Multiple Co-Benefits of a Fundamental Energy Transformation

Perspectives from the Global Energy Assessment

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The Global Energy Assessment

IIASA

International Institute for Applied Systems Analysis
and its international partners present the

www.GlobalEnergyAssessment.org

Towards a more Sustainable Future

- Initiated in 2006 and involves >300 CLAs and LAs and >200 Anonymous Reviewers
- Peer-review coordinated by Review Editors is complete - ongoing responses and revisions.
- Final report (Cambridge Univ. Press) in June 2011 followed by vigorous dissemination

Integration of Knowledge Clusters

- **Cluster I** characterizes nature and **magnitude** of challenges, and express them in selected indicators
- **Cluster II** reviews existing and future resource and technology **options**
- **Cluster III integrates** Cluster II elements into systems, and links these to indicators from Cluster I
- **Cluster IV** assesses policy options, and specifically identifies **policy packages** that are linked to scenarios meeting the needs, again in an **iterative** fashion.

Sponsoring Organizations

International Organizations

GEF
IIASA
UNDESA
UNDP
UNEP
UNIDO
ESMAP (World Bank)

Industry groups

First Solar
Petrobras
WBCSD
WEC

Governments/Agencies

Austria - multi-year
European Union
Germany
Italy
Norway
Sweden - multi-year
USA (EPA, DoE)

Foundations

UN Foundation
Climate Works Foundation
Global Environment & Technology Foundation

Global Energy Transformations

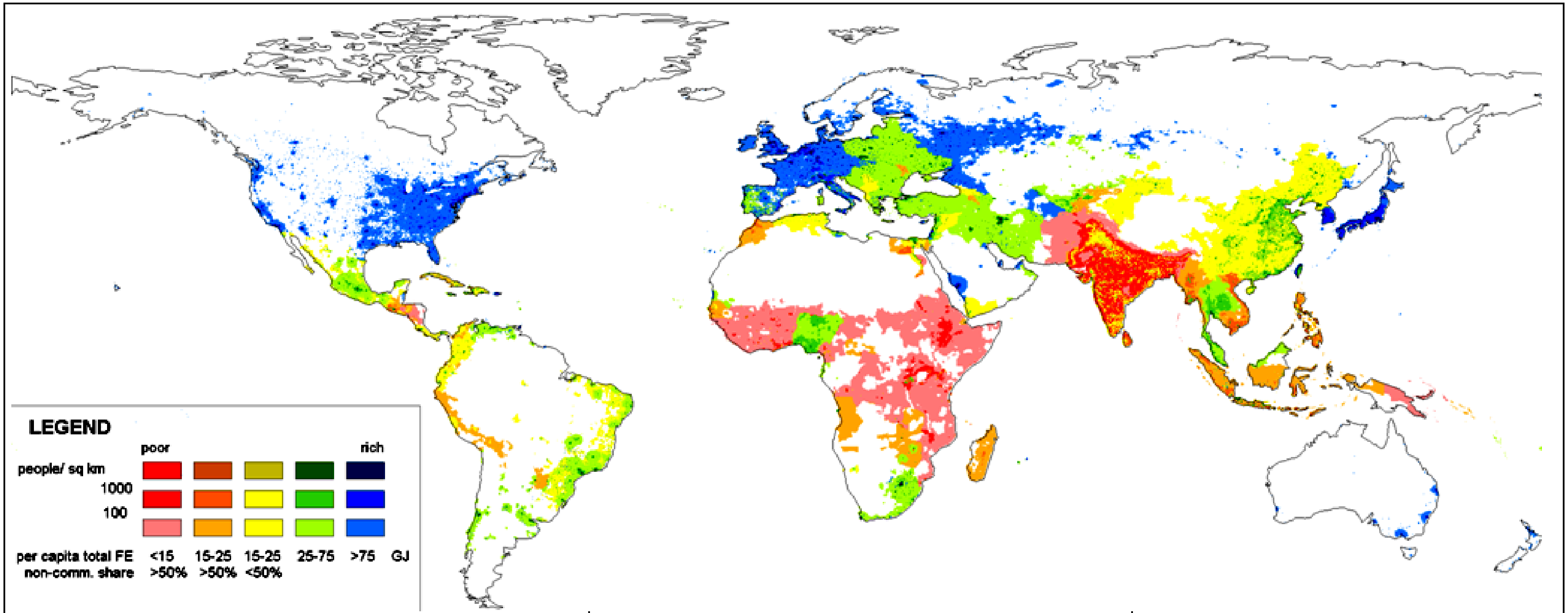
- Access to energy and ecosystem services (a prerequisite for MDGs & wellbeing)
- Vigorous decarbonization for mitigating climate change brings multiple co-benefits
- Energy transformations require R&D and rapid technology diffusion & deployment
- Sustained energy investments are needed and would result in multiple co-benefits

Food for a Week, Darfur Refugees, Chad

Food for a Week, Germany

Mapping Energy Access

Final energy access (non-commercial share) in relation to population density



Billions of people:

