International Trends of Energy Transition

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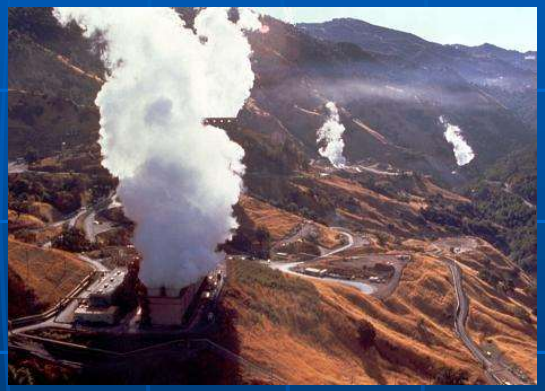
Motivation
Sustainability
Energy sustainability
Transitions: present/future

ENERGY SUSTAINABILITY

Energy Sustainability Requirements

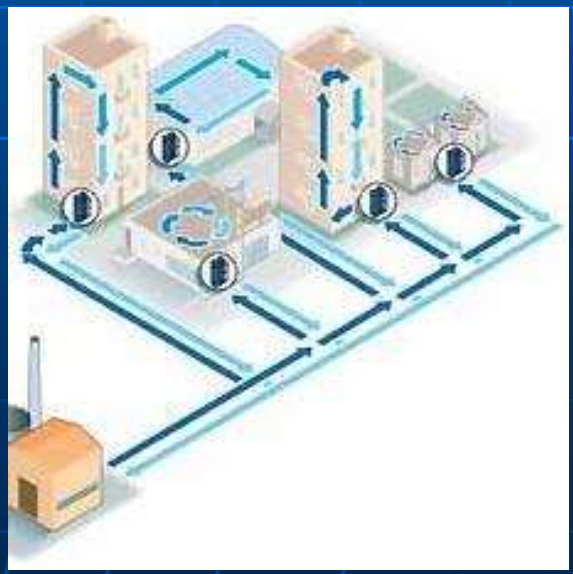
1. Sustainable energy sources



Energy Sustainability Requirements

1. Sustainable energy sources
2. Appropriate energy carriers



Energy Sustainability Requirements

1. Sustainable energy sources
2. Appropriate energy carriers
3. Increased efficiency

Device and system efficiency

Supply-demand matching

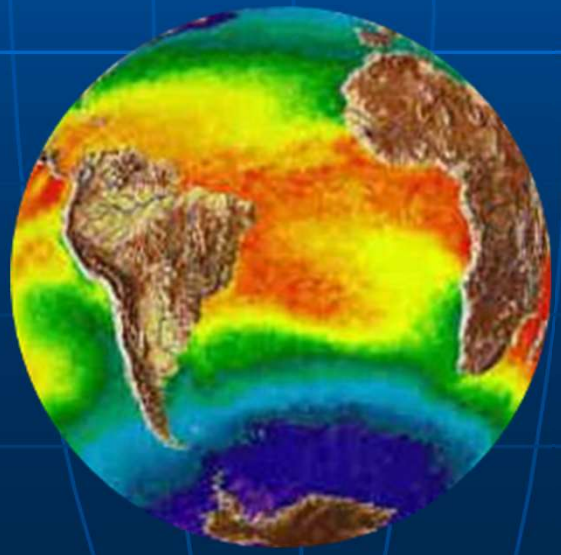
Exergy efficiency

Energy management

Design cities/regions for efficiency

Energy Sustainability Requirements

1. Sustainable energy sources
2. Appropriate energy carriers
3. Increased efficiency
4. Reduced environmental impact



LCA

CCS

Energy Sustainability Requirements

1. Sustainable energy sources
2. Appropriate energy carriers
3. Increased efficiency
4. Reduced environmental impact
5. Satisfy other facets of sustainability

