

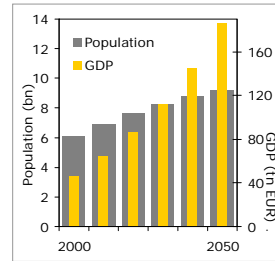
## The Energy Report

Transition to a fully sustainable global energy system by 2050

Kees van der Leun  
cRRescendo conferRence  
Almere, 13 October 2011

### What's the issue?

#### a. growing demand for energy



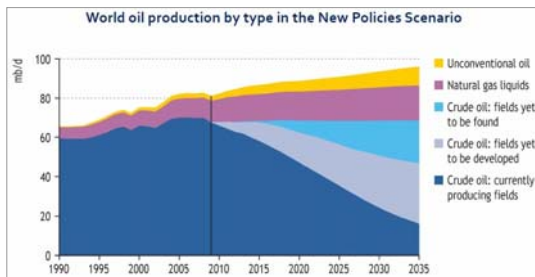
From 2010 to 2050:

- Population +33%
- World economy (GDP): +200%
- Demand for energy services (industry, buildings, transportation) roughly in line with GDP growth

Source: The Energy Report, WWF & Ecofys, 2011

### What's the issue?

#### b. fossil fuel supplies tight

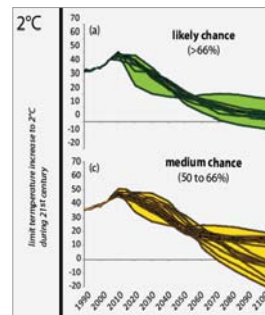


→ Strong price increases to be expected

Source: IEA World Energy Outlook, 2010

### What's the issue?

#### c. CO<sub>2</sub>-emissions must be reduced



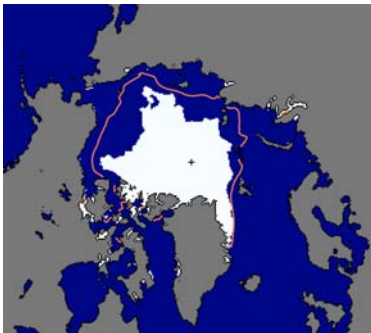
Scenarios that give the world a chance to stay below 2°C have:

- Emissions peak before 2020
- Emissions 60-70% lower than now by 2050

Hardly any scenarios exist with a change of staying below 1.5°C

Source: UNEP, The Emissions Gap Report

### Arctic Sea Ice, 10-09-2011





*The Energy Report - Transition to a fully sustainable global energy system by 2050*

## Key question

**Is  
a fully sustainable  
global energy system  
possible by 2050 ?**

ECOFYS

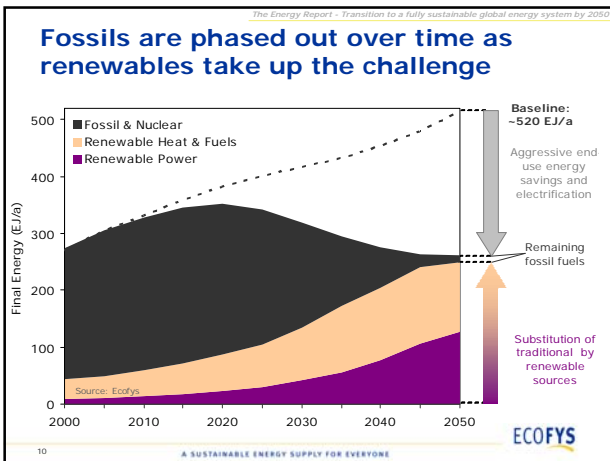
*The Energy Report - Transition to a fully sustainable global energy system by 2050*

## Answer

**Yes**

*And the  
Ecofys Energy Scenario  
shows how it can be done..*

ECOFYS



*The Energy Report - Transition to a fully sustainable global energy system by 2050*