Abject poverty: 1.3
Poor: 0.6
Less poor: 1.4
Middle class: 1.6
Rich: 1.2

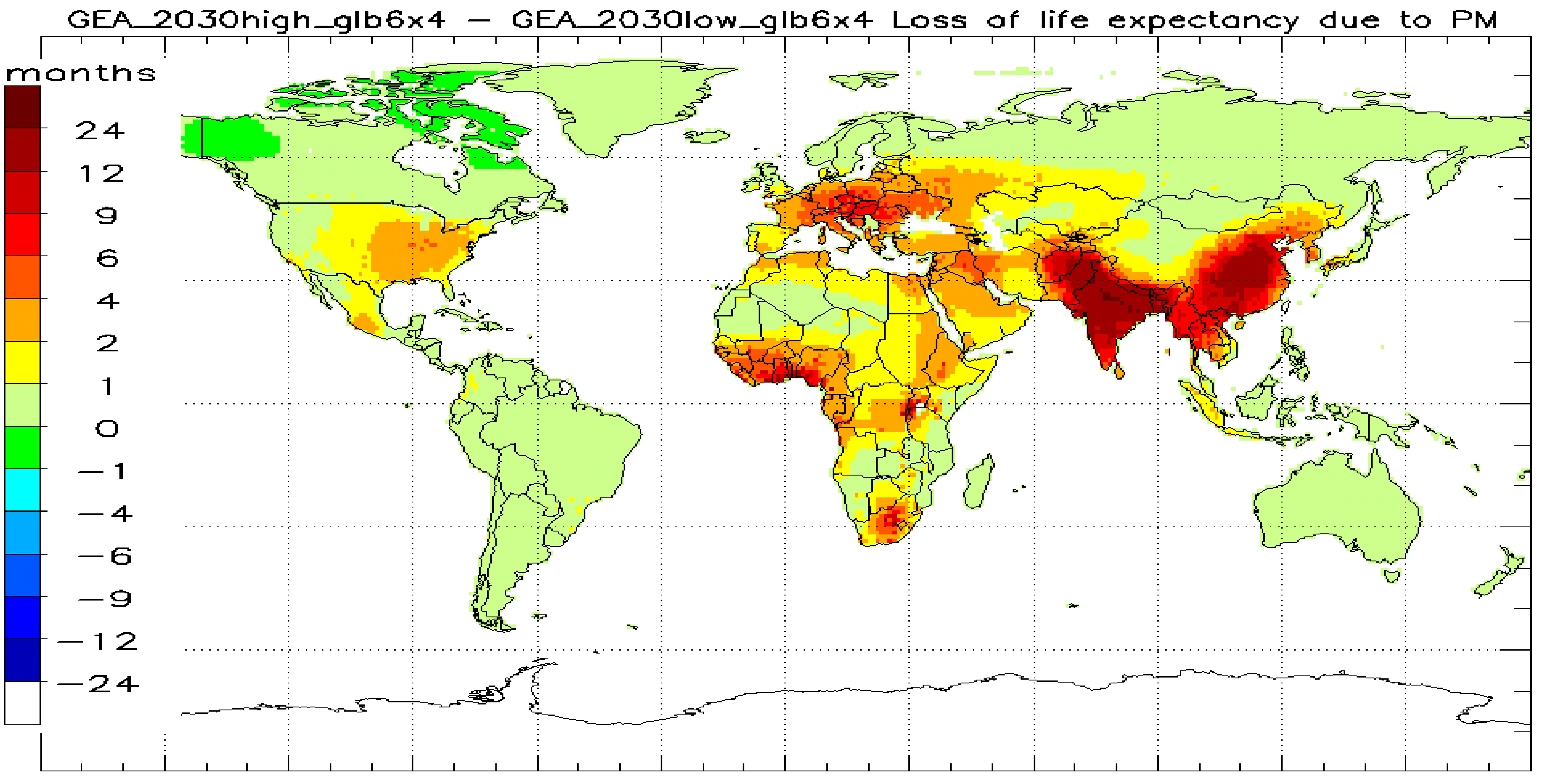
3.3

2.8

Source: Gruebler et al, 2009

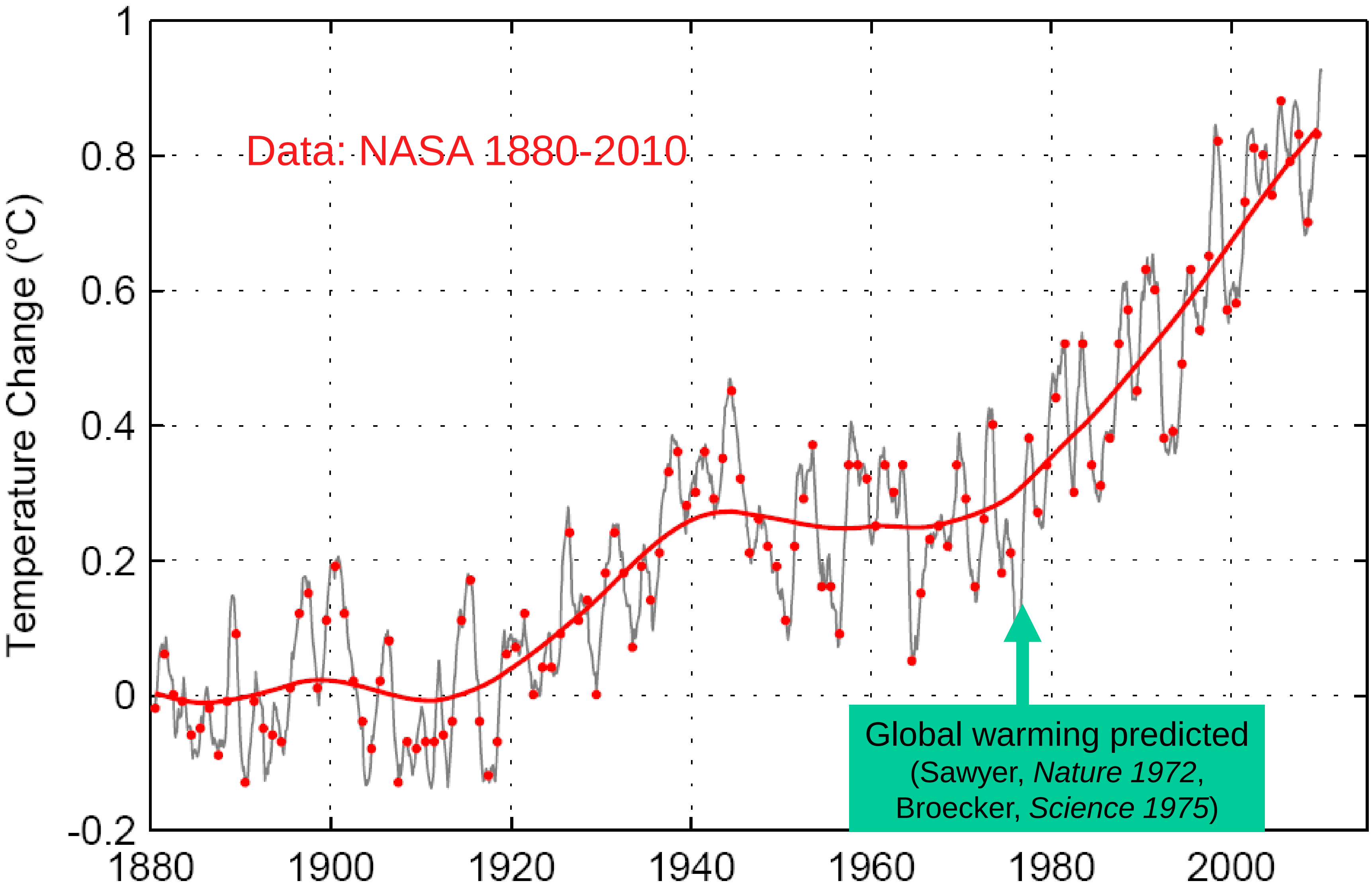
Health Benefits of Pollution Control

(loss of stat. life expectancy - PM)



Source: Dentener et al, 2009

Earth is Warming



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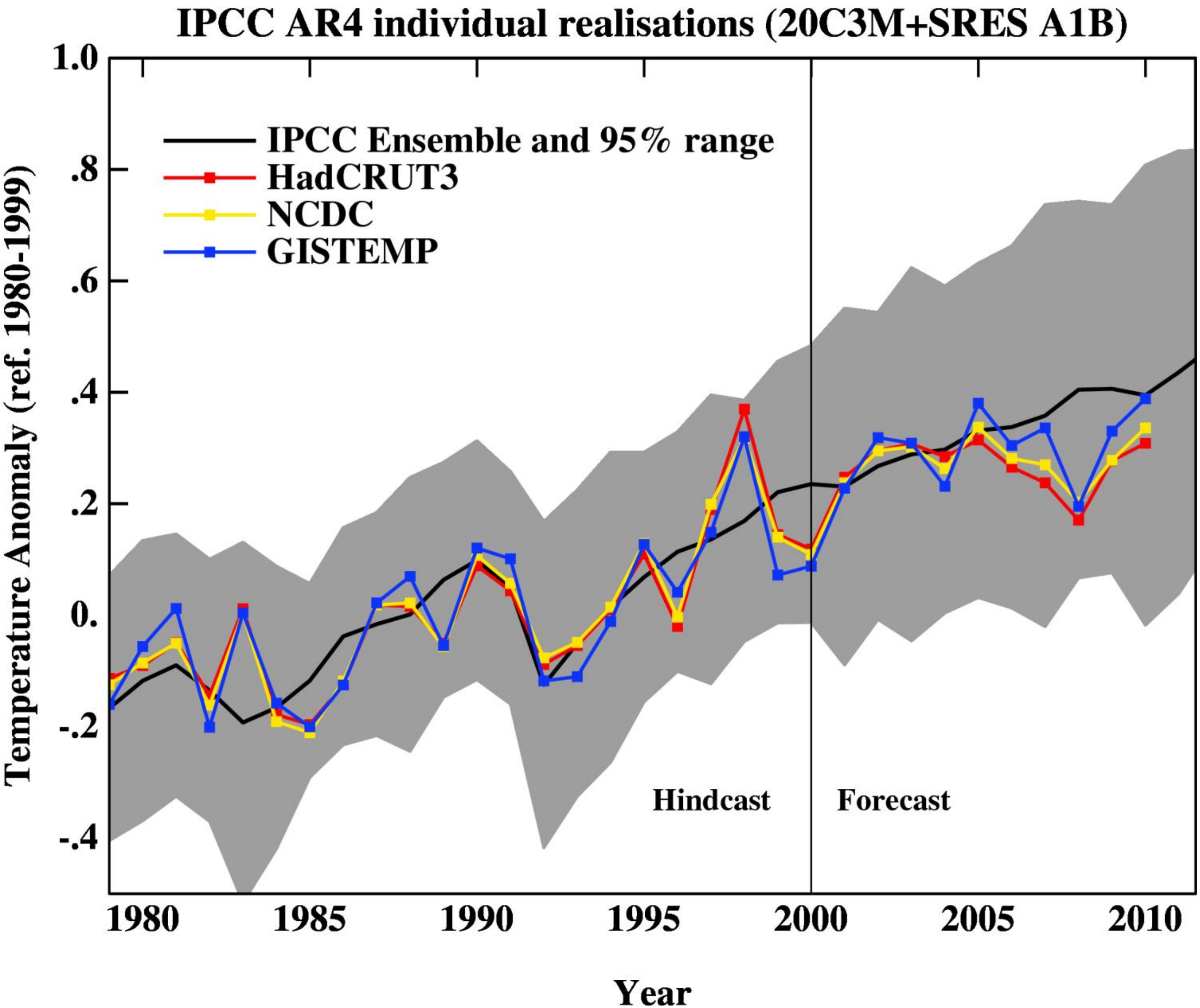
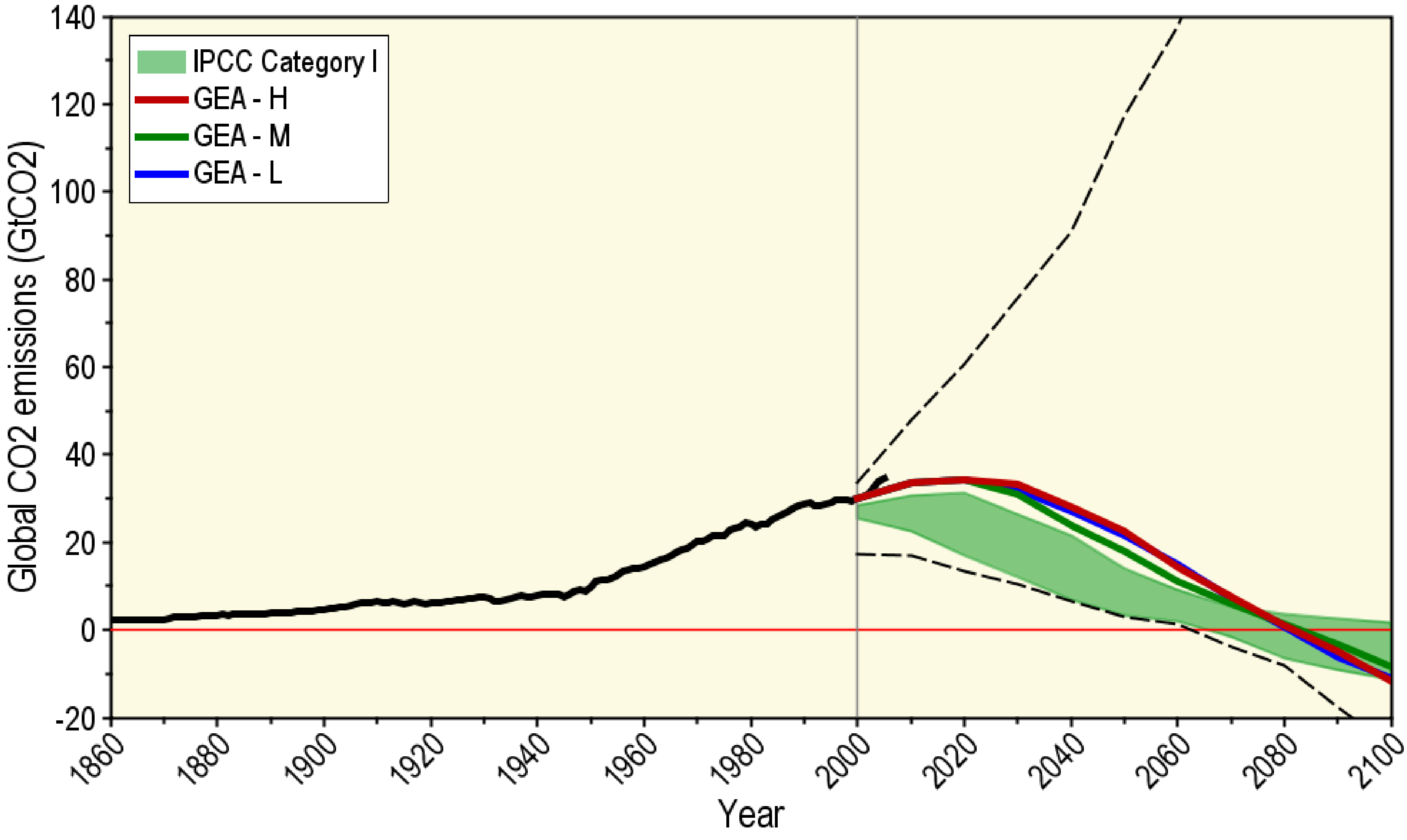


