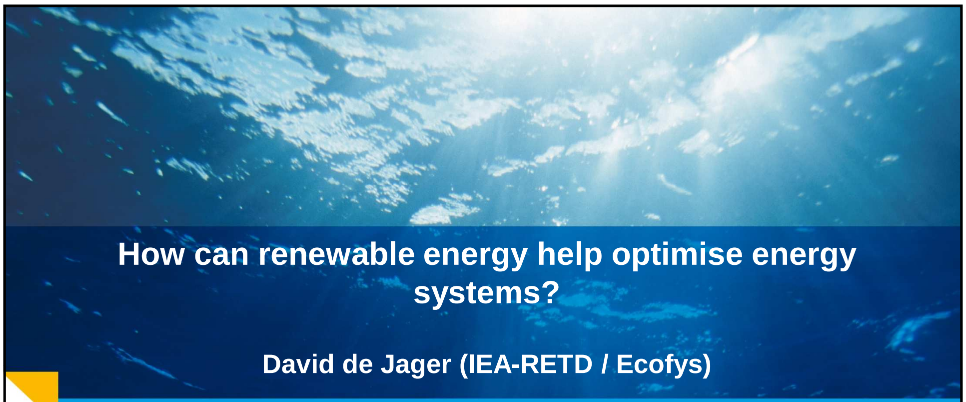

How can renewable energy help optimise energy systems?

David de Jager (IEA-RETD / Ecofys)

23rd Session of the UNECE Committee on Sustainable Energy

21 November 2014

United Nations, Palais des Nations, Geneva

IEA - RENEWABLE ENERGY TECHNOLOGY DEPLOYMENT

IEA-RETD

The mission of IEA-RETD is to accelerate the large-scale deployment of renewable energies

RETD stands for "Renewable Energy Technology Deployment"

IEA-RETD provides a **policy-focused, technology cross-cutting platform** ("Implementing Agreement") under the legal framework of the International Energy Agency

- Created in 2005, currently (2015) **9 member countries**: Canada, Denmark, the European Commission, France, Germany, Ireland, Japan, Norway, UK
- IEA-RETD commissions annually **5-7 studies** bringing together the experience of some of the world's leading countries in RE with the expertise of renowned consulting firms and academia
- Reports and handbooks are freely available at www.iea-retd.org
- IEA-RETD organizes **workshops** and presents at international events

Agenda

- Elements for a sustainable future energy system
- Implementing renewable energy – the 'right' way
- The role of gas in the uptake of renewable energy?

Agenda

- Elements for a sustainable future energy system
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Implementing renewable energy – the 'right' way

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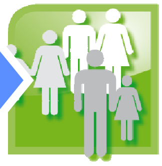
Reversing the energy supply chain

Traditionally: supply oriented approach

System efficiency of only 2-5%



Paradigm shift: start with (people) needs

ECOFYS

Elements for a sustainable future energy system

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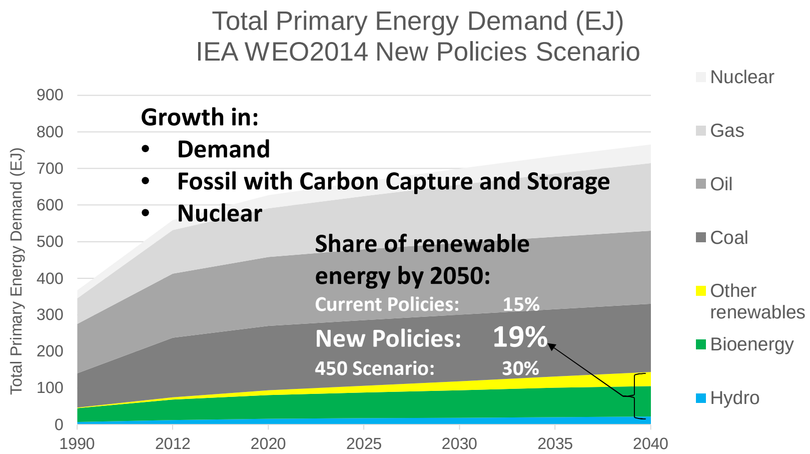
Towards large-scale renewable energy deployment in 2050?