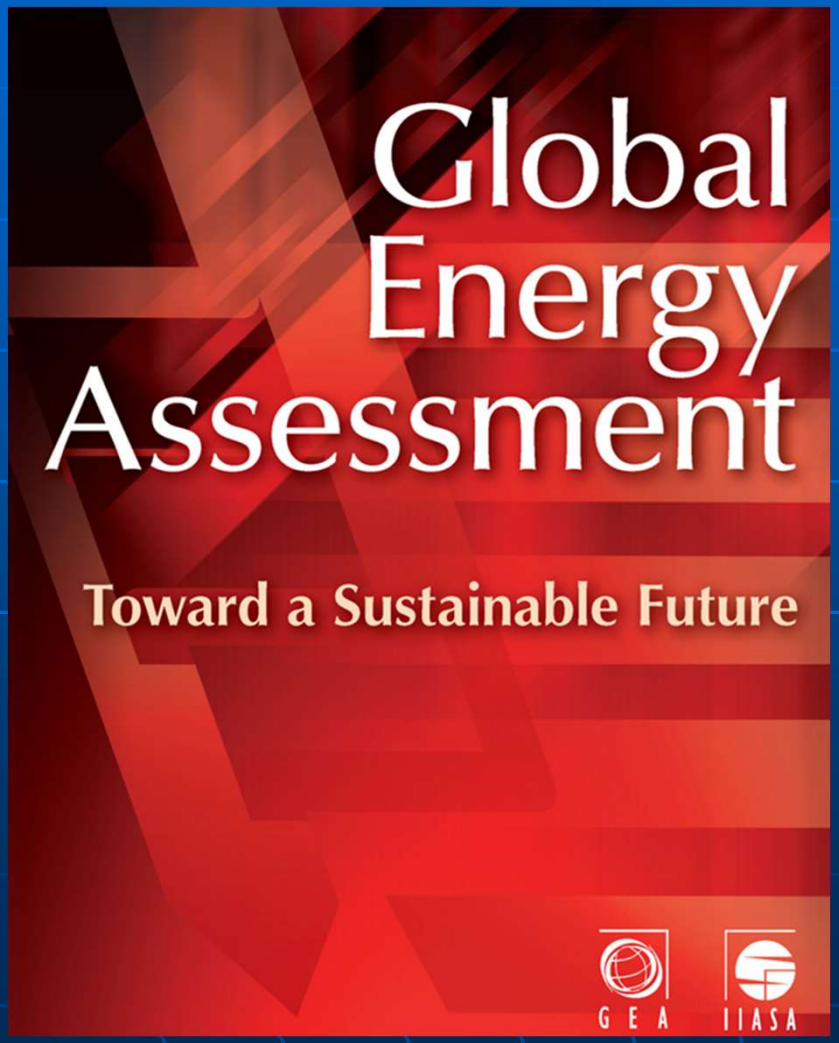
Culture
Attitudes
Policies
Urbanization
Living standards
Ethics
Globalization
Education
Economics
Lifestyle
Laws
Health

TRANSITIONS: PRESENT/FUTURE

Context


Global Energy Assessment
An integrated, multidisciplinary assessment of
the global energy challenges of a CHANGING WORLD
WWW.GLOBALENERGYASSESSMENT.ORG