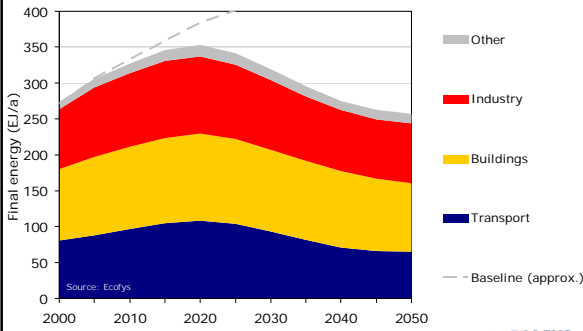
### Demand and supply are examined in 10 world regions

- Europe
- North America
- Latin America
- Russia and other Eurasia
- Middle East
- OECD Pacific
- China
- India
- Rest of Asia
- Africa

Currently, the Scenario is only valid at the global level, but future regional studies are possible

ECOFYS

## Absolute energy use can be reduced without a reduction in energy services

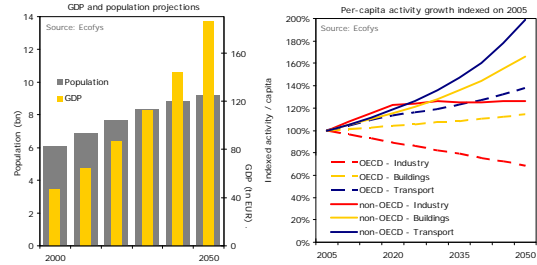


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## Activity increases, most strongly in non-OECD regions



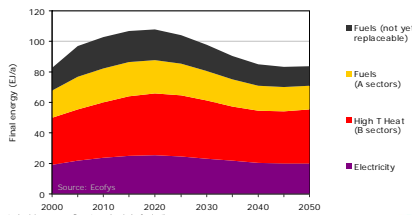
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## Reduced demand for raw materials and increased efficiency are key in industry

- Material efficiency
- Shift to current most efficient technologies
- Alternative production pathways and recycling



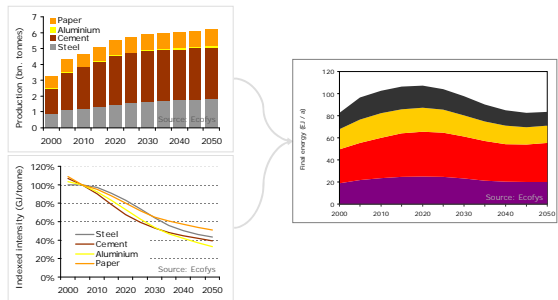
A sectors = steel, cement, aluminium, paper; B sectors: chemicals, food, other

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## Stabilisation in energy demand in industry through ambitious energy efficiency improvements



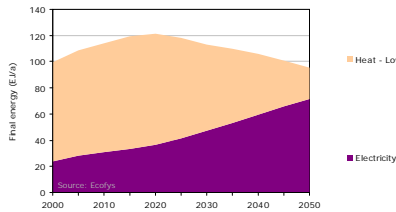
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## Buildings: strongly reduce heat demand, increase electrification

- Heating & Cooling
- New buildings: **near-zero energy use**
  - Existing buildings: **retrofitted** at an ambitious rate
  - Cooling: provided with renewable / local cooling solutions
- Local solutions
- Solar water heating systems will provide half of all water needs
  - Electric **heat pumps** will replace fuel use with renewable electricity

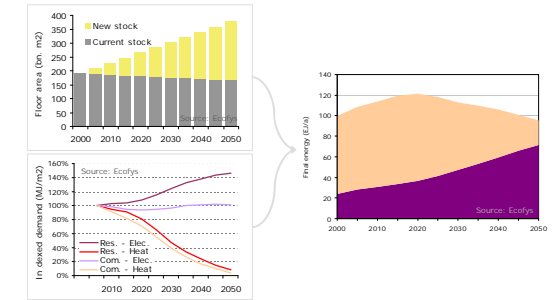


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## Stabilisation in buildings results from ambitious energy efficiency improvements



Floor area and specific energy use are shown for Residential sector only for illustrative purposes.