Source: IEA WEO2014

Elements for a sustainable future energy system

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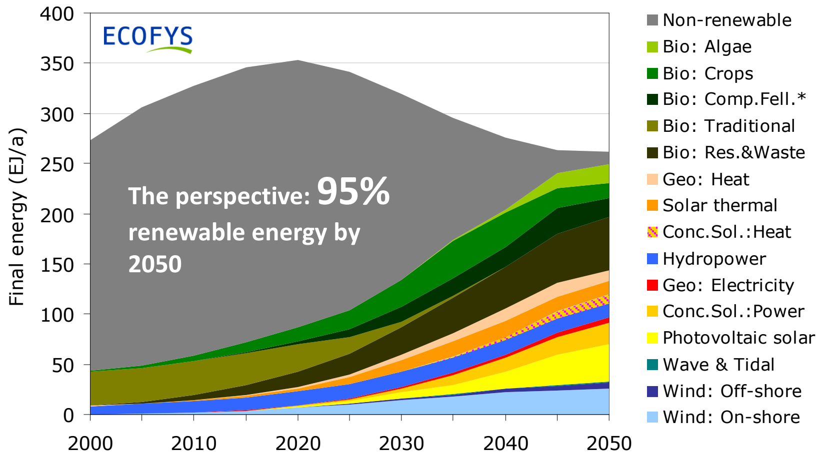
Towards large-scale renewable energy deployment in 2050?



Source: The Energy Report, WWF & Ecofys, 2011

Elements for a sustainable future energy system

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Towards large-scale renewable energy deployment in 2050?

- New energy architecture is largely based on:
  - Energy efficiency / Smart demand solutions (flexibility)
  - Electrification (more decentralised)
  - Renewable energy and other carbon-neutral technologies
  - Geographically interconnected systems
  - Interconnections / Energy trade
  - Storage solutions (also across energy carriers)
- Moderate societal cost
- Conditions:
  - buy-in to concept of sustainability and decarbonisation
  - the redirection of energy strategy

Elements for a sustainable future energy system

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Key challenges

1. **Change**
   - Getting political buy-in
   - Getting to the goal – evolution versus planning
   - Delivering energy efficiency
   - Mobilising investment
2. **Security**
   - Security of supply (Market design / Capacity mechanisms / Mandatory reserve / Storage)
   - Stability (Interlinkage of supply and demand / Different energy carriers)
3. **Costs** (private/societal cost)

Elements for a sustainable future energy system

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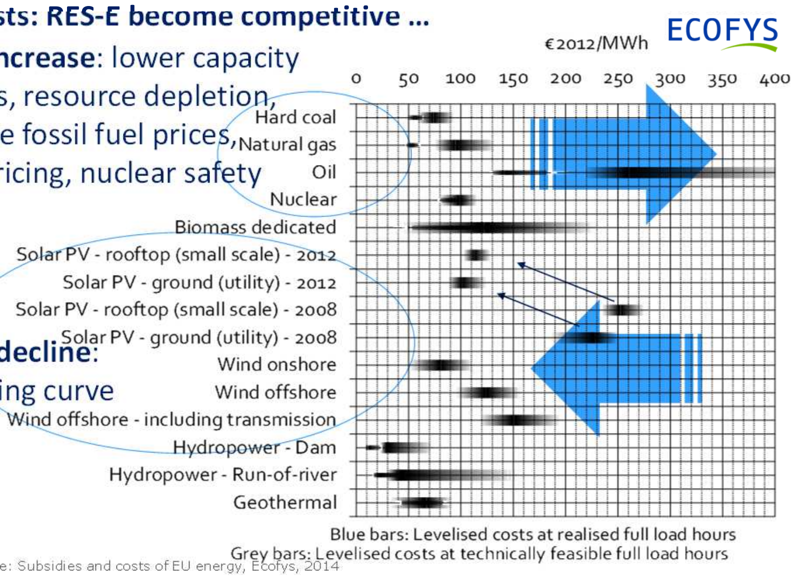
Costs: *RES-E* become competitive …

