INTERNATIONAL LOW-CARBON ENERGY TECHNOLOGY PLATFORM

How2Guide for Bioenergy

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Southeast Asia regional workshop

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International Energy Agency
iea

International Energy Agency

Founded in 1974

- **Formed in wake of 1973 oil embargo with mission to promote member country energy security -- autonomous agency of the Organisation for Economic Cooperation and Development (OECD)**

28 member countries

- **Asia Pacific:** Australia, Japan, Republic of Korea and New Zealand
- **North America:** United States, Canada
- **Europe:** Austria, Belgium, Czech Rep, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey and United Kingdom
- **European Commission** also participates in the work of the IEA
- **Chile and Estonia** are in the process of accession to become members of the IEA

Headquarters: Paris

Decision-making body: Governing Board

- Consists of member country representatives
- Under the Governing Board, several committees are focusing on each area

Secretariat:

- **Staff of around 250,** mainly energy experts and statisticians from its member countries

International Low-Carbon Energy Technology Platform

The Technology Platform is the chief IEA tool for:

- Engaging with Partner countries and organisations on low-carbon energy technologies

- Adapting IEA global analysis to regional and local contexts

Key information

- Created in 2010 upon mandate of the IEA Ministers to foster international collaboration on low-carbon energy technologies

- Three types of activities:

  1. *How2Guide* manuals for roadmap development at the national and regional levels

  2. Multilateral engagement and partnership building

  3. Selected thematic analysis (cross-cutting)

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IEA Technology Roadmaps

- **Highlight pathway(s) to reach large scale use of low-carbon technologies, consistent with Energy Technology Perspectives publication**

- **Focus on the key steps over the next 5-10 years, as well as long-term milestones, including:**
  - Identify barriers and obstacles and how to overcome these
  - Identify key conversion pathways
  - Key RD&D gaps and how to fill them while ensuring sustainability
  - Identify market requirements and policy needs
  - Define international collaboration needs

- **Developed under consultation of industry, governmental and research institutions as well as NGOs**