Key Output



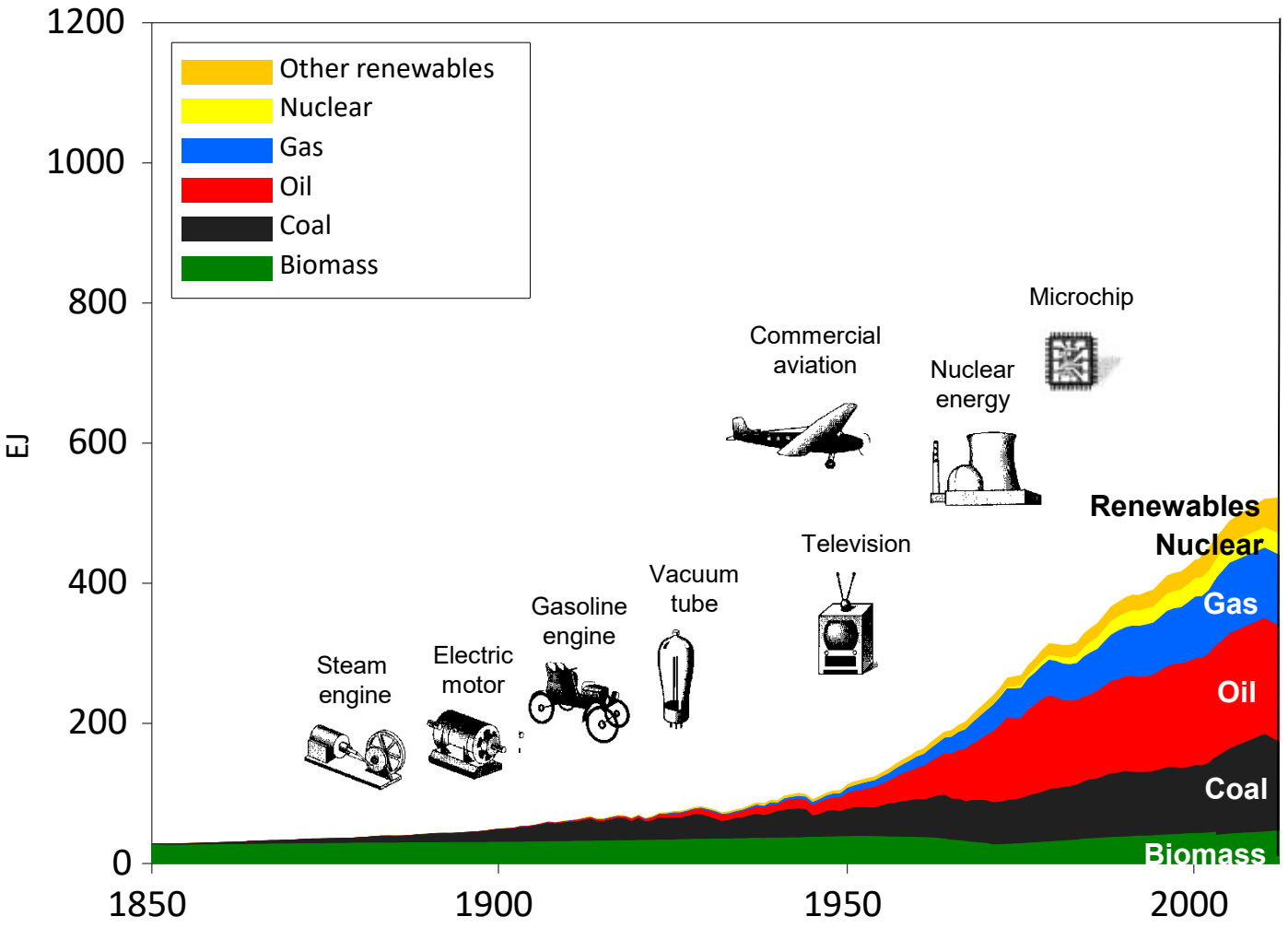
- Published 2012
- 5 year project
- 1900 pages
- 300 authors
- 25 teams
- 200 reviewers
- Assesses present
- Assesses future (40 pathways)
- Global to local

The Global Energy Challenge

- Major transformations are needed for future energy systems to be affordable, safe, secure, and environmentally sound