Source: Realclimate 2010

Global Carbon Emissions



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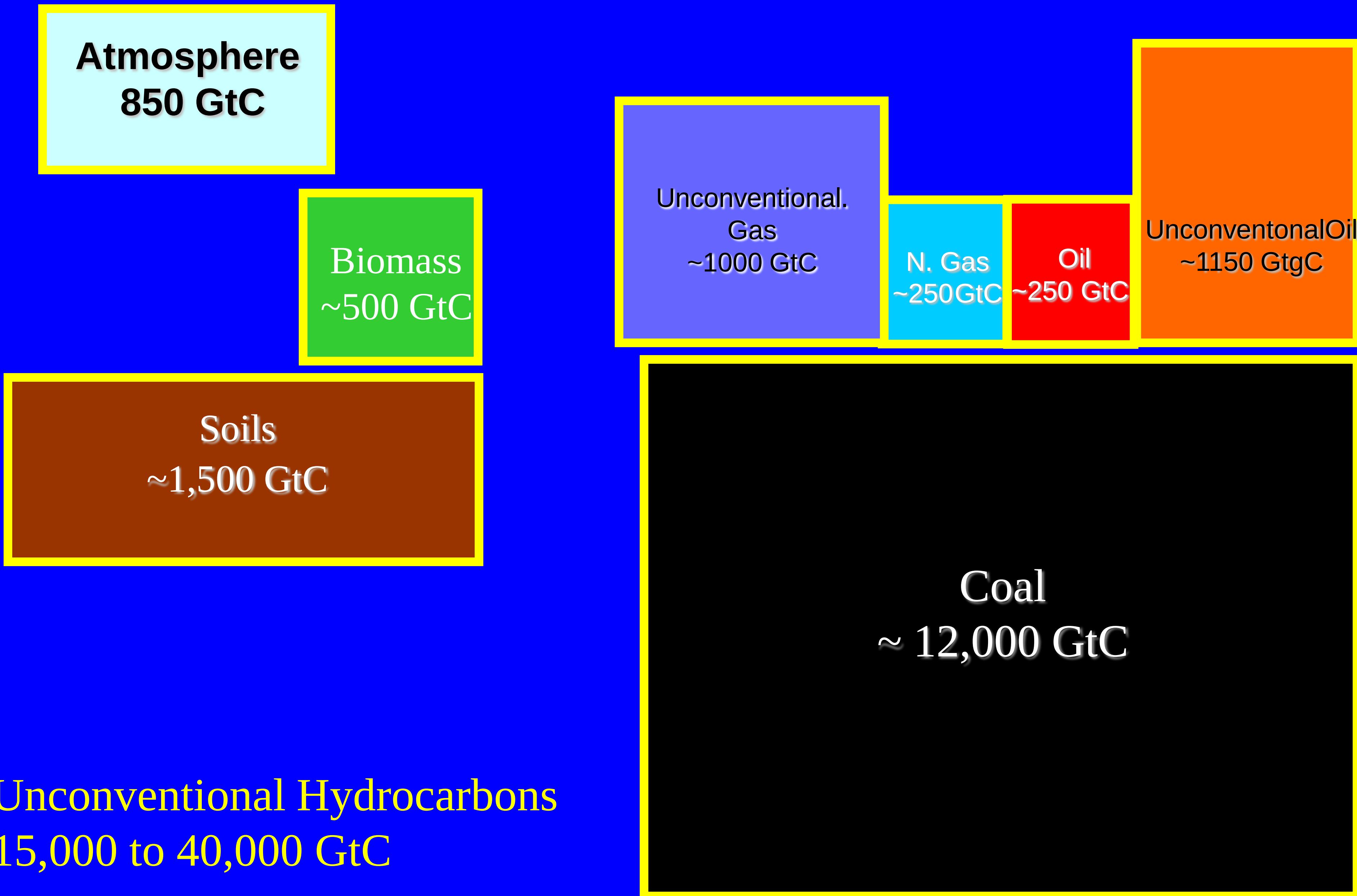
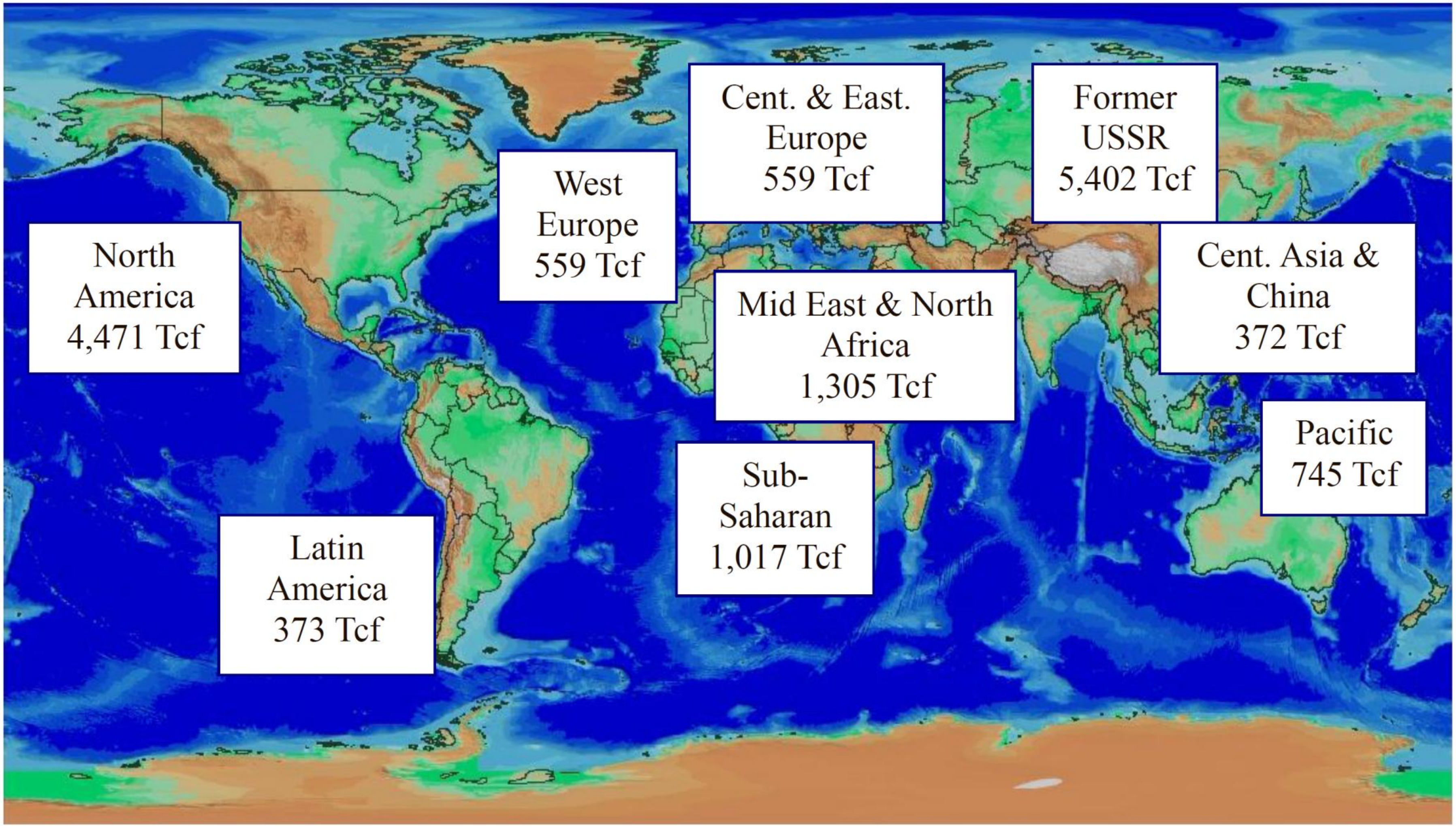
Global Carbon Reservoirs