  Available under: *www.iea.org/roadmaps*

IEA Roadmap process
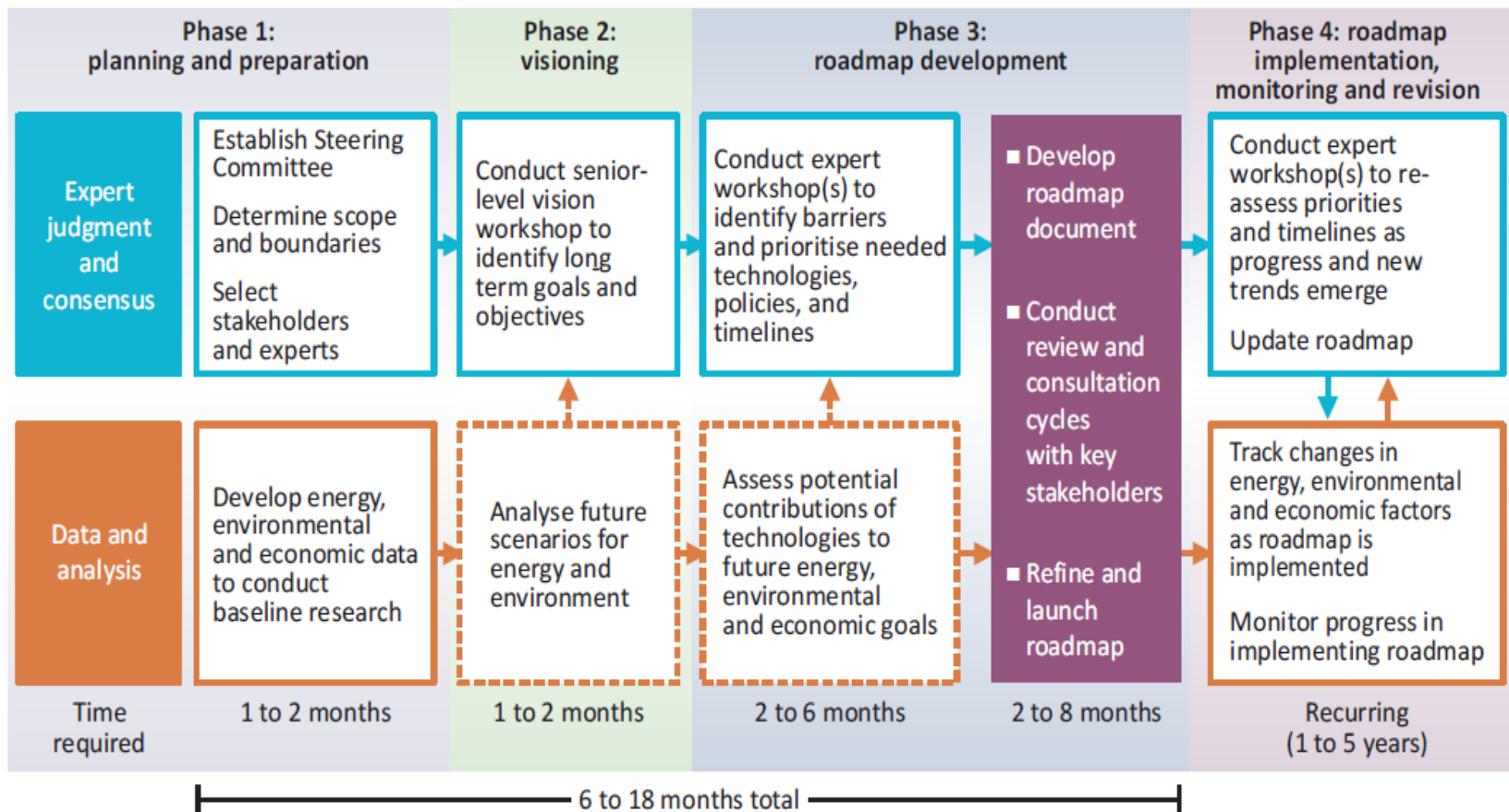
Source: IEA Roadmap Guide (2014). Note: Timescales are indicative.

Dotted lines indicate optional steps, based on analysis capabilities and resources.

How2Guides: concept

What are we doing?

- How2Guides are manuals for policy and decision makers to develop technology roadmaps tailored to national / regional circumstances

Why are we doing this?

- To scale-up IEA capabilities to provide support to countries for national roadmap development
- To enhance the impact of the IEA's technology roadmap programme

Is this only for IEA Members?

- Not at all – developing countries and emerging economies are a key audience for this initiative

Work streams

- *How2Guide for Wind Energy* (released on 10 March 2014)
- ***How2Guide for Bioenergy* (expected Q1 2015)**
- *How2Guide for Smart Grids* (expected in 2015)

How2Guide for Bioenergy (1)

Key elements :

■ **Define the process of developing and implementing a bioenergy technology roadmap**

■ Roadmap methodology guidance through **four steps**, illustrated by case studies

■ **Case studies** from IEA Member and Partner countries (Southern Africa, South East Asia, South America)

■ **Comprehensive decision support toolbox**, including and referencing work of other international/regional organisations

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How2Guide for Bioenergy (3)

Process to developing the *How2Guide for Bioenergy*

Identify key stakeholders and build consensus

Identify tools and related work

Identify barriers and solutions

Production of the H2G publication

How2Guide for Bioenergy (4)

Identify key stakeholders and build consensus

Identify tools and related work

Identify barriers and solutions

Production of the H2G publication

30 Oct. 2013 Inception workshop

Q1 2014 Structure of the H2G report

April 2014 Regional ws South Africa

July 2014 Regional ws South-East Asia

November 2014 Regional ws South America

Q4 2014 Complete draft H2G report

Q1 2015 Publication

Regional expert workshops

- Objectives:
  - ✓ indentify and share regional best practices as well as less successful experiences
  - ✓ understand regional drivers to bioenergy policy and technology deployment
  - ✓ present resources and tools which can be used in support of bioenergy roadmap planning and implementation

