

# Solar Hydrogen economy: benefits for the South?

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**Wolfram Krewitt, Joachim Nitsch**

German Aerospace Center (DLR)  
Institute of Technical Thermodynamics,  
System Analysis and Technology Assessment  
Stuttgart, Germany

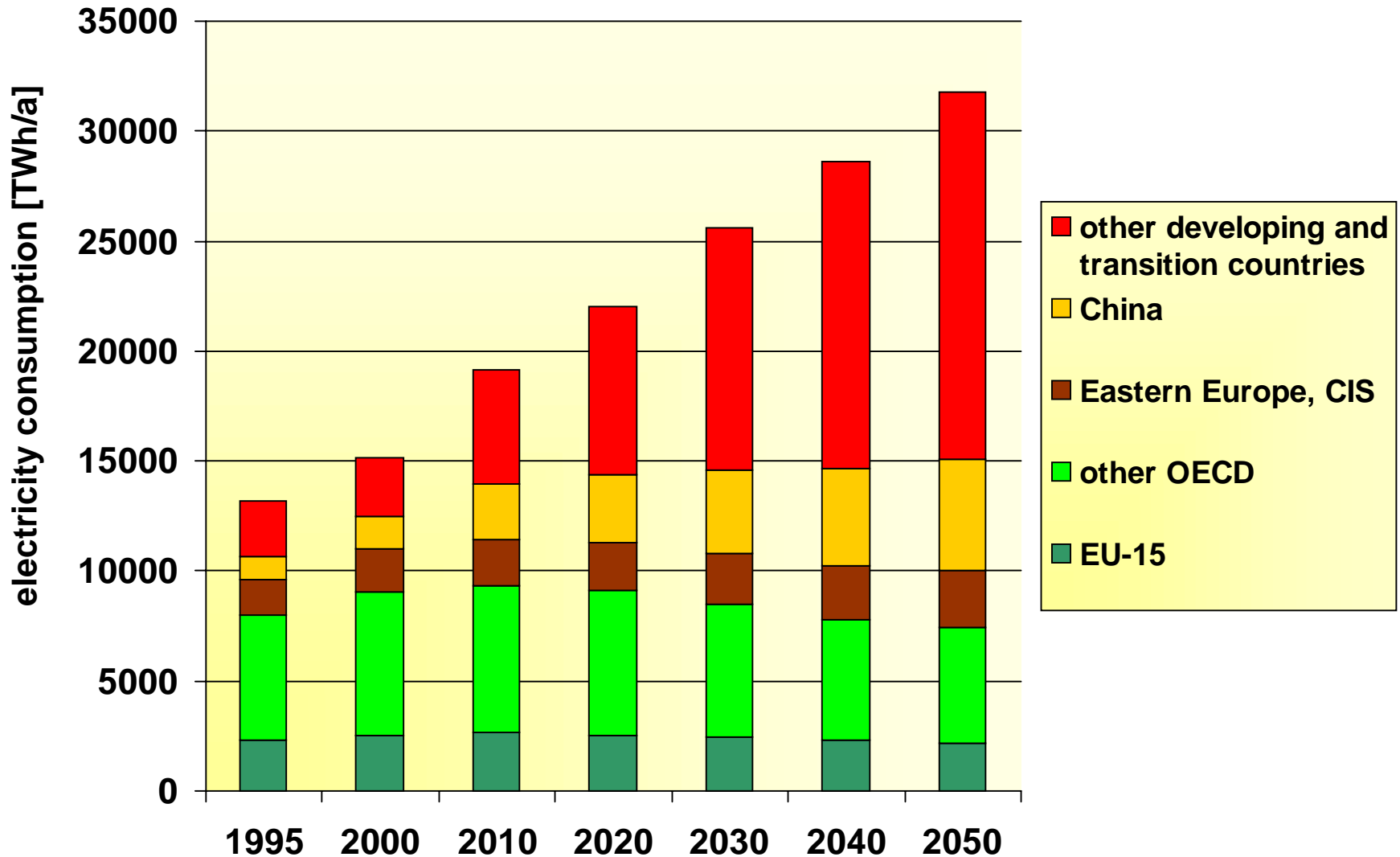
**New Energy for the South**

**1-2 April 2003**

**Gelsenkirchen**

