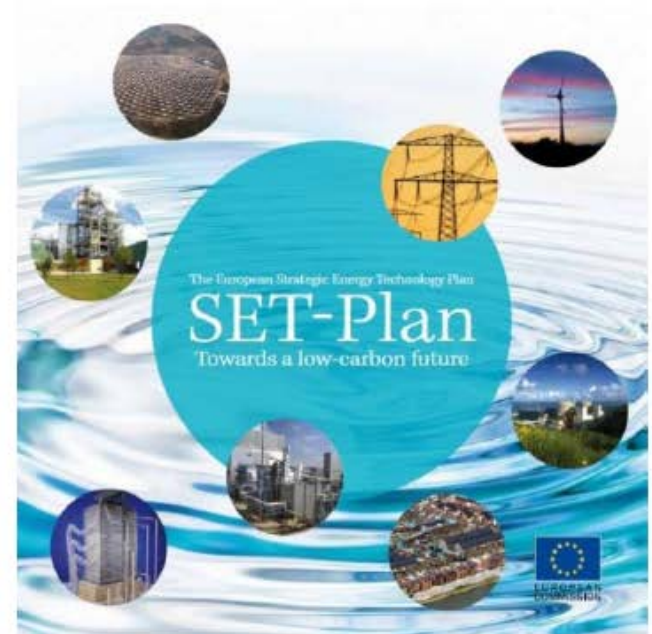
www.eera-set.eu



EERA is an official part of
the EU SET-Plan.

<http://setis.ec.europa.eu/>

- A public research alliance
- A cornerstone of the Strategic Energy Technology Plan (SET-Plan)
- Bringing together 250 research organisations
- Working together in 15 Joint Programmes
- Collaborating with European Industry
- With global outreach
- And aligning national research



JPs launched in 2010

- Bioenergy ≈ 327*
- CCS ≈ 361*
- Geothermal ≈ 408*
- Mat. For Nucl. ≈ 198*
- Wind Energy ≈ 162*
- Smart Grids ≈ 144*
- PV ≈ 162*

JPs launched in 2013

- Environmental, economic and social impact "E3S" ≈ 194*
- Shale gas ≈ 181*

JPs launched in 2011

- AMPEA ≈ 522*
- CSP ≈ 132*
- Energy Storage ≈ 430*
- FC&H2 ≈ 160*
- Ocean Energy ≈ 45*
- Smart Cities ≈ 212*