Global Primary Energy

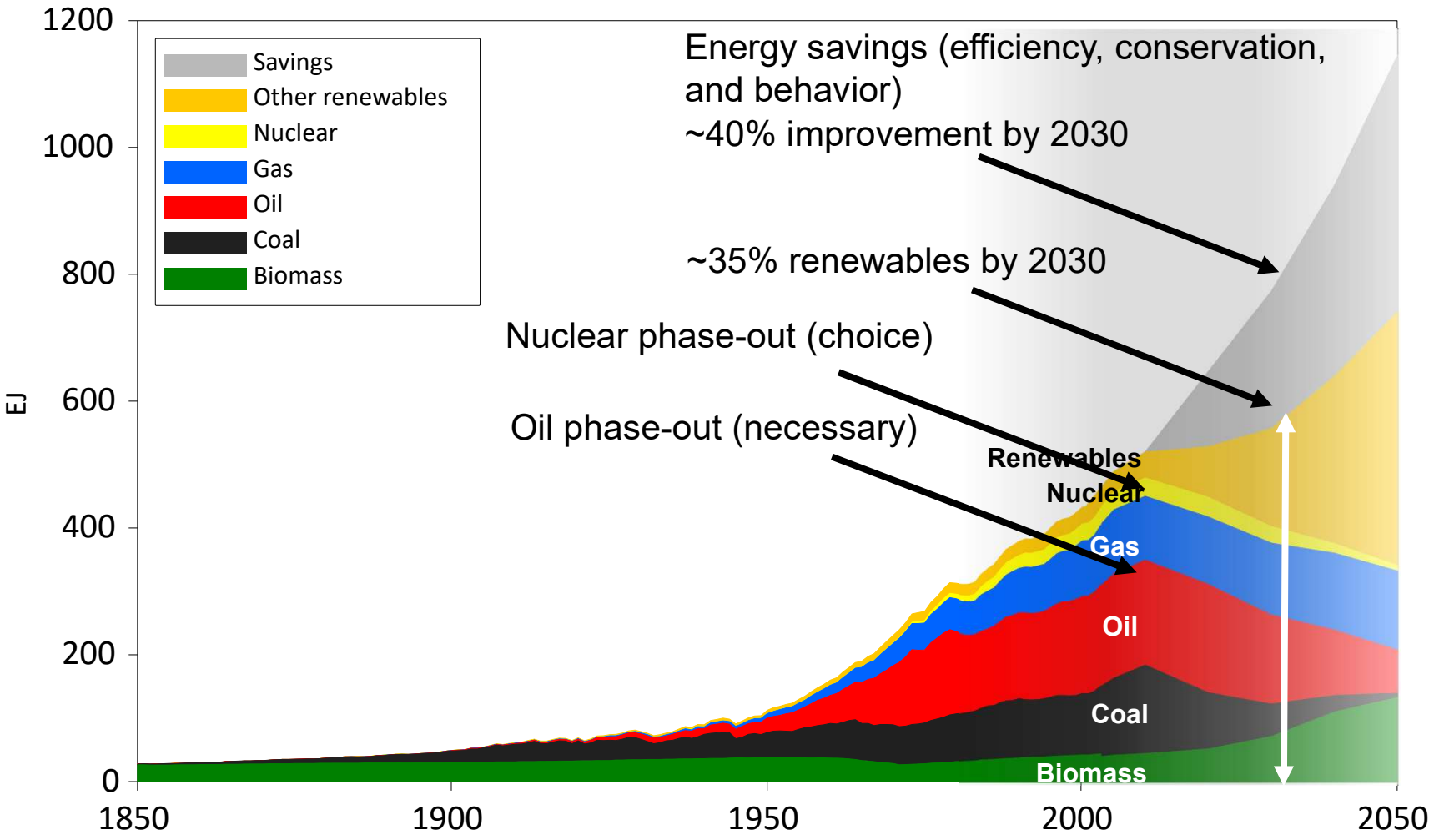
Present



Source: Riahi et al, 2012

Global Primary Energy

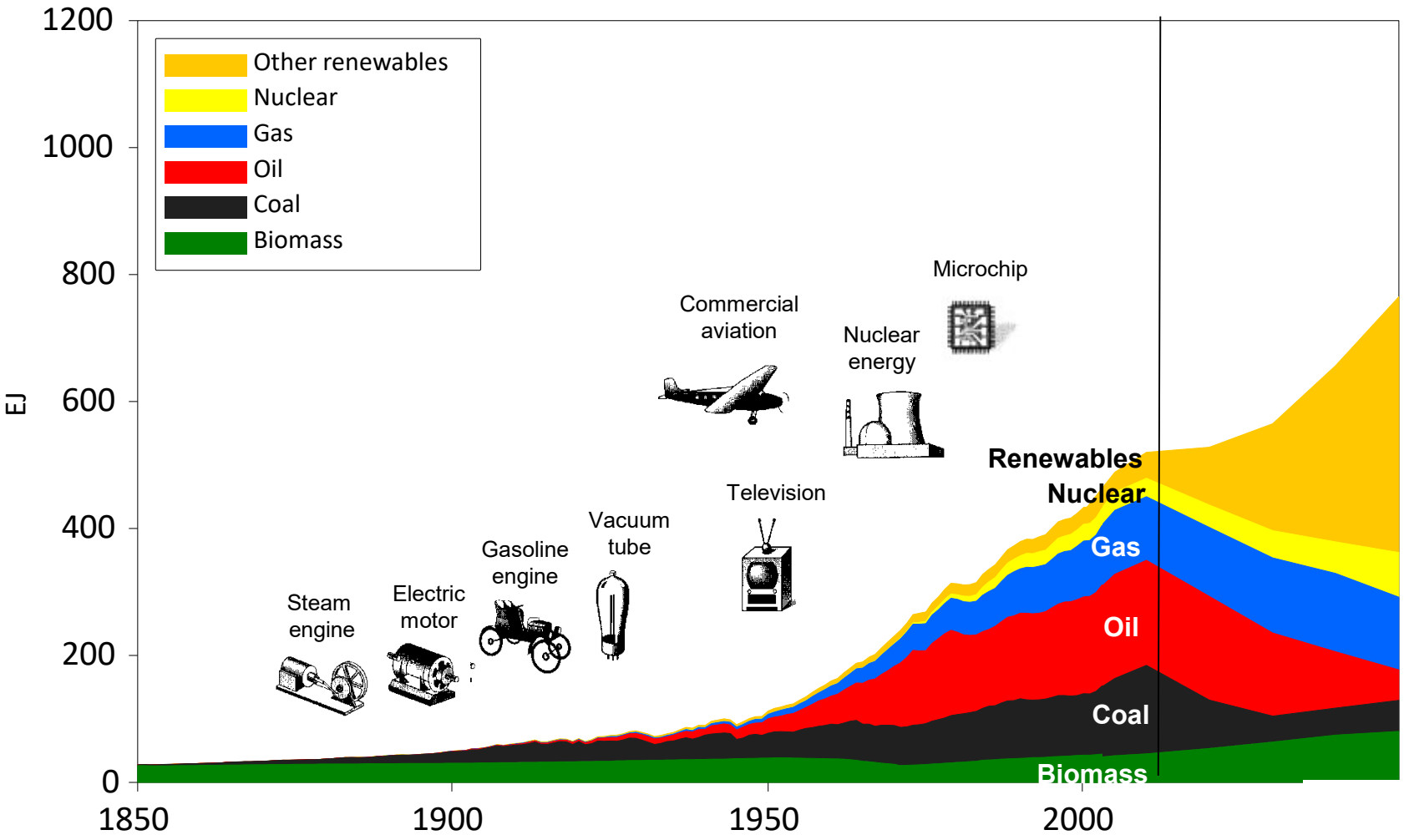
Example Pathway 1 (no CCS, no nuclear)