Unconventional Hydrocarbons
15,000 to 40,000 GtC

Estimated shale gas resource



14,803 TCF ≈ 15,600 EJ

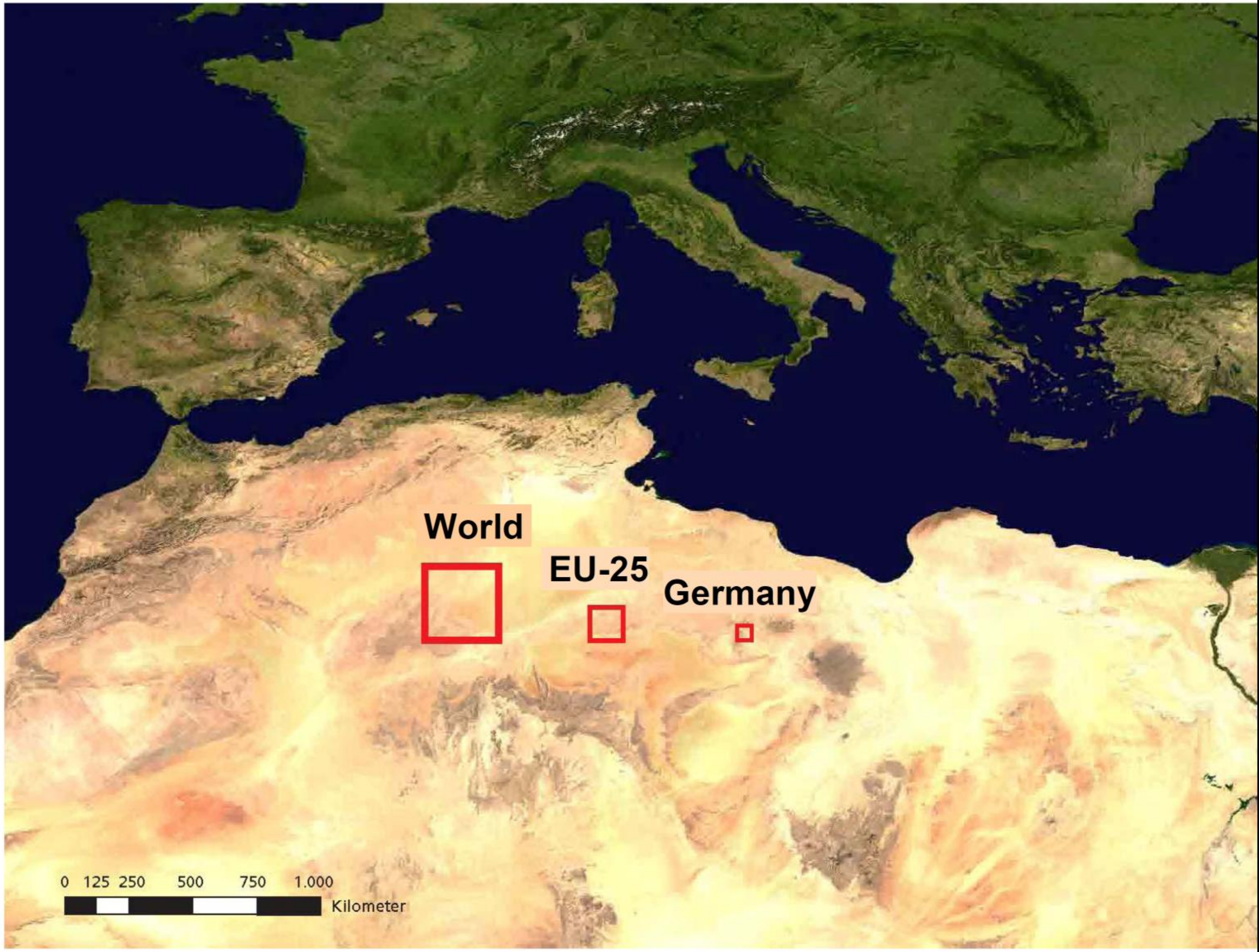
IGU 2003, VNIIGAS 2007, USGS 2008, BGR 2009