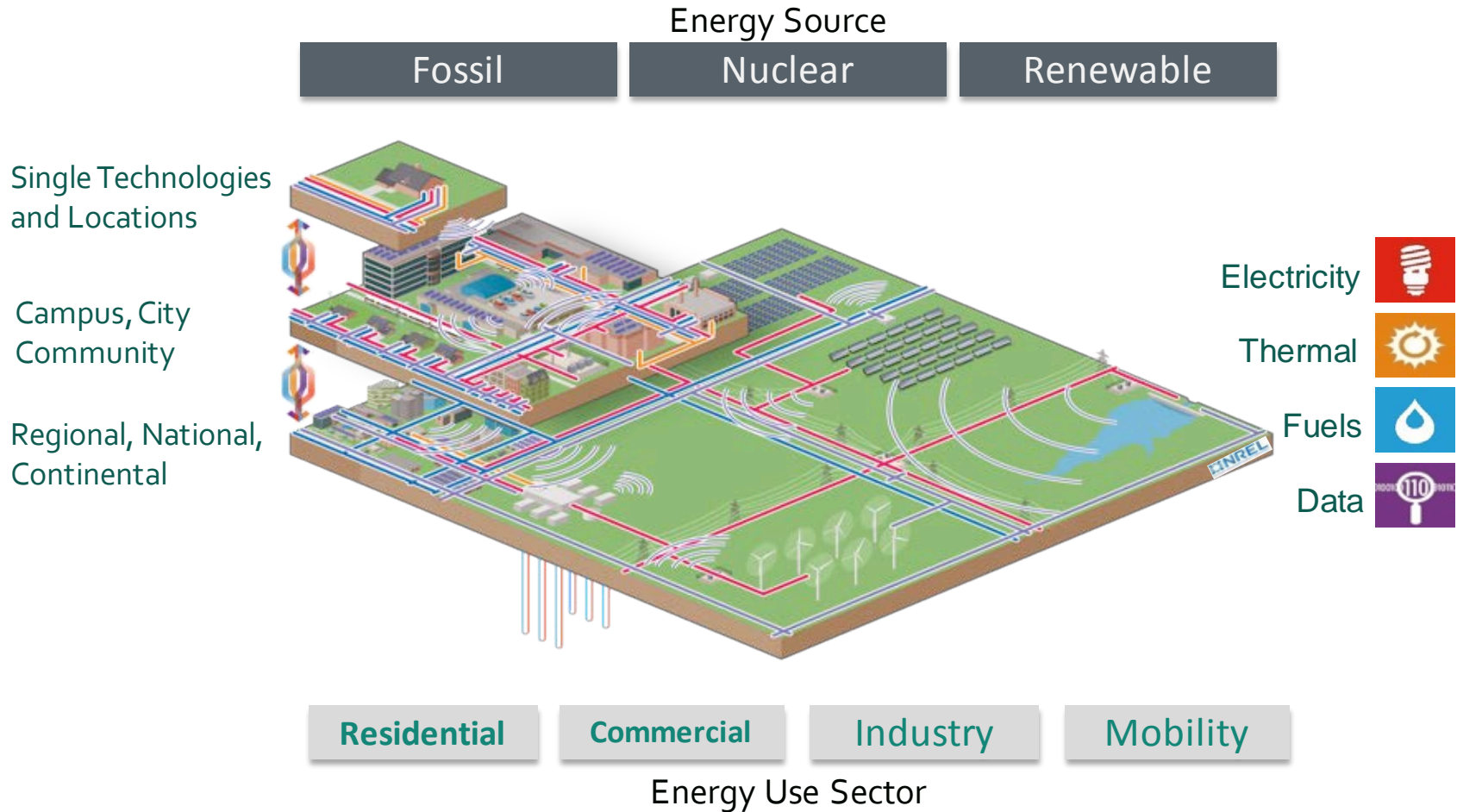
JPs under development

- Energy Efficiency in Industrial Processes
- Energy Systems Integration

*FTEs (Full-time equivalent)

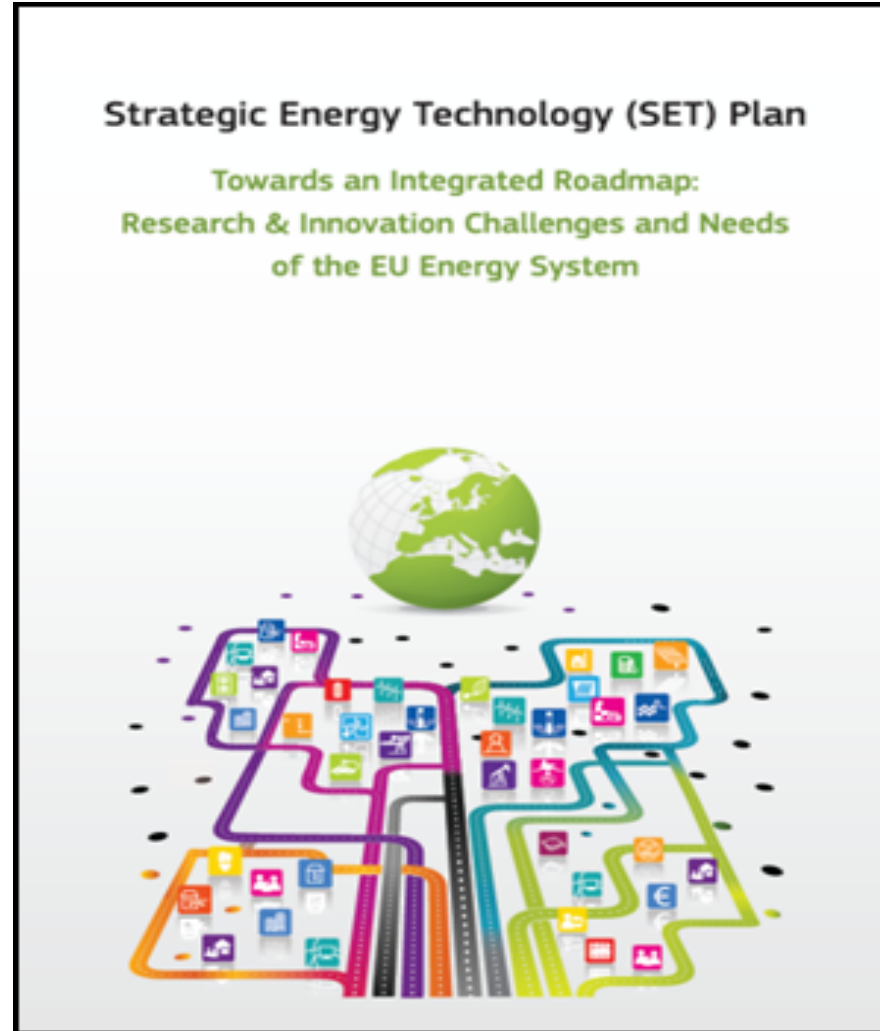
WHAT IS ESI

Optimizes the integrated suite of electrical, thermal, and fuels pathways at all scales