- Thematic focus:
  - ✓ Southern Africa: waste-to-energy and biogas
  - ✓ South East Asia: Biomass resources and sustainability of biomass
  - ✓ South America: conventional and advanced biofuels

Technology Roadmap

Bioenergy for Heat and Power
&
Biofuels for Transport

Key role of bioenergy in a low-carbon future

6°C Scenario emissions: 58 Gt ------------>

2°C Scenario emissions: 16 Gt ----------->

- Power generation 42%
- Industry 20%
- Transport 17%
- Buildings 13%
- Other transformation 9%
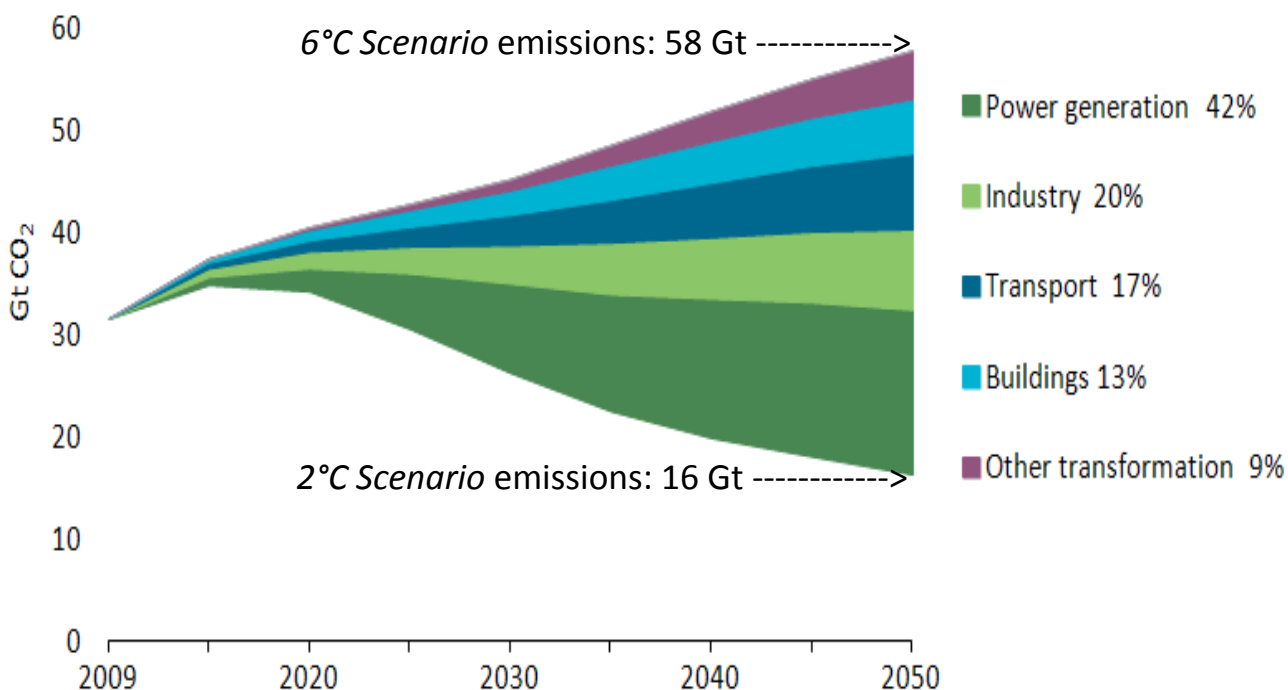
Bioenergy technologies	Emissions reduction in 2050
Bioenergy power	1.0 Gt $CO_{2\text{-}eq}$
Bio-power + CCS	0.3 Gt $CO_{2\text{-}eq}$
Bioenergy heat (industry)	0.5 Gt $CO_{2\text{-}eq}$
Bioenergy heat (buildings)	0.1 Gt $CO_{2\text{-}eq}$
Biofuels	2.1 Gt $CO_{2\text{-}eq}$
Total	**4.1 Gt $CO_{2\text{-}eq}$**