Cost increase: lower capacity factors, resource depletion, volatile fossil fuel prices, CO_2 pricing, nuclear safety

Cost decline: learning curve

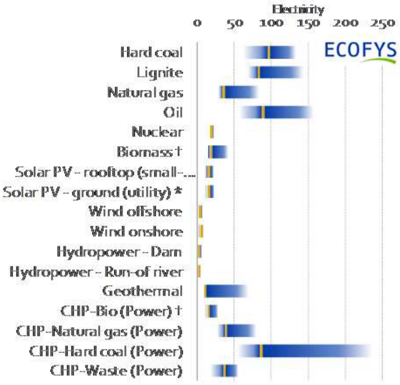


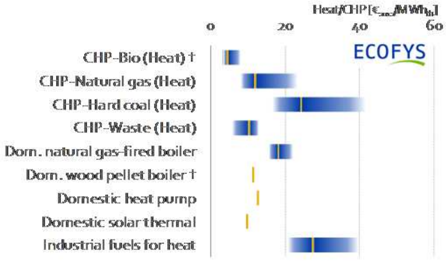
Source: Subsidies and costs of EU energy, Ecofys, 2014

Levelised costs of electricity in Europe (2012)

Elements for a sustainable future energy system

… and have significant co-benefits: lower external costs





External costs of electricity and heat supply options in Europe (2012)

… and increased security of supply

Source: Subsidies and costs of EU energy, Ecofys, 2014

Agenda

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With a reversed energy supply chain:

- Renewable energy sources can play a major role in sustainable energy supply systems

- Key technical and institutional challenges:

  Deliver renewable energy
  in a sustainable way,
  in the right form,
  at the right place,
  at the right time,
  at the lowest system costs.

http://www.ecofys.com/en/blog/apples-to-oranges-comparing-the-costs-of-energy-technologies/

Roadmap to reach a sustainable energy system

Maximise energy efficiency to stabilise and reduce demand

Electrify to shift demand to the most abundant renewable energy sources

Prepare electricity systems for high supply-driven share

Scale up renewable power options

Supply residual fuel and heat demand with sustainable bio-energy

Make initial investments to reap net savings by 2040

Action by all stakeholders is required now to change direction

Source: The Energy Report, WWF & Ecofys, 2011

RES-E

The 'right' way – the policy perspective

More renewables, more problems?

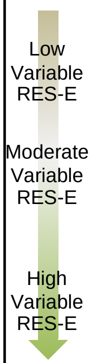
- With increasing penetration, variable RES-E integration increasingly affects power system planning and operation
  - Cost of implementation/incentives
  - Grid impacts
  - Effect of operational changes on revenue streams
  - Societal support (spatial planning)
  - Next generation RES-E policy instruments needed?
- Available strategy-sets reflect penetration levels, and grow more interdependent at high penetrations

Implementing renewable energy – the 'right' way

RES-E

Example policy evolution through stages of RES-E penetration

Securing RES-E Generation	Securing Grid Infrastructure	Short-Term Security of Supply: *Flexibility*	Long-Term Security of Supply: *Adequacy*



Source: IEA-RETD RES-E-NEXT report, 2013

Introduction and Objectives

RES-E

Example policy evolution through stages of RES-E penetration

	Securing RES-E Generation	Securing Grid Infrastructure	Short-Term Security of Supply: *Flexibility*	Long-Term Security of Supply: *Adequacy*
Low Variable RES-E	Establish basic RES-E support mechanisms (e.g., Feed-in tariffs, targets, tenders)			
Moderate Variable RES-E	Integrate RES-E into dispatch optimisation			
High Variable RES-E	Influence location of RES-E on grid to lessen distribution or bulk grid impacts Encourage RES-E production			

Source: IEA-RETD RES-E-NEXT report, 2013

RES-E

Example policy evolution through stages of RES-E penetration

	Securing RES-E Generation	Securing Grid Infrastructure	Short-Term Security of Supply: *Flexibility*	Long-Term Security of Supply: *Adequacy*
Low Variable RES-E	Establish basic RES-E support mechanisms (e.g., Feed-in tariffs, targets, tenders)	Evaluate grid infrastructure needs in light of RES-E resources		
Moderate Variable RES-E	Integrate RES-E into dispatch optimisation	Establish RES-E grid codes and designated transmission zones		
High Variable RES-E	Influence location of RES-E on grid to lessen distribution or bulk grid impacts Encourage RES-E production	Employ low-visibility transmission technologies Employ active network management		