focused on the interfaces where the coupling and interactions are strong and represent a challenge and/or an opportunity.

WHY A JP ON ESI ?



WHY JP ESI

An imperative for innovation

Transforming these substantial changes to the energy system in the medium to long term into an economic and industrial opportunity for Europe will not happen without further development and rollout of new solutions. Innovation is needed to further reduce primary energy demand, diversify and consolidate supply options (both external and indigenous) compatible with Member States energy mix choices, and to develop a flexible and integrated energy system, from energy supply to energy networks and demand. In addition, technological progress should be accompanied by the appearance of innovative business models and schemes that guarantee a fair reward of the services ensuring the adequate functioning of the system.

WHY JP ESI

associated uncertainties. Their combination allows the development of **integrated solutions** across the entire energy system, while allowing business initiatives to shape them according to evolving market conditions.

In the last decade, the European energy policy has made considerable progress towards creating an **integrated and liberalised internal market for both electricity and gas.** The liberalisation of the market

Heating and cooling systems should progressively **integrate and optimise various distributed low GHG emitting, efficient supply sources with flexible demand.** R&I actions are therefore needed to develop and

MAIN AIM OF JP ESI

The overall aim of the Joint Programme (JP) in Energy Systems Integration (ESI) is to **develop the technical and economical tool box that government and industries will need to build the future efficient and sustainable European energy system** . As such it seeks to **optimize the energy system by leveraging the synergies between electricity, gas, heat, and fuel pathways at all scales**. The energy elements of the **water and transport** system are also included in ESI as is the enabling data and control network that enables the optimization. The control variables in this problem are **technical, economic and regulatory**.

ADDED VALUE OF JP ESI

- Coordination and collaboration among more than 15 **European research centres from 10 different countries** in activities related to ESI