Source: Energy Technology Perspectives 2012

- Reaching the 2DS will require **42 Gt CO_2 annual emissions reduction** by 2050

- Biomass is the only renewable energy source that can make a contribution in all sectors, providing **around 10% of total CO2 emissions reduction**
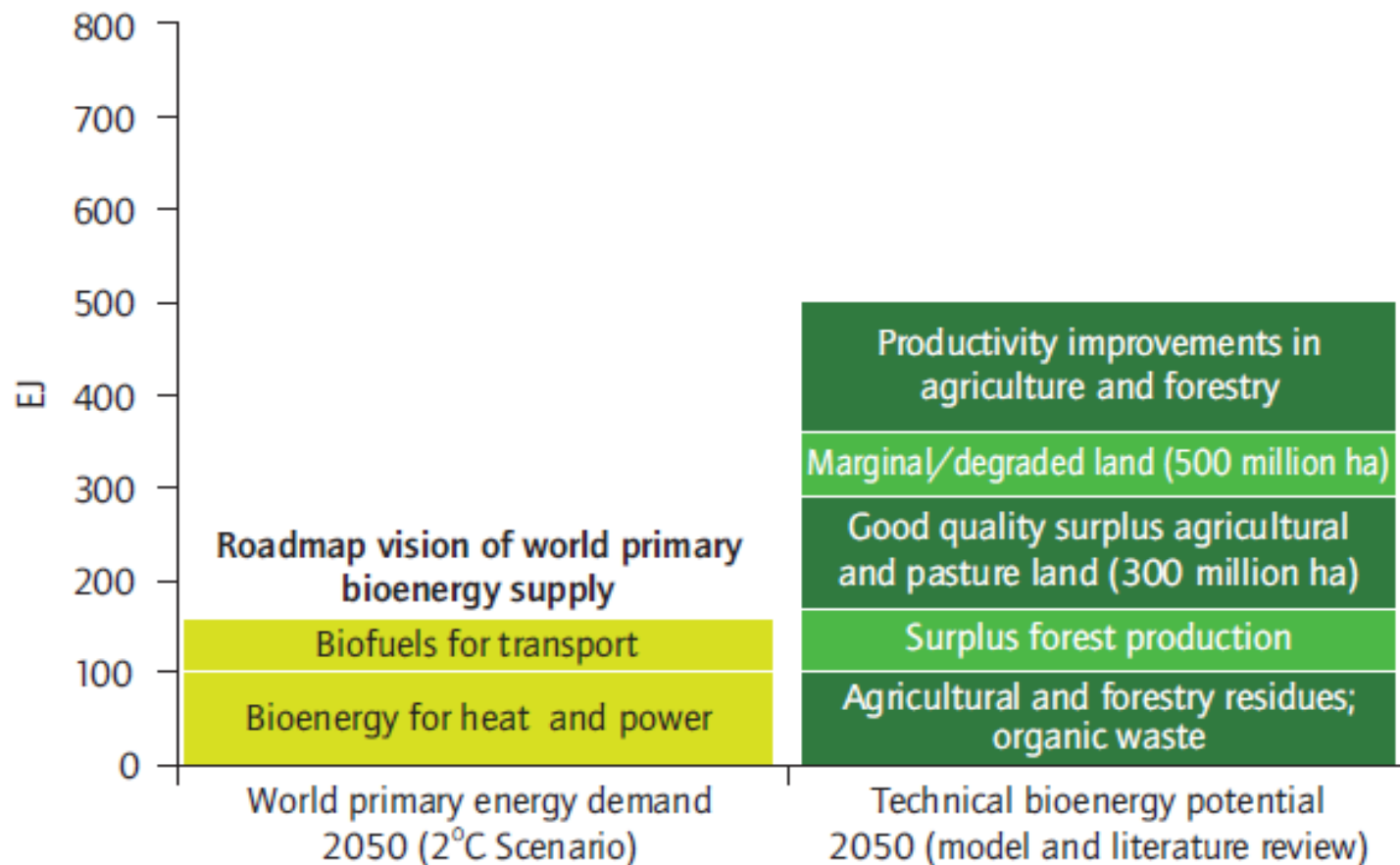