Source: Riahi et al, 2012

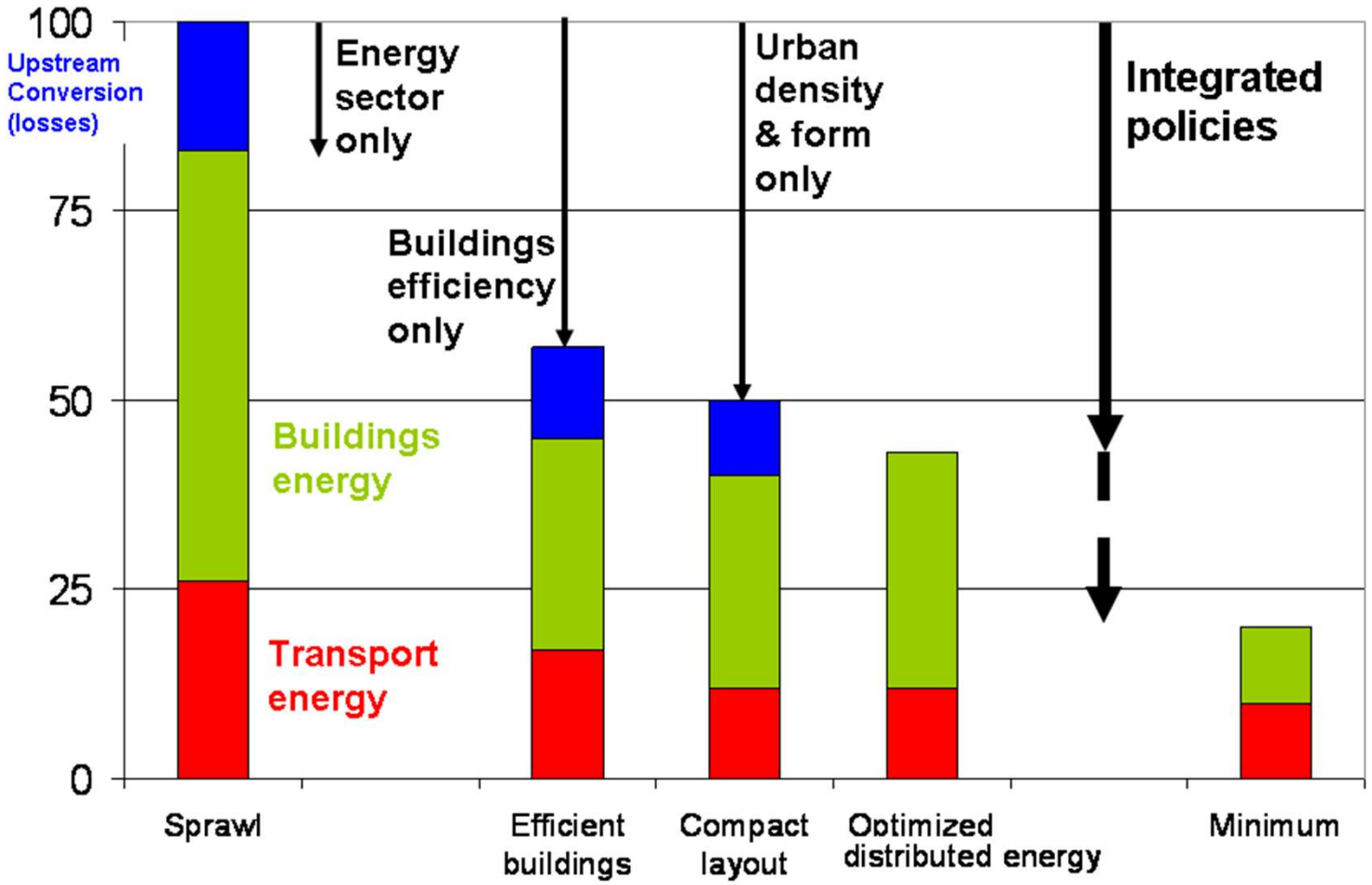
Global Primary Energy

Example Pathway 2



Source: Riahi et al, 2012

Policy Integration at the Urban Scale

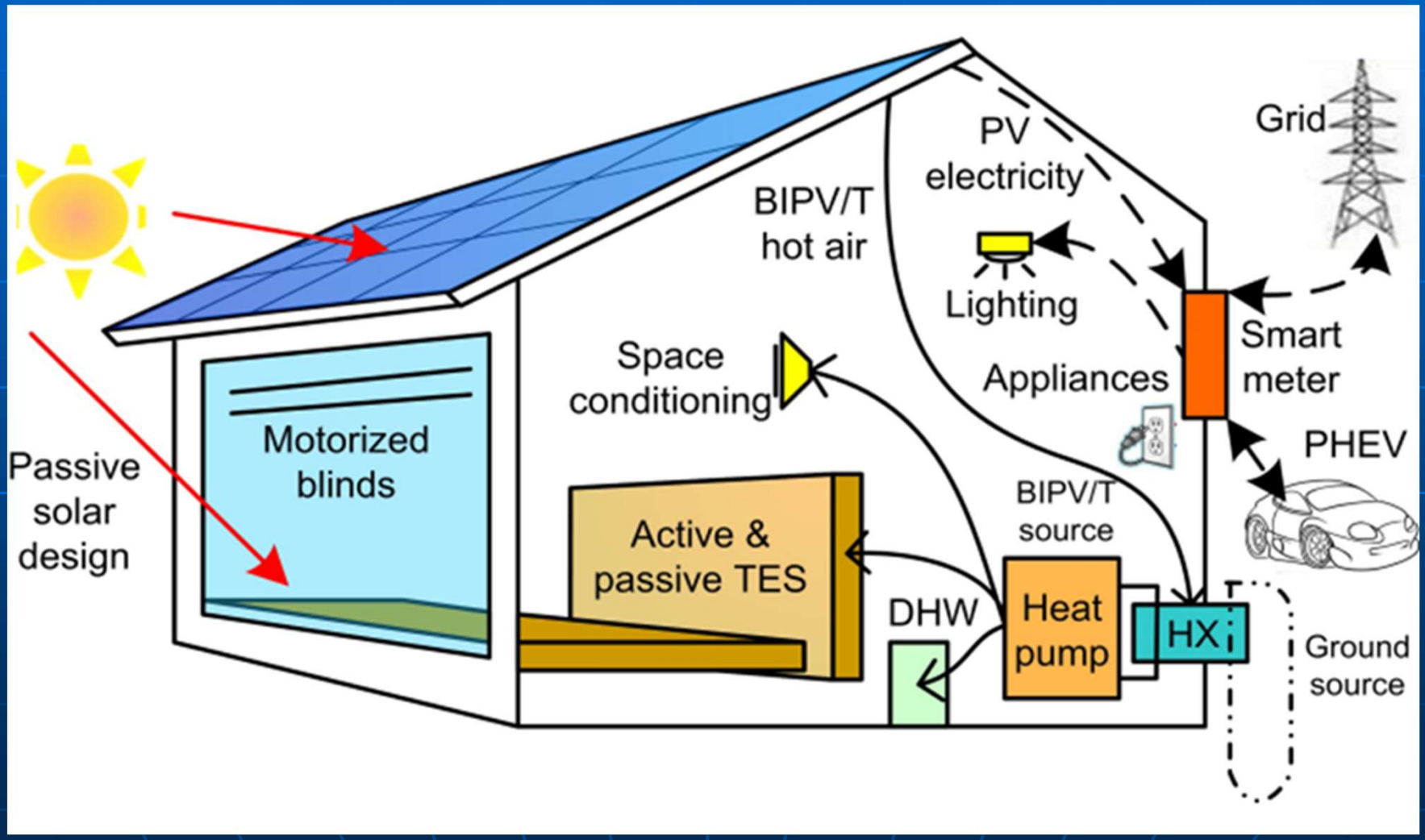


Simulated energy use for an urban settlement of 20,000 inhabitants using SimCity Model combining spatially explicit models of urban form, density, and energy infrastructures, with energy systems optimization