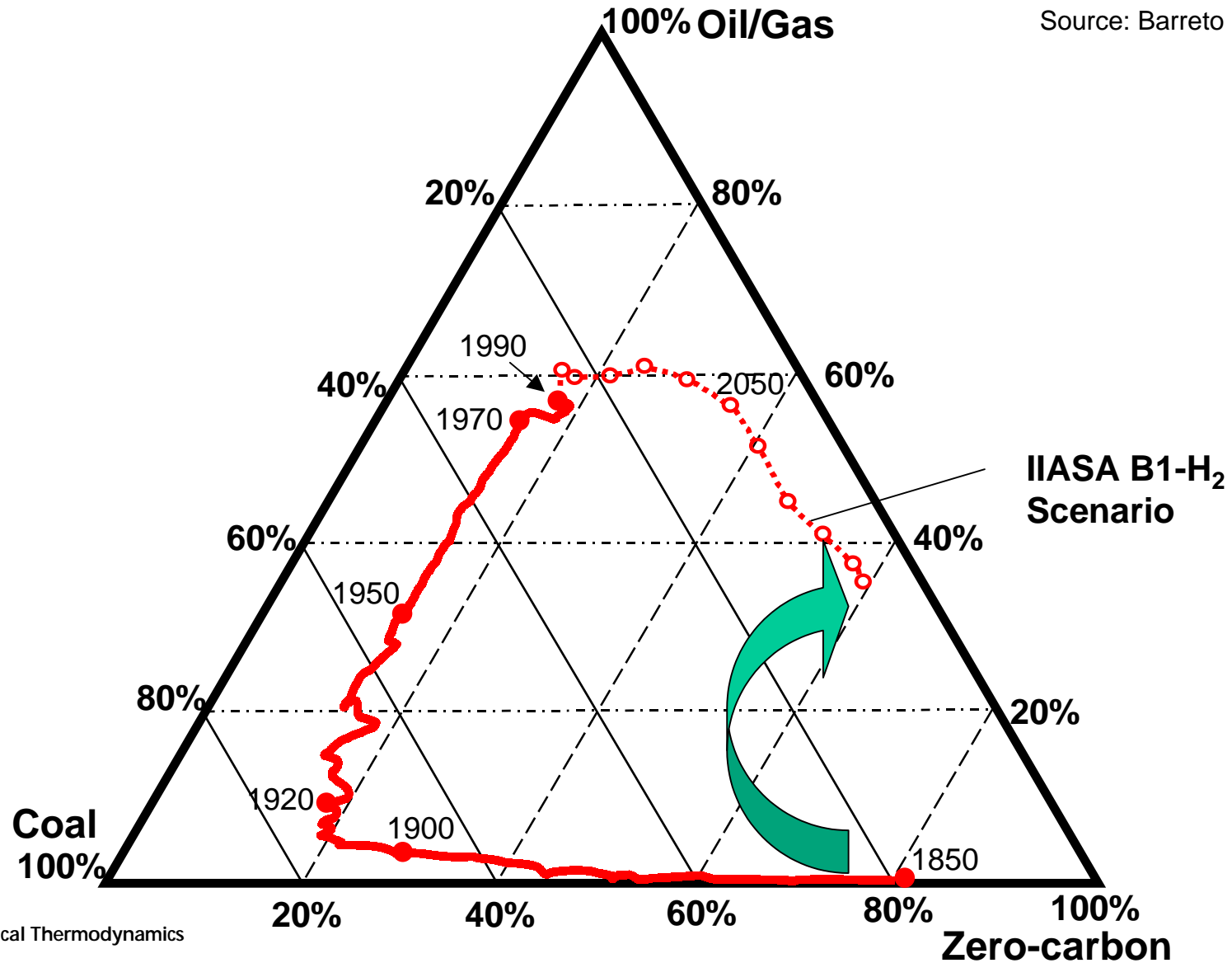
# future global electricity demand

Source: „Global Solar Energy Economy“, DLR



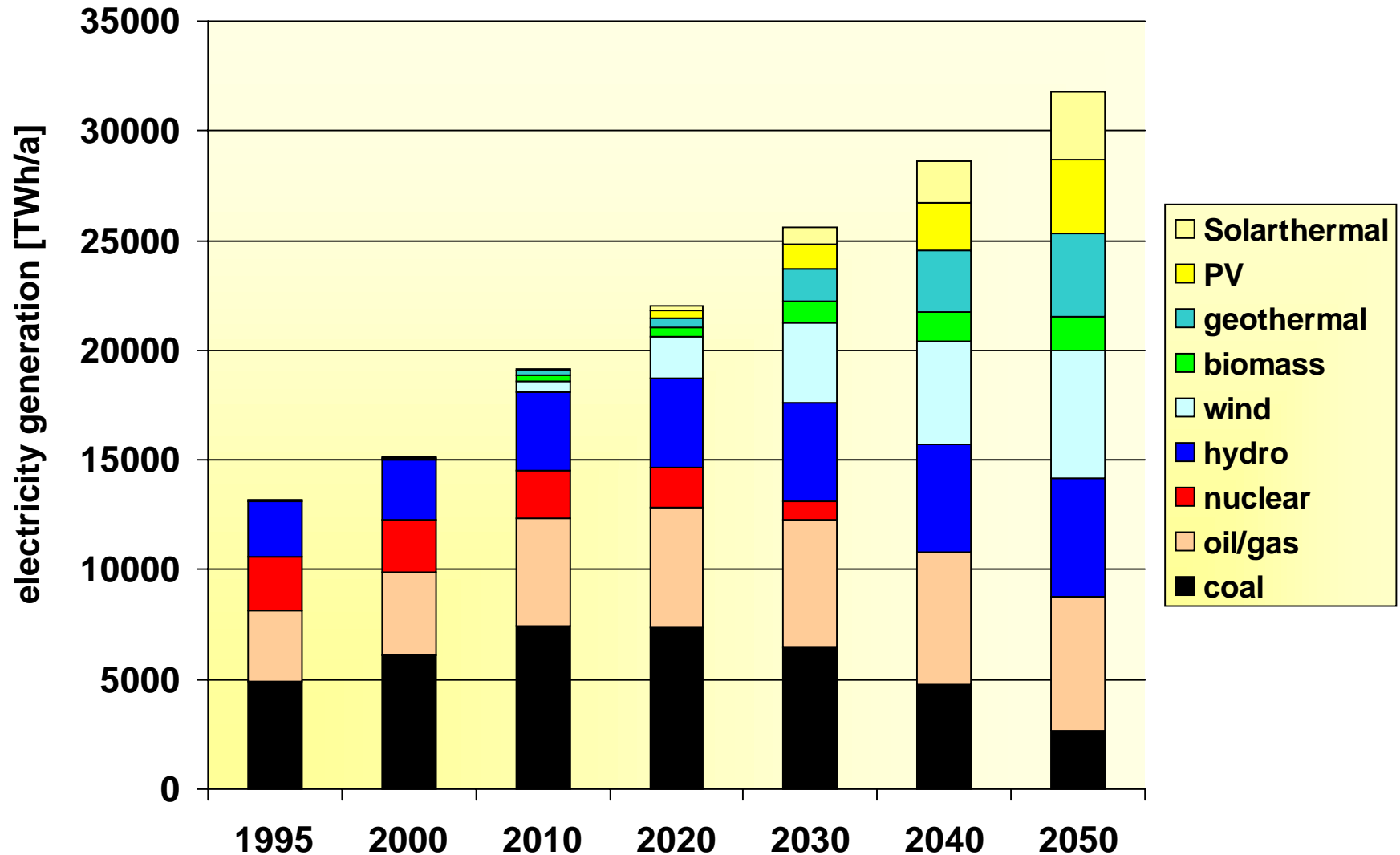