Required desert area for the sustainable supply of electricity

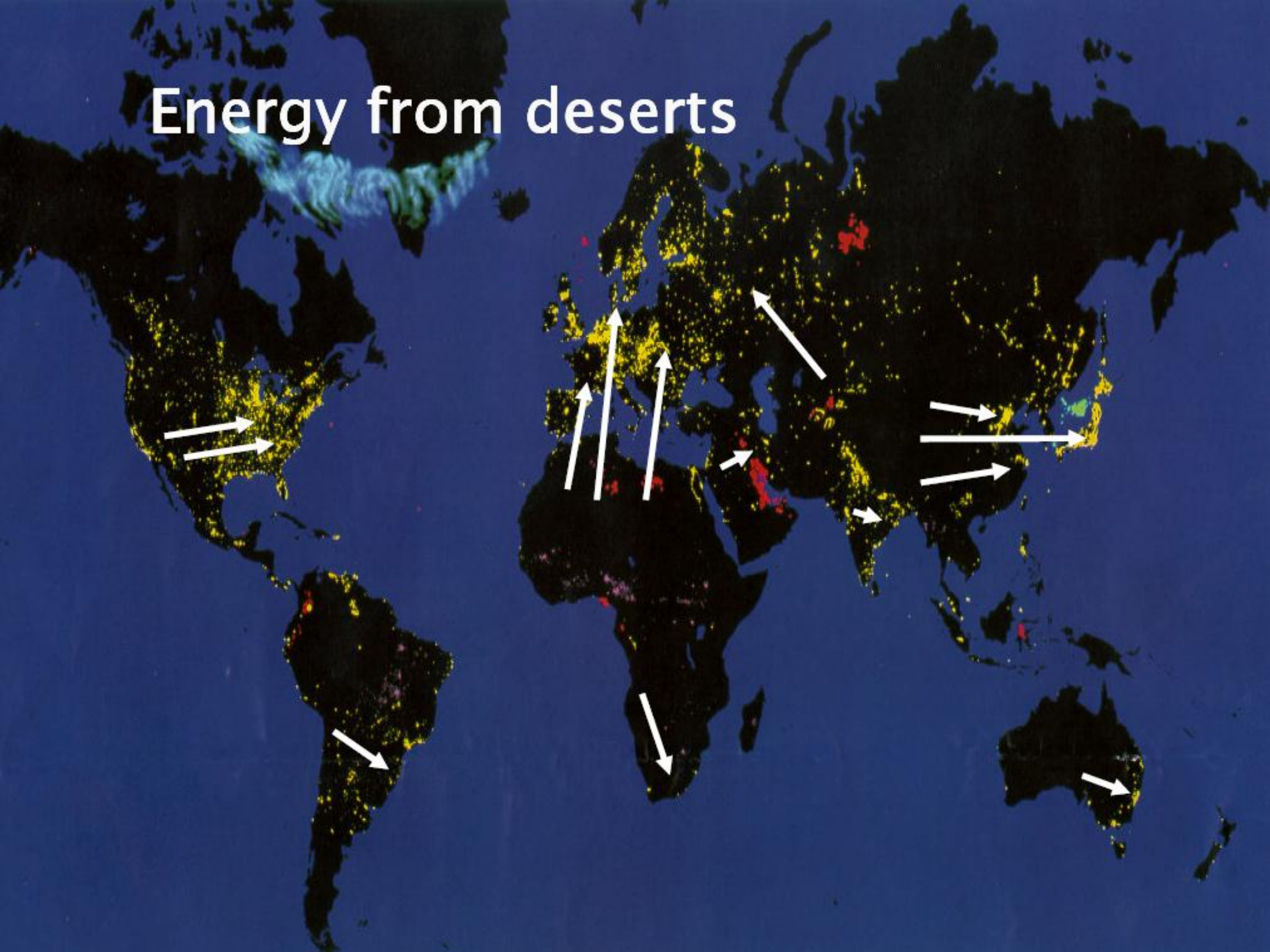
World 300 x 300 km^2

EU-25 150 x 150 km^2

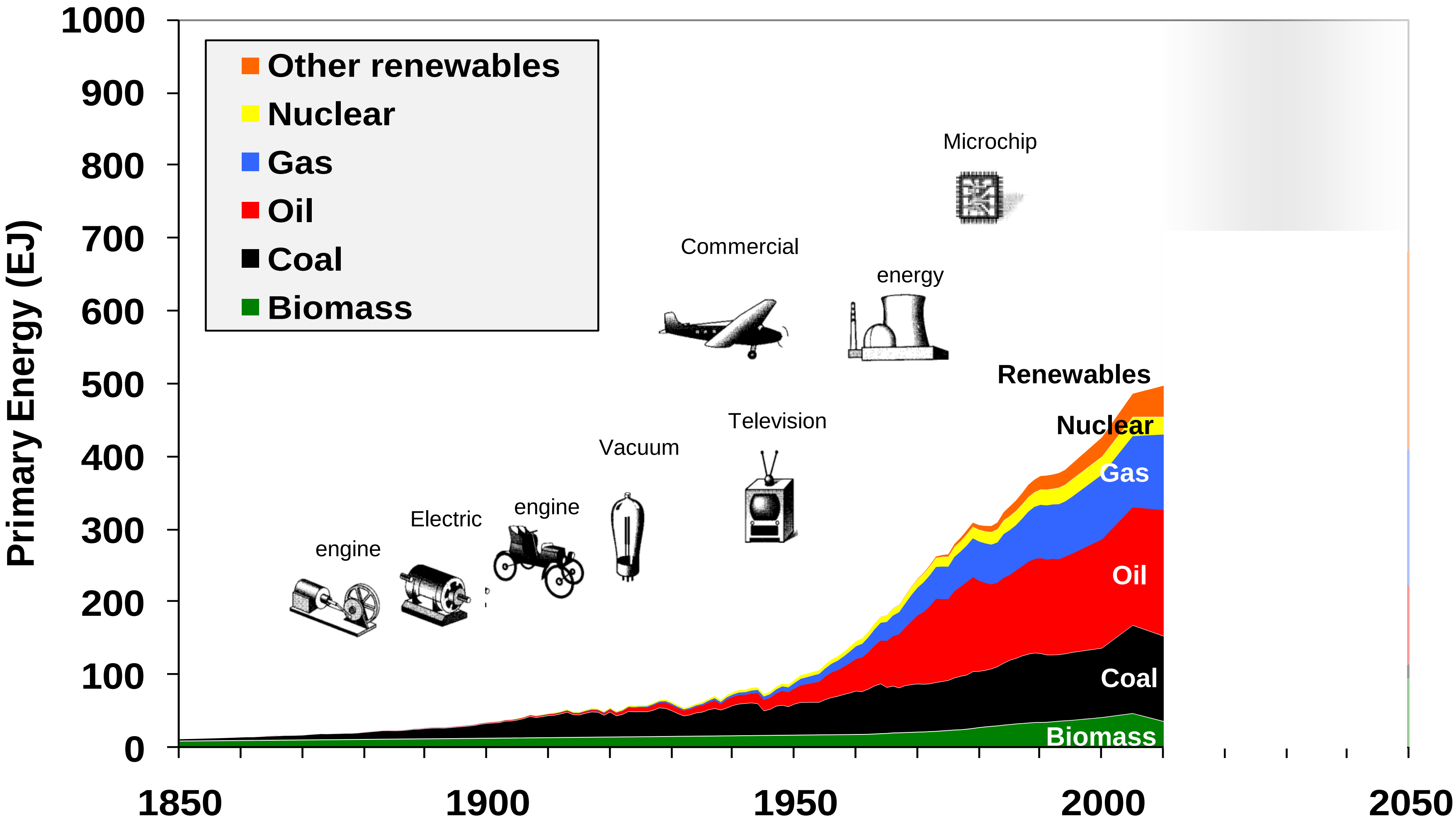
Germany 50 x 50 km^2



Energy from deserts



Global Primary Energy



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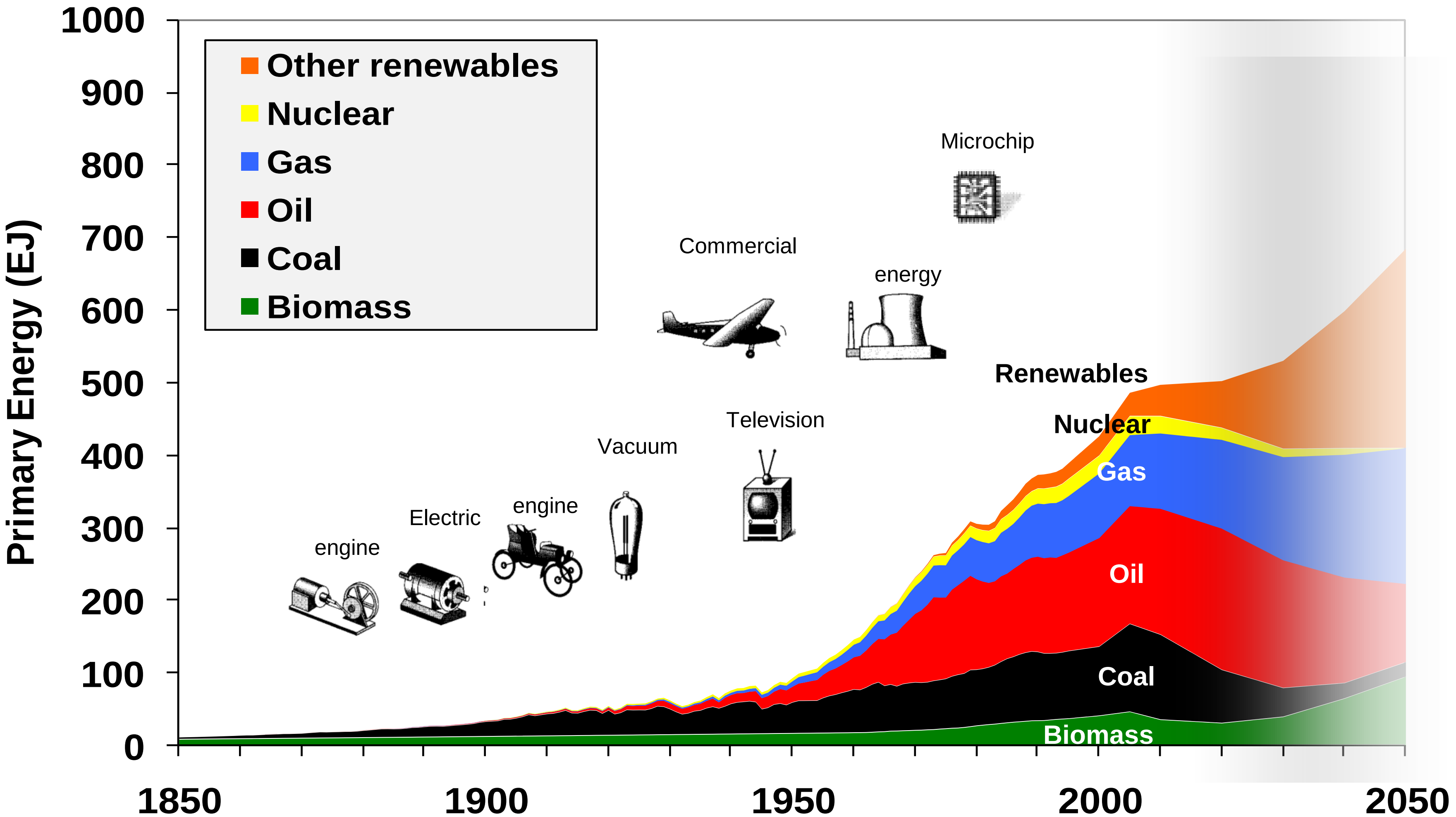