Biomass becoming largest primary energy source in in the 2 Degree Scenario
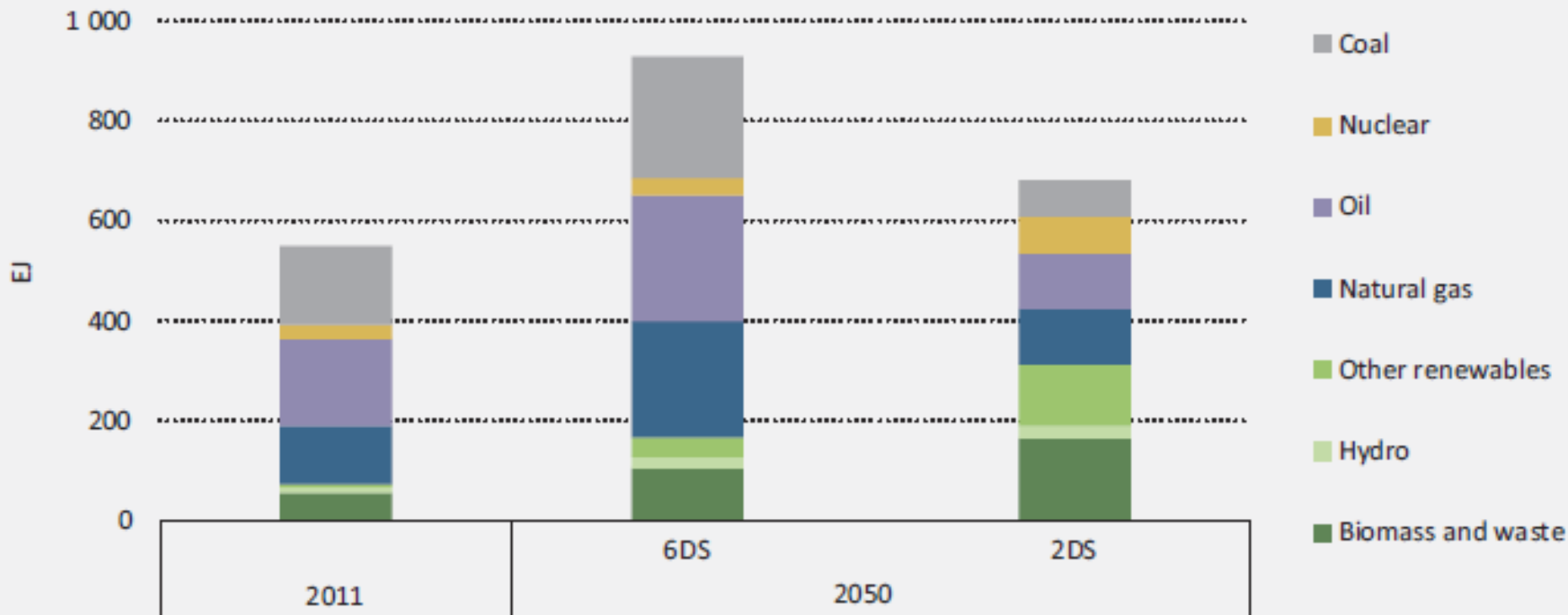
In the 2DS, biomass (and wastes) contribute one quarter of primary energy supply in 2050
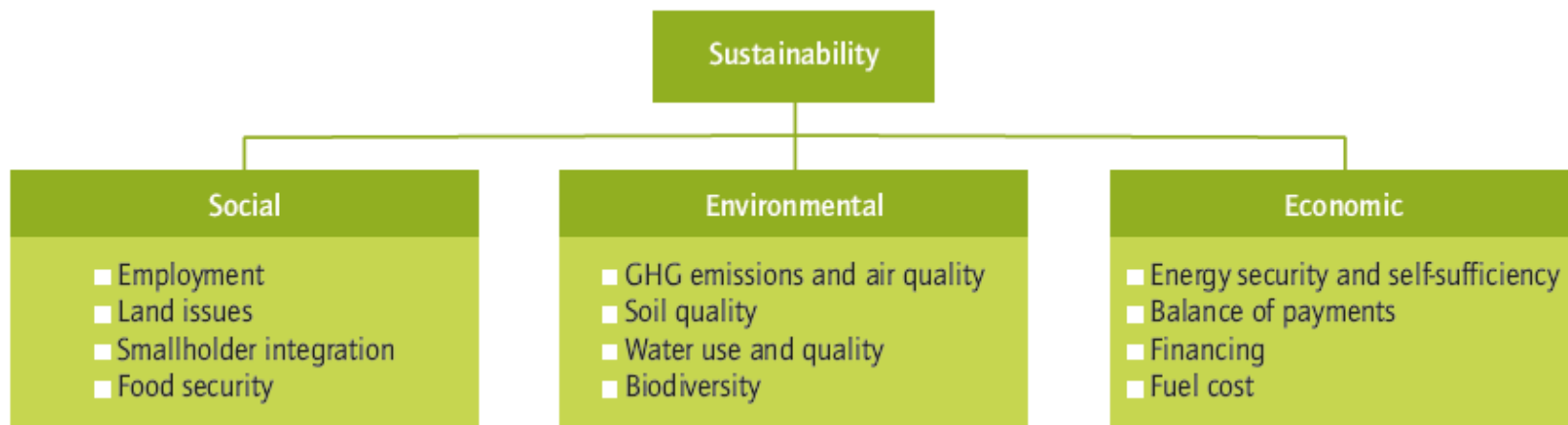
Biomass Supply Prospects – Uncertainties Remain