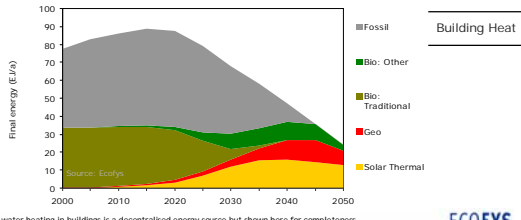
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## Renewables can provide all building heat needs

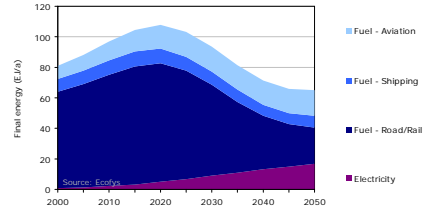
- Space heating from:
  - Decentralised solar heating and
  - Centralised or district-level renewable sources: geothermal, bioenergy



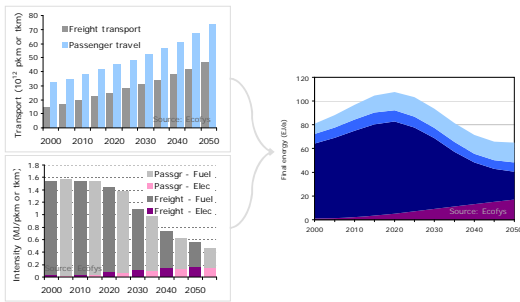
\*Solar water heating in buildings is a decentralised energy source but shown here for completeness

## Electrification is key to sustainability in transport

- No major reduction of **travel volume**
- Ambitious **modal shifts** towards efficient transport modes, e.g. from car to rail
- Ambitious assumptions on **efficiency** improvements in existing technologies
- Decisive shift to **electric forms of transport**
- Renewable fuels**

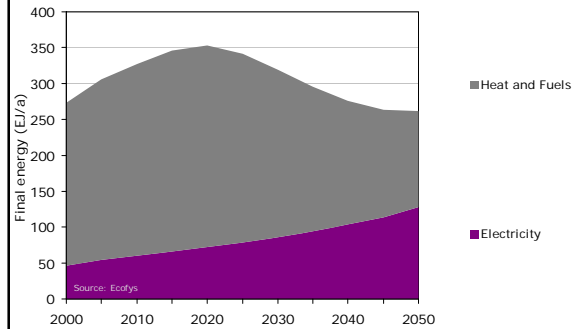


## Stabilisation in the transport sector through ambitious energy efficiency improvements



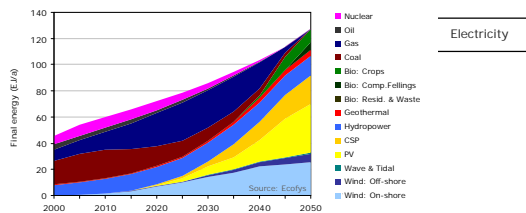
Activity graph excludes shipping. Shipping energy demand is based on GDP growth and relative efficiency savings in line with other modes.

## The ambitious electrification allows us to make maximum use of solar, wind, hydro etc.



## 100 % renewable electricity by 2050

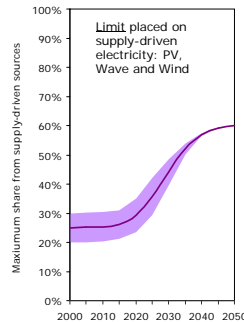
- Renewable electricity so abundant that options will compete
- Supply-driven sources limited by grid capacity in later years
- Hydro, geothermal, CSP\* and bioelectricity provide demand-driven electricity