# global shares in primary energy use

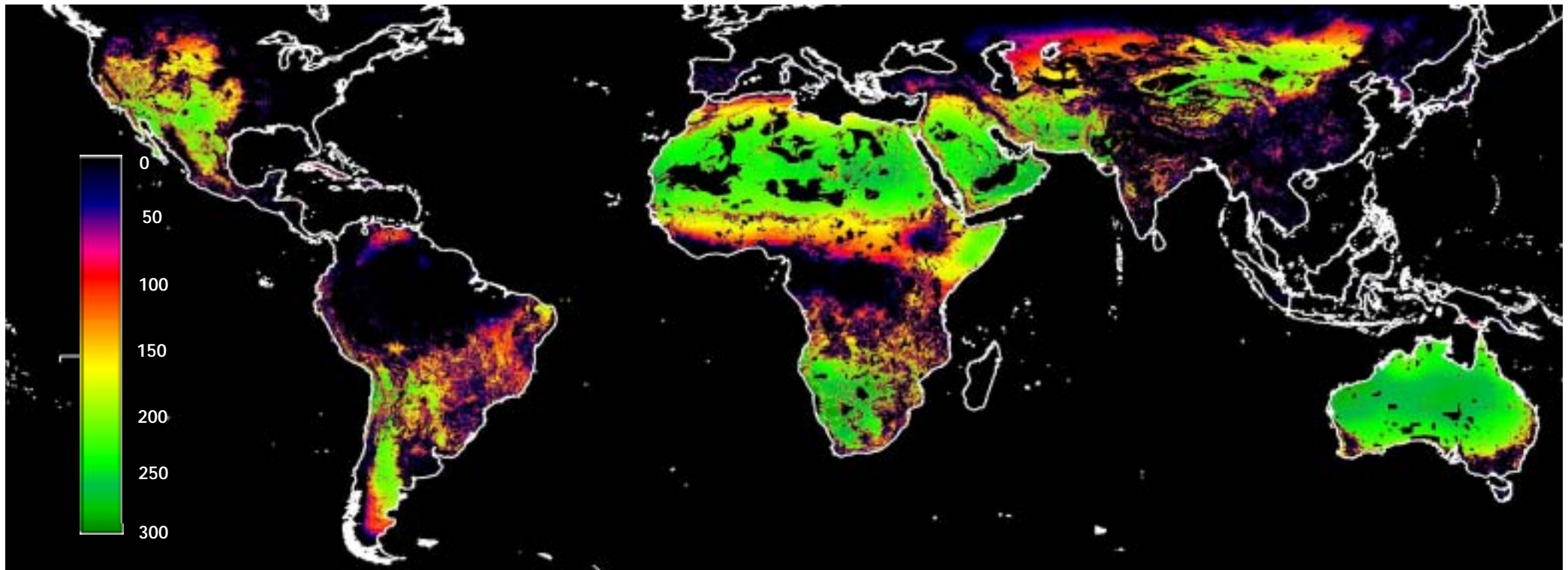
Source: Barreto et al., 2003



## future global electricity supply

Source: „Global Solar Energy Economy“, DLR