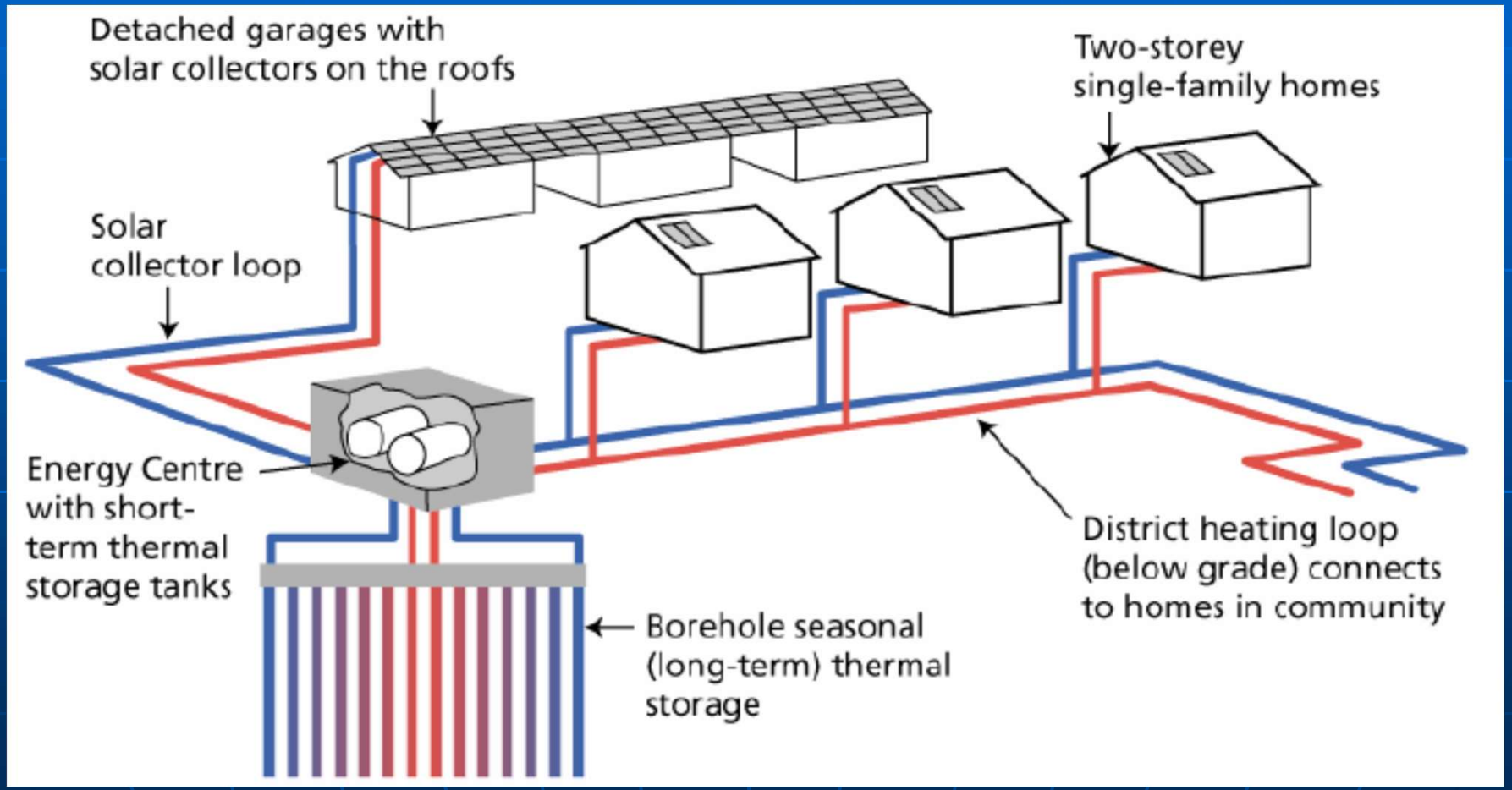
Source: Grubler et al, 2012

ILLUSTRATIONS

Net-zero Energy Buildings



Community Integrated Energy Systems

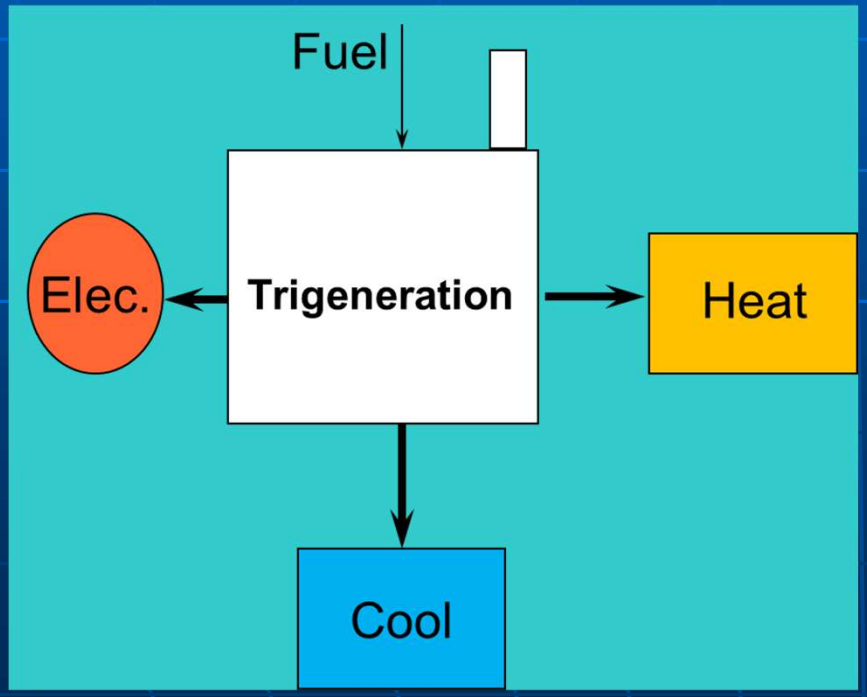


Drake Landing Solar Community, Alberta, Canada

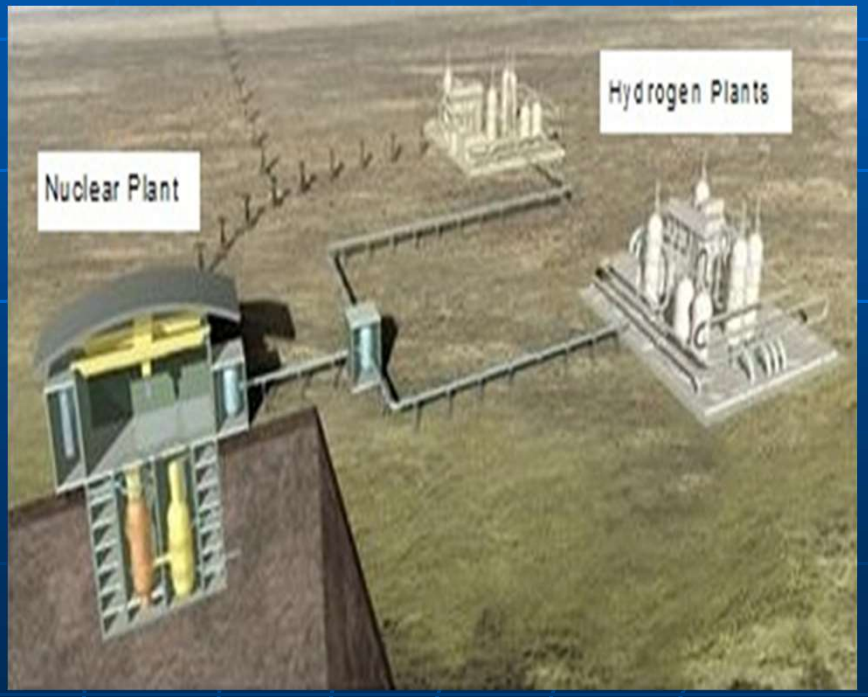
52 Homes, 90% Solar Fraction

Energy Production

Trigeneration and polygeneration



Clean hydrogen production



Energy Tools

Energy storage

Exergy methods and efficiency

the EXERGY crisis

Integrated Energy Systems

Dockside Green, Victoria, BC, Canada

Deep Lake Water Cooling, Toronto

CLOSURE

UN Sustainable Development Goals (2015-30)

Closing

Sustainability: Essential

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Energy sustainability: A critical quest

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Transitions: Key part