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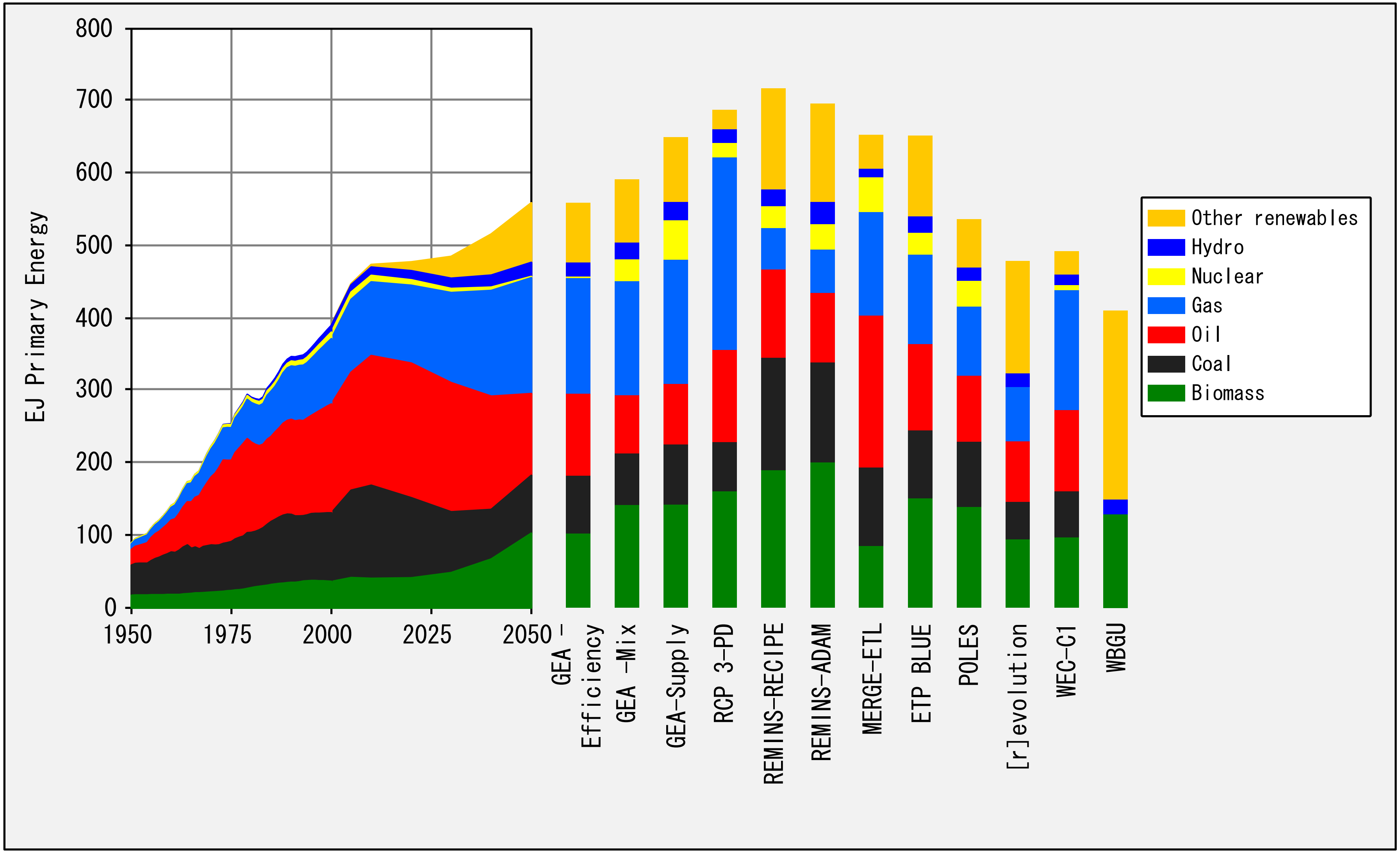

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Example of savings by reconstruction

Before reconstruction

Reconstruction according to the passive house principle

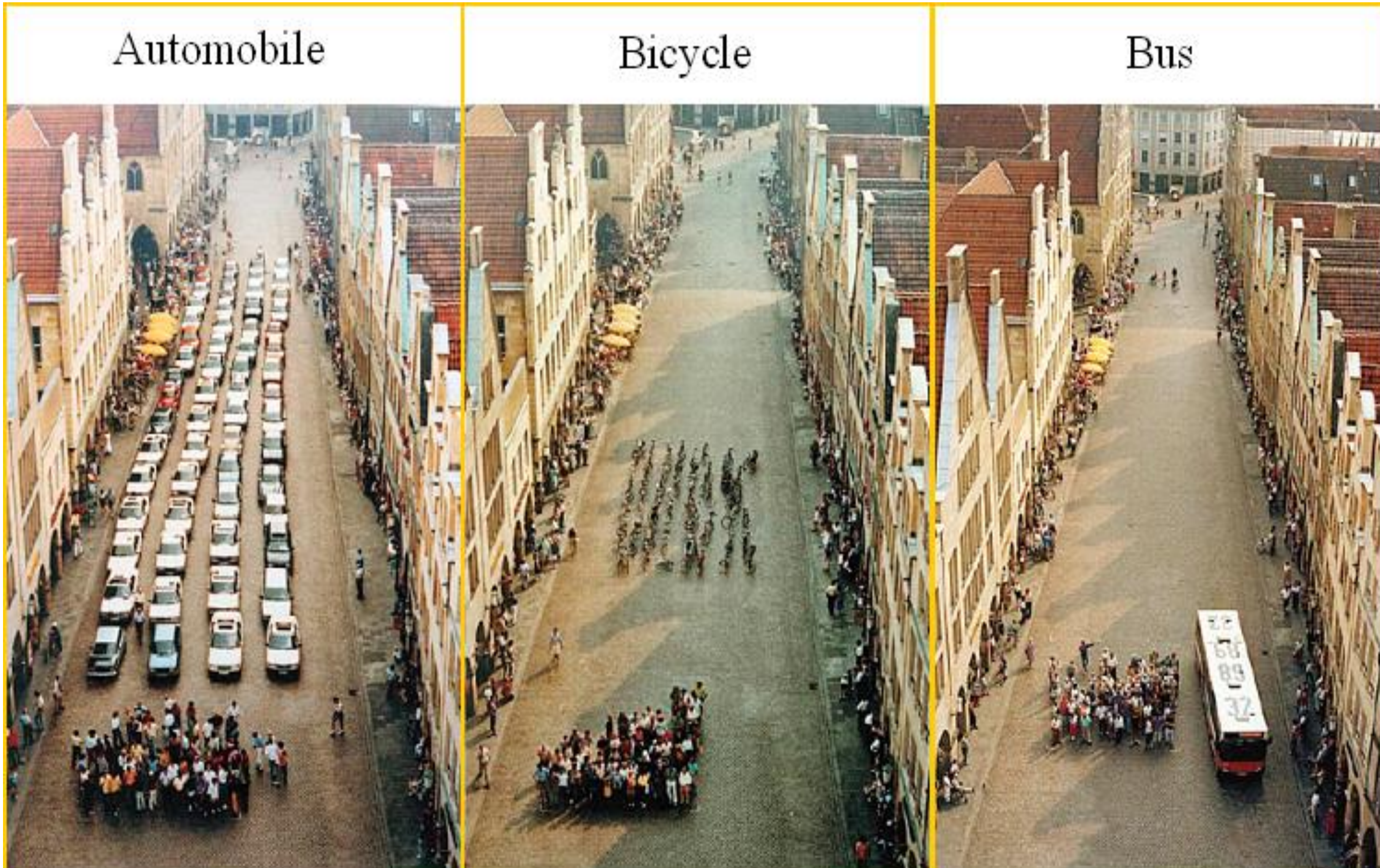
over 150 kWh/(m²a)

-90%

15 kWh/(m²a)

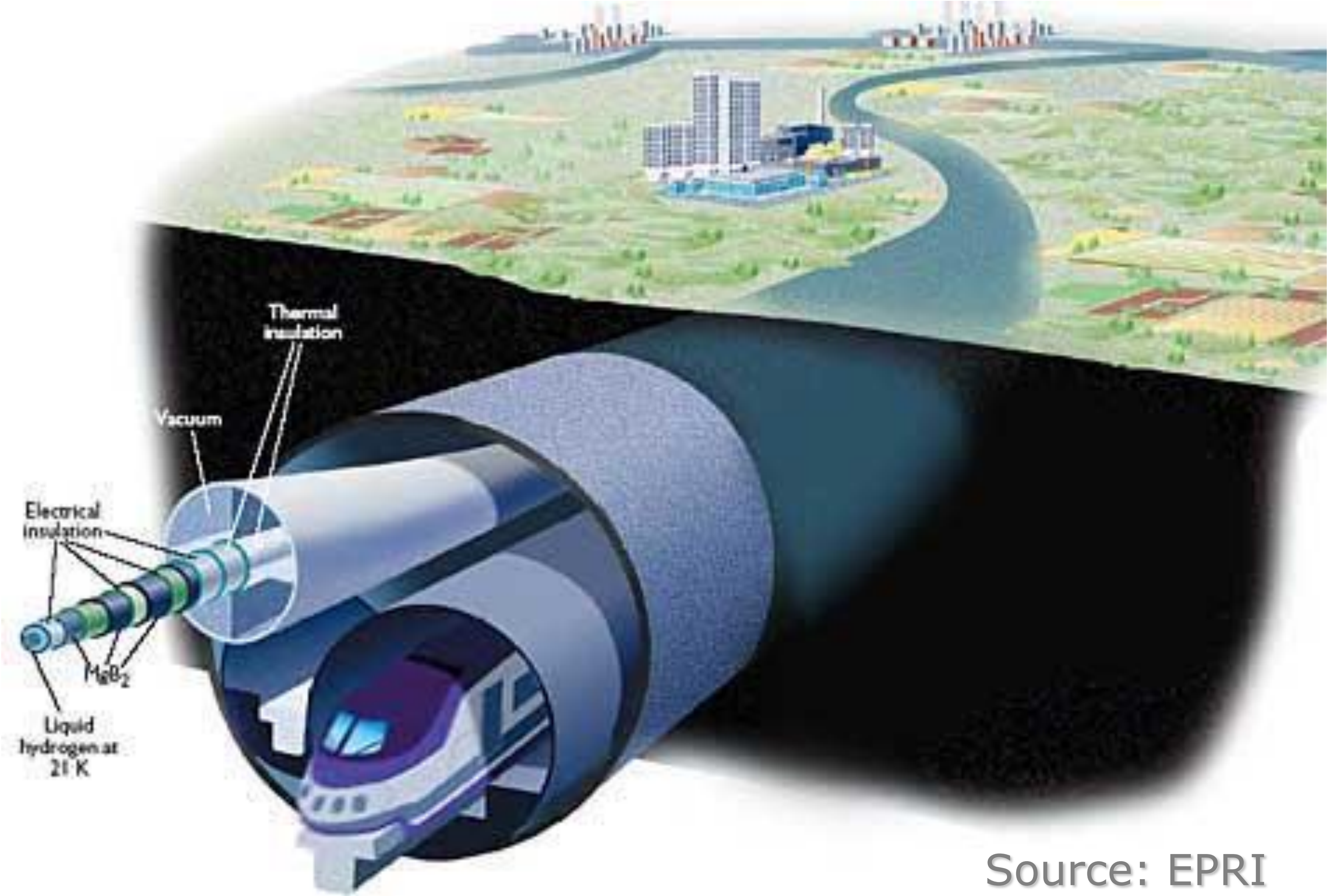
Source: Jan Barta, Center for Passive Buildings, www.pasivnidomy.cz, EEBW2006