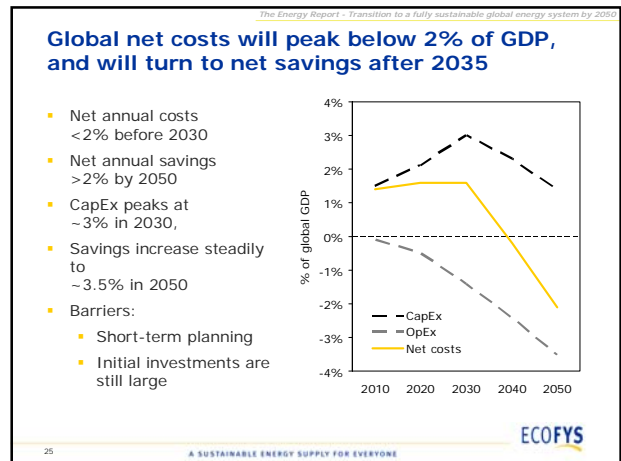
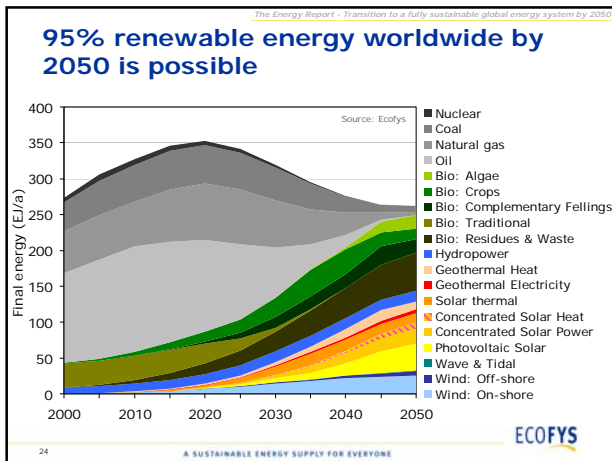


\*CSP=Concentrated Solar Power

## Electricity grids need to be upgraded and extended for maximum RES power

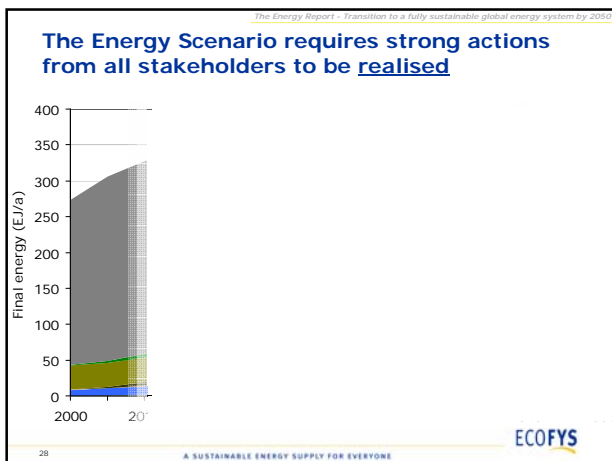
- Grids should be well-connected regionally; need to increase
  - capacity
  - range of transmission lines
- Need R&D, e.g. for better grid stability
- For ultra-high RES shares beyond 2030 require:
  - Grid improvements
  - Demand side management
  - Storage





- The Energy Report - Transition to a fully sustainable global energy system by 2050
- ### The new energy system has huge advantages
- Sustainable energy supply system is affordable based on cost of energy alone
  - Strong CO<sub>2</sub> emission reduction
    - Enough to give the world a good chance of avoiding more than 2 degrees (average) global warming
  - Environmental benefits from reducing fossil fuel use: air and water pollution
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- The Energy Report - Transition to a fully sustainable global energy system by 2050
- ### The new energy system has contingencies
- The Energy Report is based on technology available now
    - New technology becoming available in the period to 2050 will further improve the system
  - CCS was not included
    - This can further improve the emission reduction
    - Bio+CCS may be used to get CO<sub>2</sub> out of the atmosphere
  - Actual developments are often faster than we anticipated
    - For example, PV solar energy reaching cost price of € 0.10 per kWh in sunny regions now
  - Carbon costs have not been factored in
    - Accounting for savings from avoided carbon emissions would further improve the financial outcomes
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- The Energy Report - Transition to a fully sustainable global energy system by 2050
- ### Action points to reach a fully sustainable global energy system
- Maximise energy efficiency to stabilise and reduce demand
  - Electrify to shift demand to the most abundant renewable energy sources
  - Prepare electricity grids 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
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