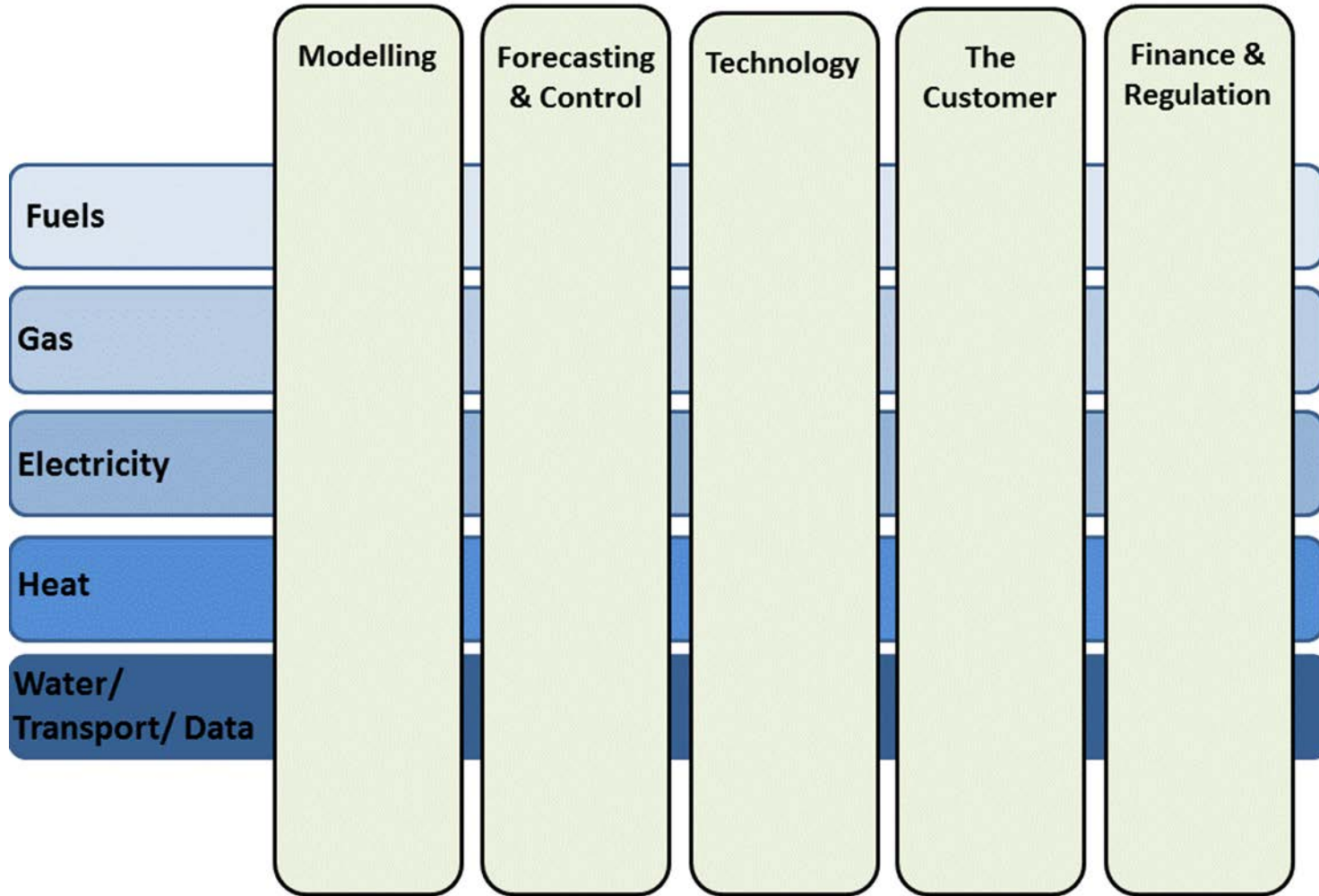
- **Metrics of success**
 - Increased efficiency of the energy system
 - Increased resilience of the energy system
 - Reduced cost
 - Reduced CO2 emissions
 - etc.

- Creation of a new generation of **high skilled professionals** in very relevant domains close to the industrial needs

JP ESI Progress So far

- Dec 2013 – Vienna – Workshop
- Communication with other interested parties
 - Calls with other JPs
- October 13th, 2014, Awareness meeting, Brussels,
- Questionnaire circulated
 - Responses analysed
- March, 5th, 2015, Description of Work Preparation, Brussels
- May 11th, 2015, Description of Work Preparation, Brussels
- June 24/25, EERA ExCo meeting, Amsterdam

Proposed Description of Work



SP1 Modelling

Drafting Team: Juha Kiviluoma, VTT; Pierliigi Mancarella, UOM; Goran Strbac, Imperial

■ **Primary Aim:** To improve understanding of modelling of the interactions between energy sectors at different temporal and geographical scales.

■ **Structure:**

- WP 1: Modelling of integrated energy systems
- WP 2: Modelling resilience in integrated energy systems
- WP 3: Interaction between local energy system models and regional energy system models

SP2 AGGREGATION, FORECASTING & CONTROL

Drafting Team: Reinhard Mackensen, Fraunhofer IWES; Henrik Madsen, DTU

■ **Goal:** devise appropriate aggregation, forecasting and control paradigms across the energy system that will help plan and operate an integrated energy system in an optimal manner.

■ **Structure:**

- WP 1: Meteorology for integrated energy systems
- WP 2: Forecasting as an input for operating the ESI
- WP 3: Aggregation
- WP 4: Control
- WP 5: Optimization
- WP 6: Systems modelling and hierarchical implementations
- WP 7: System requirements

SP3 TECHNOLOGY

Drafting Team: Peter.Breuhau, IRIS; William D'haeseleer, KU Leuven

- **Goal:** providing the necessary scientific basis for energy harvesting, conversion and enabling technologies, i.e. via their **characteristics** (such as dynamic behaviour, interfaces, costs etc.,) for transformation/transition towards a reliable and closely integrated energy system with an increasingly high share of renewable energy sources.