Area Occupied by Various Transport Modes



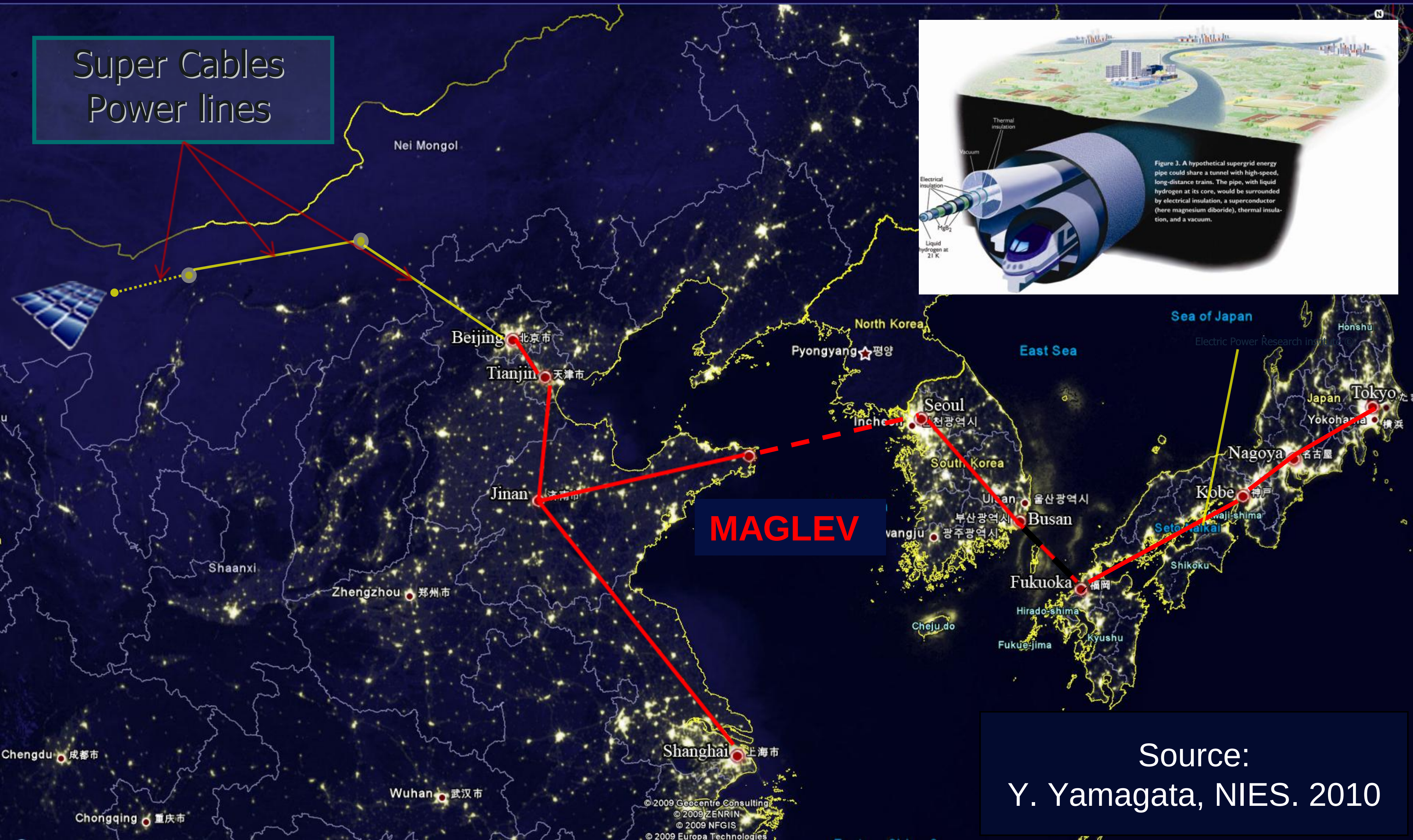
Source: WBCSD, 2005

Energy SuperGrid and MagLev



Source: EPRI

Potential Synergies between New Energy and Transport Infrastructures: Asian "Supergrid"



Source:
Y. Yamagata, NIES. 2010

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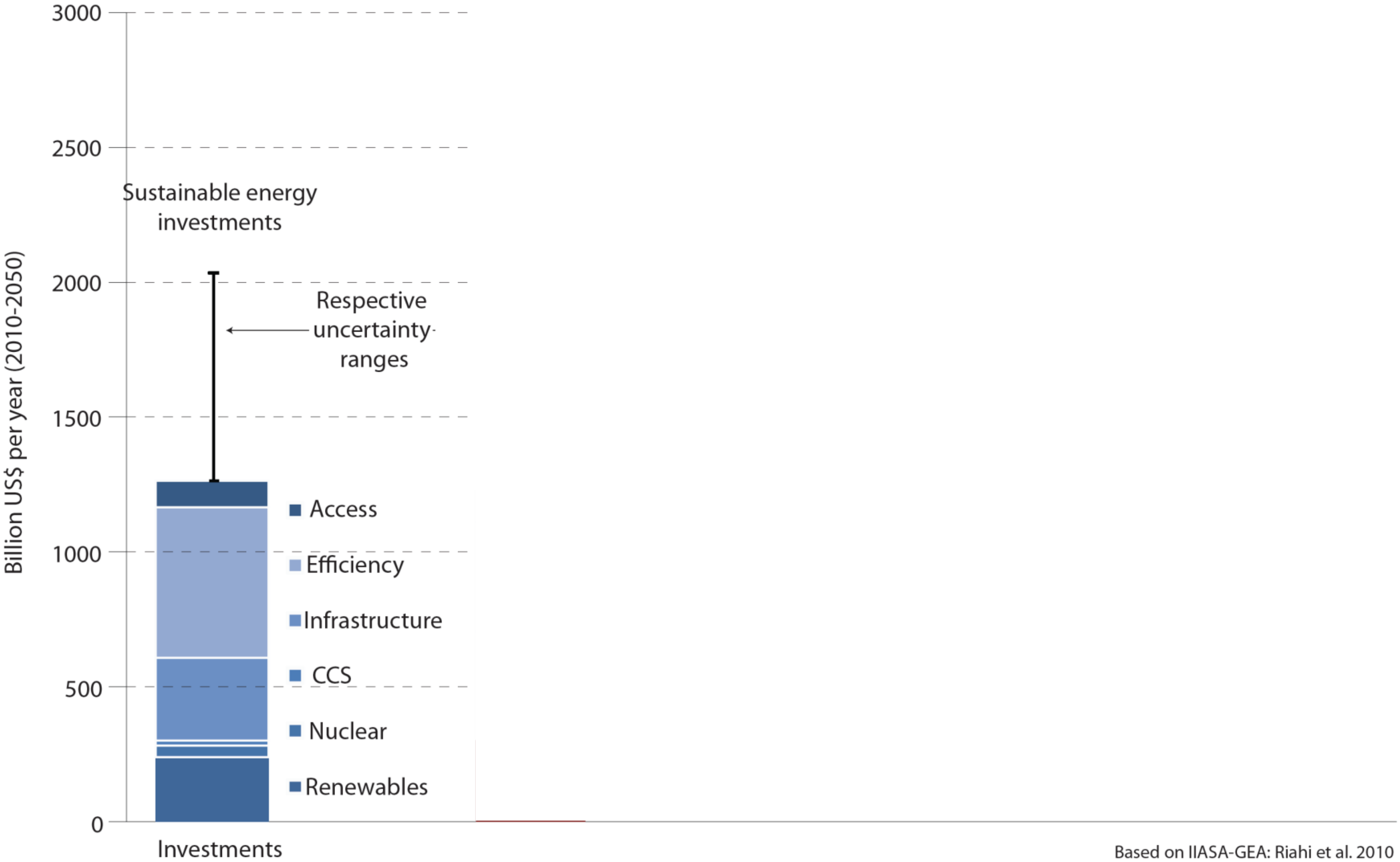
Co-Benefits of Energy Investments