Source: IEA-RETD RES-E-NEXT report, 2013

Introduction and Objectives

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RES-E

Example policy evolution through stages of RES-E penetration

	Securing RES-E Generation	Securing Grid Infrastructure	Short-Term Security of Supply: *Flexibility*	Long-Term Security of Supply: *Adequacy*
Low Variable RES-E	Establish basic RES-E support mechanisms (e.g., Feed-in tariffs, targets, tenders)	Evaluate grid infrastructure needs in light of RES-E resources	Evaluate system flexibility levels; determine binding flexibility constraints	Evaluate functioning of adequacy mechanisms
Moderate Variable RES-E	Integrate RES-E into dispatch optimisation	Establish RES-E grid codes and designated transmission zones	Improve forecasting Broaden balancing-area footprints	Initiate capacity-adequacy studies
High Variable RES-E	Influence location of RES-E on grid to lessen distribution or bulk grid impacts Encourage RES-E production ⇔	Employ low-visibility transmission technologies Employ active network management ⇔	Employ advanced system operation (e.g., advanced unit comfvise storage and/or additional flexible generation) ⇔	Improve adequacy mechanism in accordance with predominant paradigm

Source: IEA-RETD RES-E-NEXT report, 2013

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Implementing renewable energy – the 'right' way

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RES-E

Next generation policies can meet these challenges

1. Maintain **investment certainty** for RES-E and **minimise the cost** of incentives (**"cost aware"**)
   - e.g., FiTs with flexible adjustment, tenders
2. Encourage positive interplay with markets (**"market aware"**)
   - e.g., proactive consideration of revenue impacts of curtailment practices and energy imbalance penalties
3. Respond proactively to changing grid needs (**"grid aware"**)
   - e.g., linking price supports to requirements for RES-E to provide grid support services

Source: IEA-RETD RES-E-NEXT report, 2013

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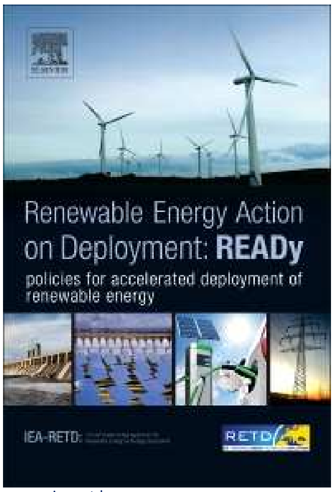
IEA-RETD ACTION Star

Policies for accelerated deployment of renewables



ACTION

IEA-RETD ACTION Star

Alliance building	Build alliances and reach agreements among policy makers and with relevant stakeholders including industry members, consumers, investors, and others.
Communicating	Communicate knowledge about renewable energy resources, technologies and issues to create awareness on all levels, and to address concerns of stakeholders.
Target setting	Clarify goals, set ambitious targets at all levels of government and enact policies to achieve them.
Integrating	Integrate renewables into policymaking and take advantage of synergies with energy efficiency.
Optimizing	Optimize policies by building on own policies or other proven policy mechanisms and adapting them to specific circumstances.
Neutralizing	Neutralize disadvantages in the marketplace, such as misconceptions of costs and the lack of a level playing field.

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The role of gas in the uptake of renewable energy

Gas will be a crucial element of the architecture

Gas has clear benefits:

- High exergy potential
- Storage medium
- Potentially lower to near-zero CO_2-emissions (with CCS)

However:

- But not necessarily **natural gas**
  - Biogas
  - Syngas
  - Hydrogen
- Natural gas can support the new energy architecture
  - Balancing power
  - Gas infrastructure
- Demand for heating will decrease (electricity / heat pumps)
- Position of gas on electricity market

…

For additional information on IEA-RETD

Online: www.iea-retd.org
Contact: info@iea-retd.org

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