

Parallel Session 1-1

Innovative solutions to respond to the needs of the power system

LCS R Net 6th Annual Meeting
Rome, 1st – 2nd October 2014

Power sector – core of decarbonisation

IEA's 2014 Energy technology perspectives: Harnessing electricity's potential

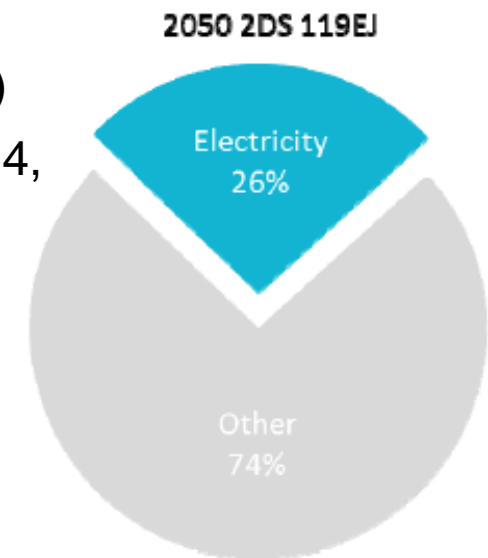
- Electricity sector is leading in decarbonisation
- Electricity sector is bound to „export“ emission reductions via higher shares in final energy demand
- This means integration of high shares of fluctuating renewable energies which has significant impacts
 - For the electricity system
 - For electricity markets



The electricity sector

Core developments

- Double demand increase
 - In traditional uses (China – India)
 - In new uses such as heating of buildings, transport, industry
- This leads to increasing shares in growing global energy demand by 2050
 - 17 % → 26% of global final energy use (ETP 2014, 2DS)
 - 66 EJ → 119 EJ // 52 % of primary energy use (ETP 2014, 2DS)
- Supply switches from fossil to RES
 - Fossil generation decreases from 68 to 20%
 - RES increase from 20 to 65% (with more than 20% fluctuating)



The challenge

Electrification of energy demand

- Supply of low temperature heat by direct RES or with (electric) heat pumps
- E-mobility and use of „electro-fuels“
- Electrifying basic materials industry?
 - By electric processes (heat, electro-chemistry, hydrogen for steel making ...)
 - Using electro based feedstocks



Recent study:

Germany 2050 a GHG neutral country

- A very far reaching vision to decarbonise an industrial country
- RES Electricity supplies almost all energy
 - Directly as 35% of final energy supply
 - Indirectly via electrolysis to H₂, CH₄, fuels (-> high conversion losses)
- Up to 5 times today's electricity demand needed
- Reversed cost structure of the system:
 - Methane and fuels become more expensive than electricity
 - Priority for electrification



Power system

Six challenges

1. Phasing in RES and simulatenously phasing out fossils
2. Integrating fluctuating RES into the electricity system
3. Integrating other low carbon generation options?
4. Dealing with increasing shares of low/zero marginal cost generation options
5. Saving electricity while electrifying larger parts of the energy system
6. Converting electricity to RES methane and fuels?

Overview

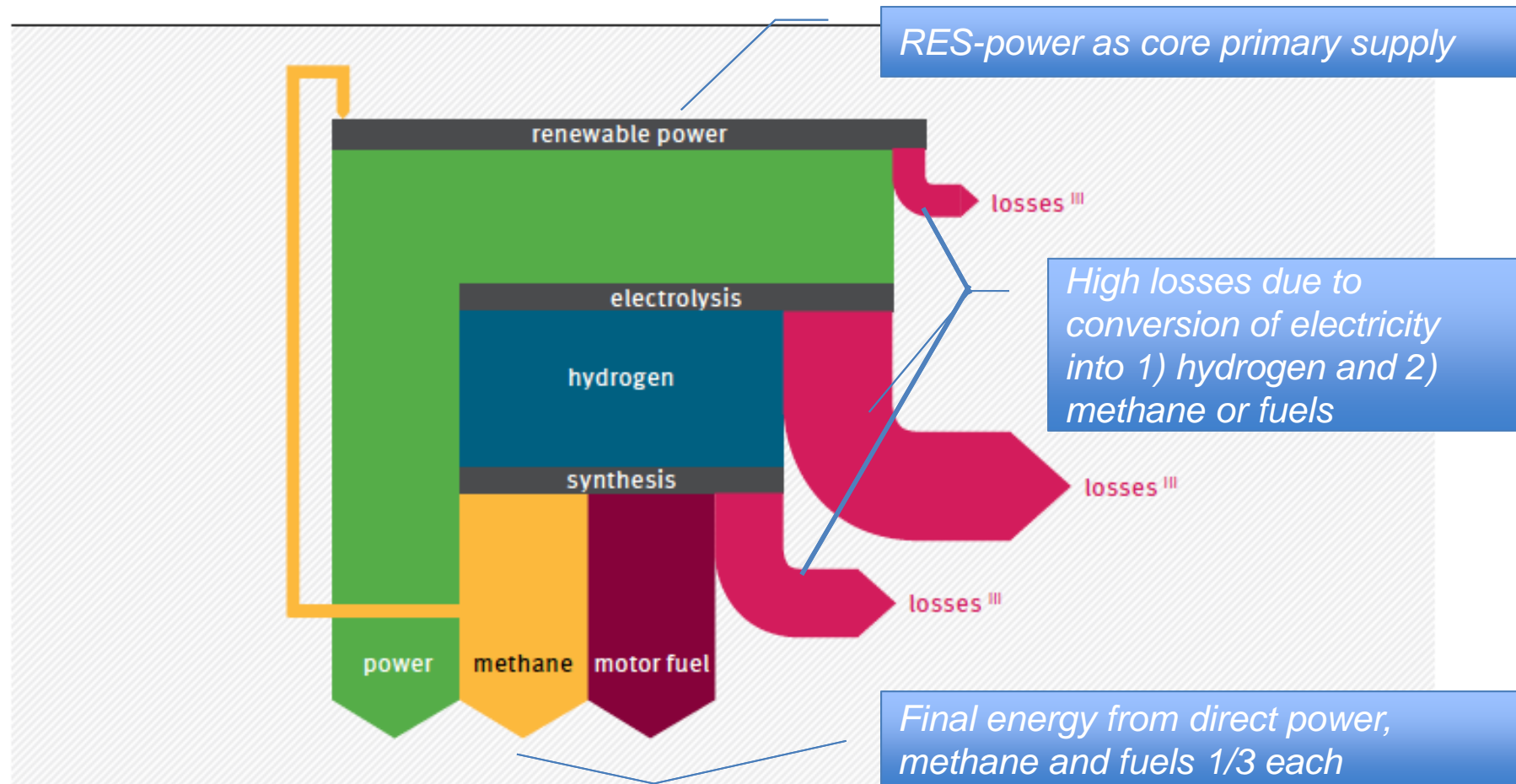
- Power system – a core to deep decarbonisation

- Topics of the presentations
 - **Hans-Martin Henning, ISE, Freiburg:** Integration of renewables and energy efficiency solutions.
 - **Paolo Deiana, ENEA, Italy:** Enabling decarbonisation of the fossil fuel based power sector through CCS.
 - **Christine Krüger, Wuppertal Institute :** Improvements of Electric and Thermal Energy Storage.

How is the (fully renewable) final energy supplied?

Supply fully based on RES electricity

Qualitative representation of the energy flow in the UBA THGND 2050 Scenario^{I,II}



I Including demand for renewable inputs for the chemical industry.

II Representations of energy flows are proportional to the energy flows required.

III Including line losses, losses from reconverting methane into power and losses from converting biomass into power

Source: Umweltbundesamt