Based on IIASA-GEA: Riahi et al. 2010

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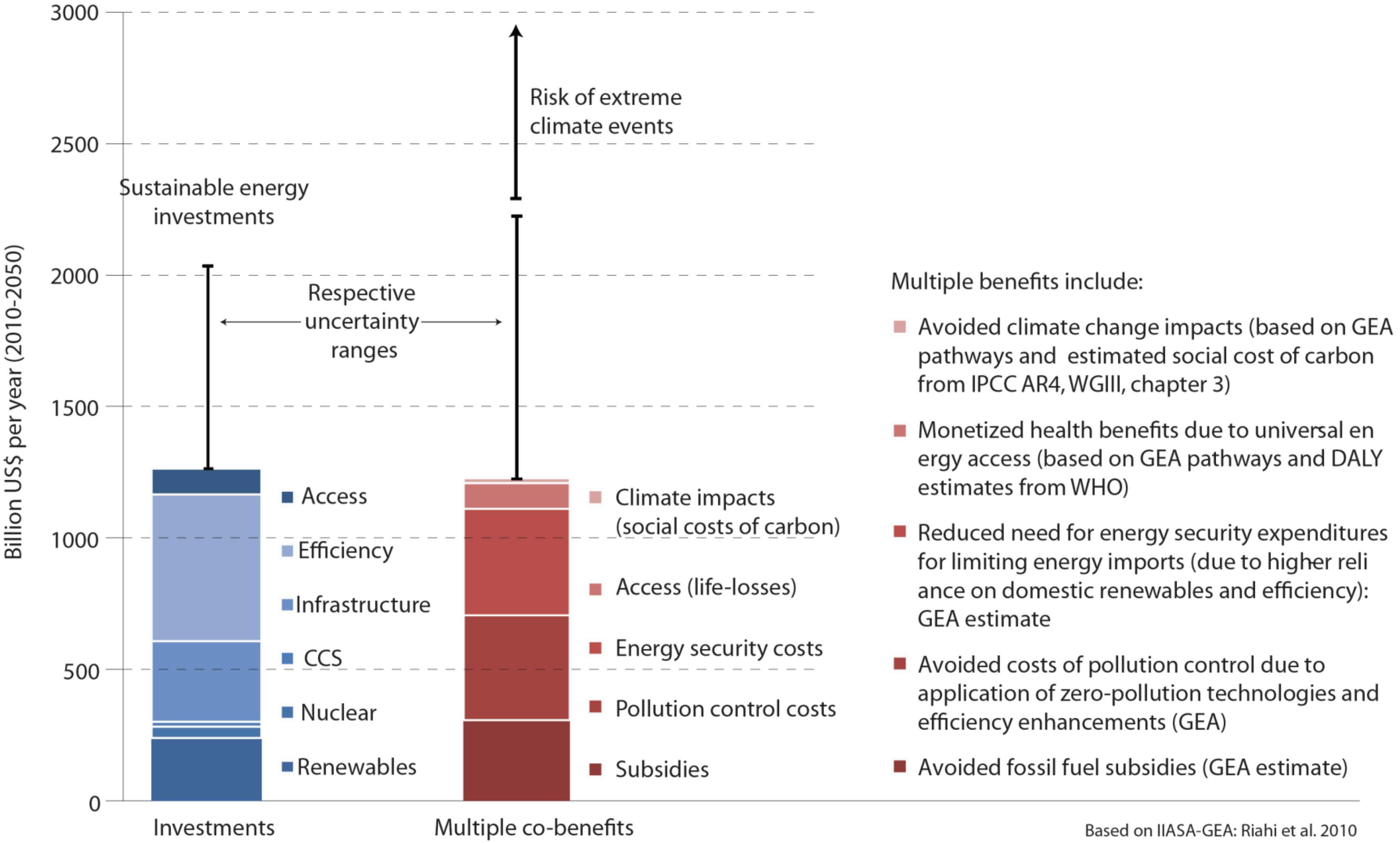

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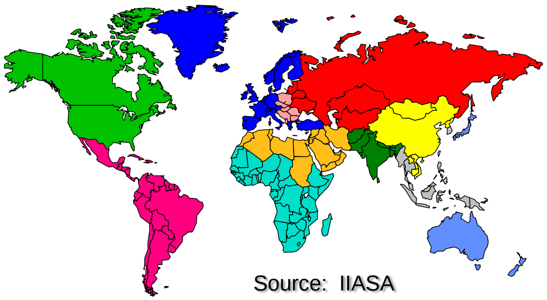
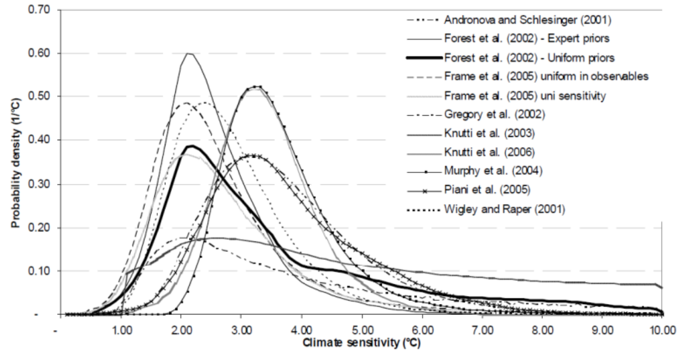
Trade-Offs & Co-Benefits

- With GEA Scenarios: Explore implications of global climate mitigation for local energy security concerns and air pollution control
  - Explore development of security indicators in $2^{o}C$ climate scenarios
  - Assess potential economic co-benefits of different combinations of security and climate policies
  - Multi-Criteria Analysis to understand policy interactions (security/pollution/climate)

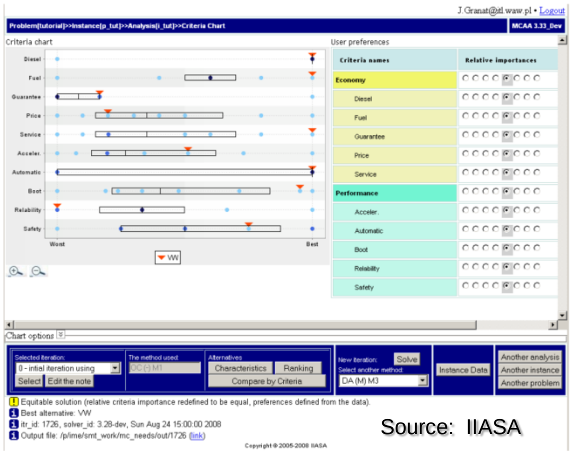
Joint Modeling Framework



Source: IIASA



Source: O'Neill, B.C., K. Riahi, and I. Keppo , 2010 (*PNAS*)



Source: IIASA

Systems engineering global energy model (MESSAGE) → **Global climate model (MAGICC)** → **Multi-criteria analysis tool (MCAA)**

Create wide range of scenarios:

Different stringency for regional energy import constraints

Different levels of climate mitigation

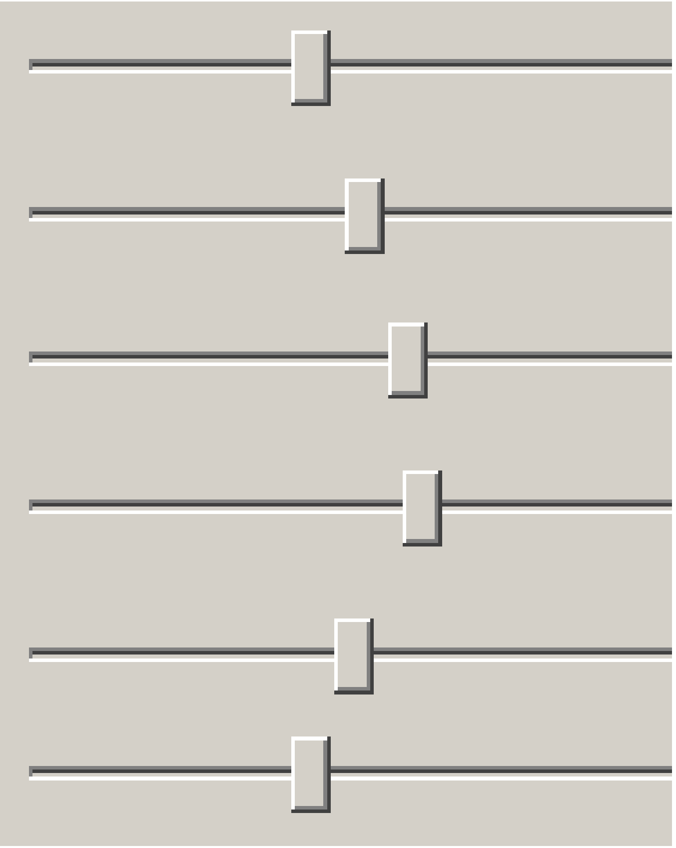
Different stringency of pollution control

Energy Transformations

depend on the ranking of policy priorities

More preferable, but more difficult →

		Worst		Best
Environment	Mid-term GHG/pollutant emissions levels (2050)	+80%		-80%
	Long-term climate target (prob. of 2 °C warming)	0%		100%
	Pollution and health impacts (years of life lost)	High		Low
Energy Security	Regional energy trade (share of PE)	100%		0%
	Diversity of trade (index)	Low		High
Economy	Total energy system cost	X trill		Y trill



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