- **Structure:**
 - WP 1: Status and impact evaluation of technologies
 - WP 2: Prioritisation of technologies with highest level of interaction
 - WP 3: Cross sector and cross carrier technologies
 - WP 4: Concepts for new topologies and architecture
 - WP 5: Resilience of energy systems

SP4: CONSUMER

Drafting team: Didier Vanden Abeele, CEA; Pekka Koponen, VTT; Linda Steg, University of Groningen,

- **Primary aim:** is to examine the human dimensions and technology interface of energy system integration

- **Structure**

- WP 1: Acceptability of integrated energy solutions
- WP 2: Understanding consumer behaviour in integrated energy systems
- WP 3: Effects and acceptability of policies to promote efficient, stable and sustainable integrated energy systems

SP5: MARKETS AND REGULATION

Drafting Team: Erik Delarue, KU Leuven; Laurens De Vries, TU Delft

- **Primary Aim:** The aim is to determine a policy mix and market design that will be effective in the short term (i.e., achieve a resource-efficient operation of the integrated energy system), and sustainable in the long term, in the sense that it will achieve the long-term policy goals without requiring fundamental adjustments.

- **Structure:**
 - WP 1: Market design for a system with a high share of variable renewable energy
 - WP 2: Interaction between policy objectives
 - WP 3: Market behaviour and uncertainty

OVERLAPS WITH OTHER JPS

- JP ESI scope is horizontal
 - Overlaps are inevitable

- JP ESI to complement other JPs
 - Smart Grids, Smart Cities, E3S, Wind, Storage, etc.
 - Overlaps will scientifically strengthen other JPs

- Overlaps to be actively managed
 - Similar to other joint programmes

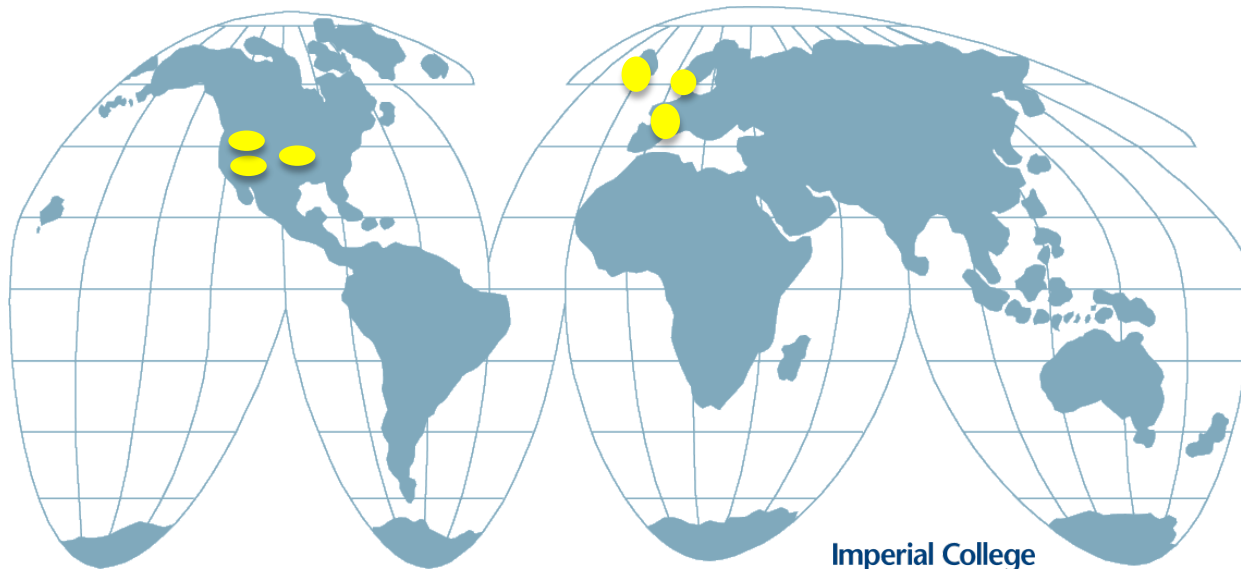
Time Line

- Final version of draft SPs – May 29th
- Circulate to all a draft – June 6th
- Full DOW by June 13th 2015
- Slides for EERA EXCO by June 17th
- To be considered by EERA EXCO on June 24/25th
Amsterdam

International activities



Addressing energy challenges through global collaboration



Imperial College
London



2015 Activities

- Research Challenges Workshop, Imperial College London, March 30/31, 2015
- ESI 101 KU Leuven & NREL, May 18 – 22 & Aug. 3 - 7.
- Workshop, Korean Energy Institute, OECD World Science and Technology Forum, OECD Ministerial Meeting, Oct. 22
- Consumer Workshop, Stanford, Nov. 2015.

Thank you for your attention!

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