**1 km<sup>2</sup> yields up to 200 - 300 GWh<sub>e</sub>/year**

**1 km<sup>2</sup> equals 50 MW coal or gas plant**

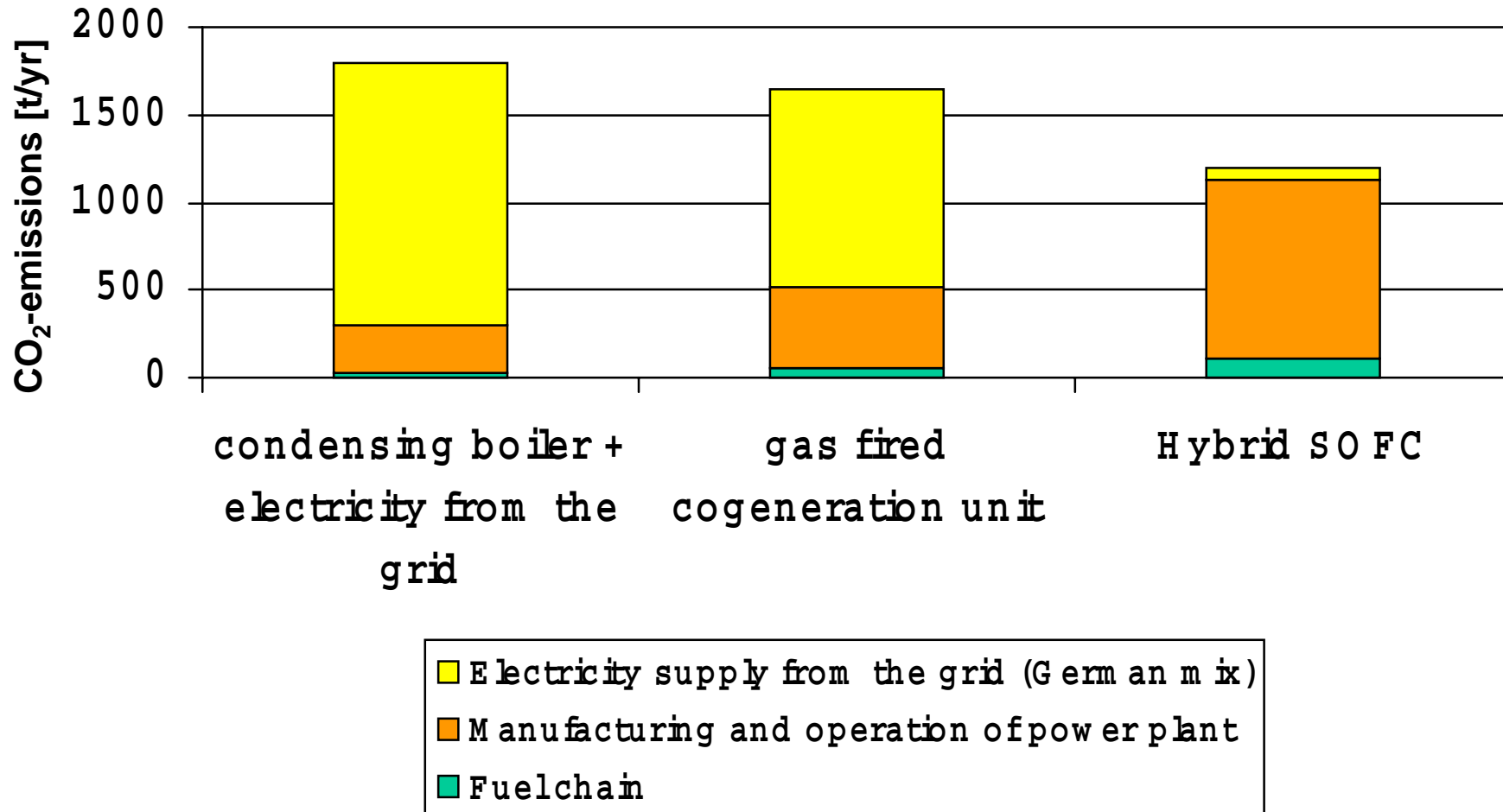
**1 km<sup>2</sup> avoids 16 million barrels of oil**

Source: DLR, 2002

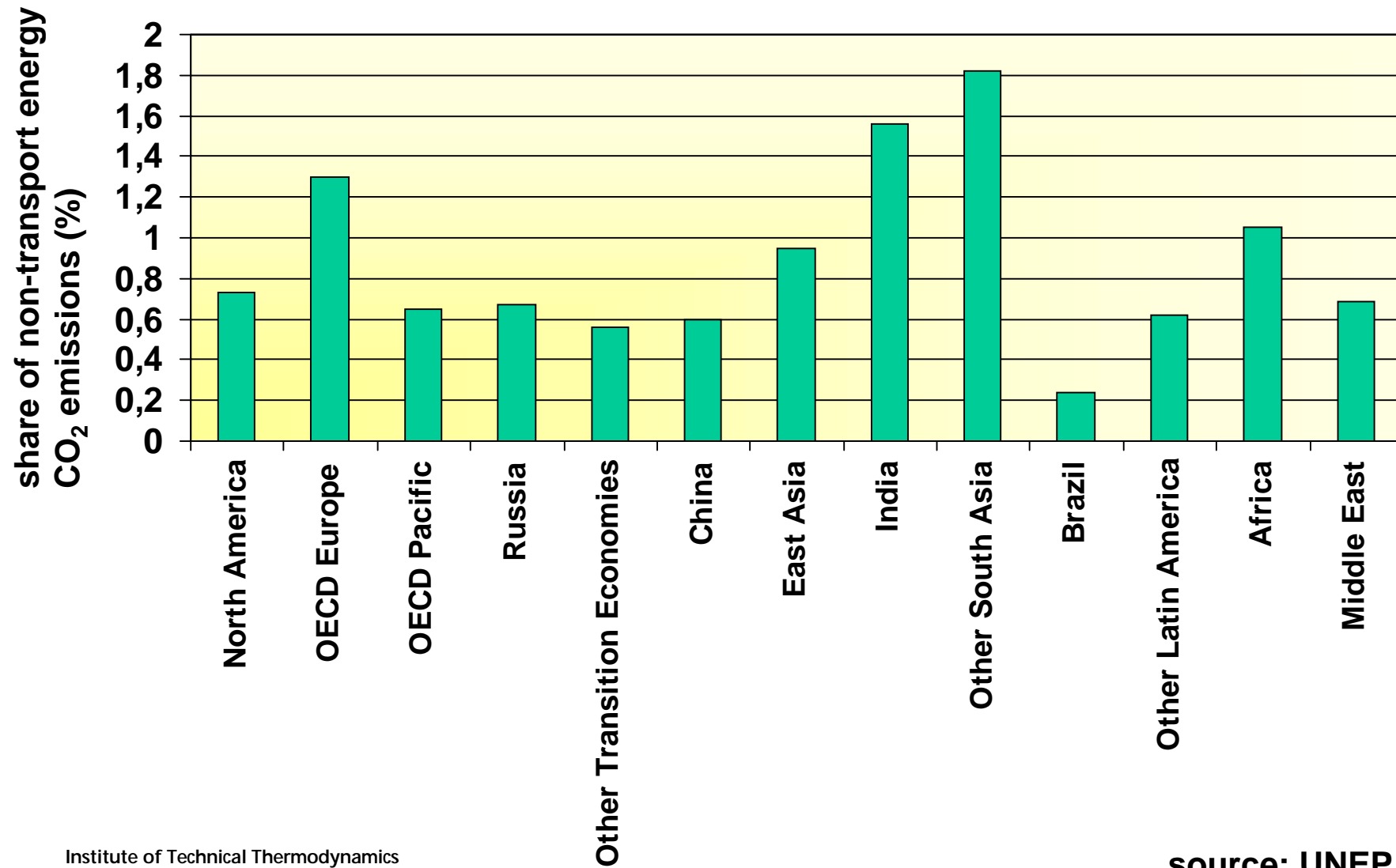
- **Fuel cells can play a transition technology role towards low-carbon energy sources, specifically hydrogen**
- **Hydrogen can be produced from a range of renewable and fossil resources and used in both transportation and stationary power markets**
- **Increasing potential for local, non Greenhouse-Gas emitting energy to be exploited**
- **Increasing energy security for those countries with limited fossil resources while keeping greenhouse gas and other emissions low**

- **Distributed generation (DG) may provide a low-cost and low-risk alternative to establishing additional grid and generation capacity in regions with insufficient transmission and distribution capacity**
- **Lower reserve margins: because of the small size and modular nature, DG may reduce the amount of reserve capacity needed to meet a given level of reliability**
- **Reduced transmission loads may increase the reliability of transmission facilities**
- **Off-grid village power applications : Renewables + fuel cells in these applications could be competitive sooner than in many other applications, due to the high cost of power production from diesel generators.**

## cumulated CO<sub>2</sub>-emissions resulting from the heat and electricity supply of a residential area



## avoided CO<sub>2</sub>-emissions from introduction of fuel cell DG (2020)



- **Capital costs of first generation fuel cells (demonstration/field test facilities) are in the range of 4.000 to 15.000 \$/kWel**
- **Significant cost reductions are expected from technological learning: target costs < 1.500 \$/kWel. First phase market integration and technological learning will take place in industrialised countries.**
- **Subsidising the cost of fuel cells in developing countries may help to avoid lock-in to other technologies, and to maximise developing country capacities to produce components more inexpensively**

- **Continuing development of fuel cell design and manufacturing technology:**  
developers are still in the process of designing complete systems, manufacturing technologies are still under development
- **Inadequate hydrogen infrastructure:**  
the existing fuel supply infrastructure is oriented to the delivery of liquid fuels. A cost-effective route for hydrogen production is not yet established.
- **Regulatory framework:**  
there is currently a lack of widely accepted safety codes and performance standards for hydrogen energy infrastructure, handling, and storage
- **Institutional framework:**  
the state of the power and energy markets in many regions does not provide incentives to maximise the specific advantages advantages of distributed generation from fuel cells (highly efficient combined heat and power generation, low emissions)

- **Industrial countries with gas infrastructure in place: hydrogen production system is expected to evolve relying on natural gas at least in the medium term**
- **Developing countries with less infrastructure available and fast growing energy demand: the system could move more readily into a renewable-based path**
- **Such a leap-frogging process will require substantial efforts and a radical departure from business-as usual trajectories and policies**