Source: Based on IPCC SRREN, 2011

- Total biomass demand for heat, power and biofuels reaches 8-11 billion tons in 2050
- Intermediate targets should be adopted to enhance international biomass trade, and assess costs and impact on sustainability

Sustainability of Biofuels

Sustainability

Social	Environmental	Economic
☐ Employment	☐ GHG emissions and air quality	☐ Energy security and self-sufficiency
☐ Land issues	☐ Soil quality	☐ Balance of payments
☐ Smallholder integration	☐ Water use and quality	☐ Financing
☐ Food security	☐ Biodiversity	☐ Fuel cost

- Sound, internationally aligned policies are needed to ensure bioenergy is produced sustainably
  - Certification schemes should be based on international sustainability criteria (as developed *e.g.* by the Global Bioenergy Partnership, GBEP)
- However, most sustainability issues are relevant to the whole agricultural/ forestry sector
- In the long-term, all agricultural and forestry products should be certified, and an overall sustainable land-use management should be aimed for

Overview on Bioenergy Technologies

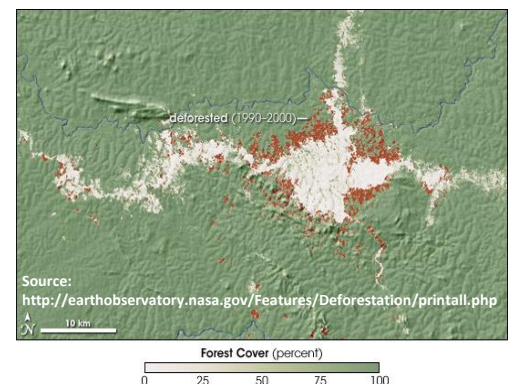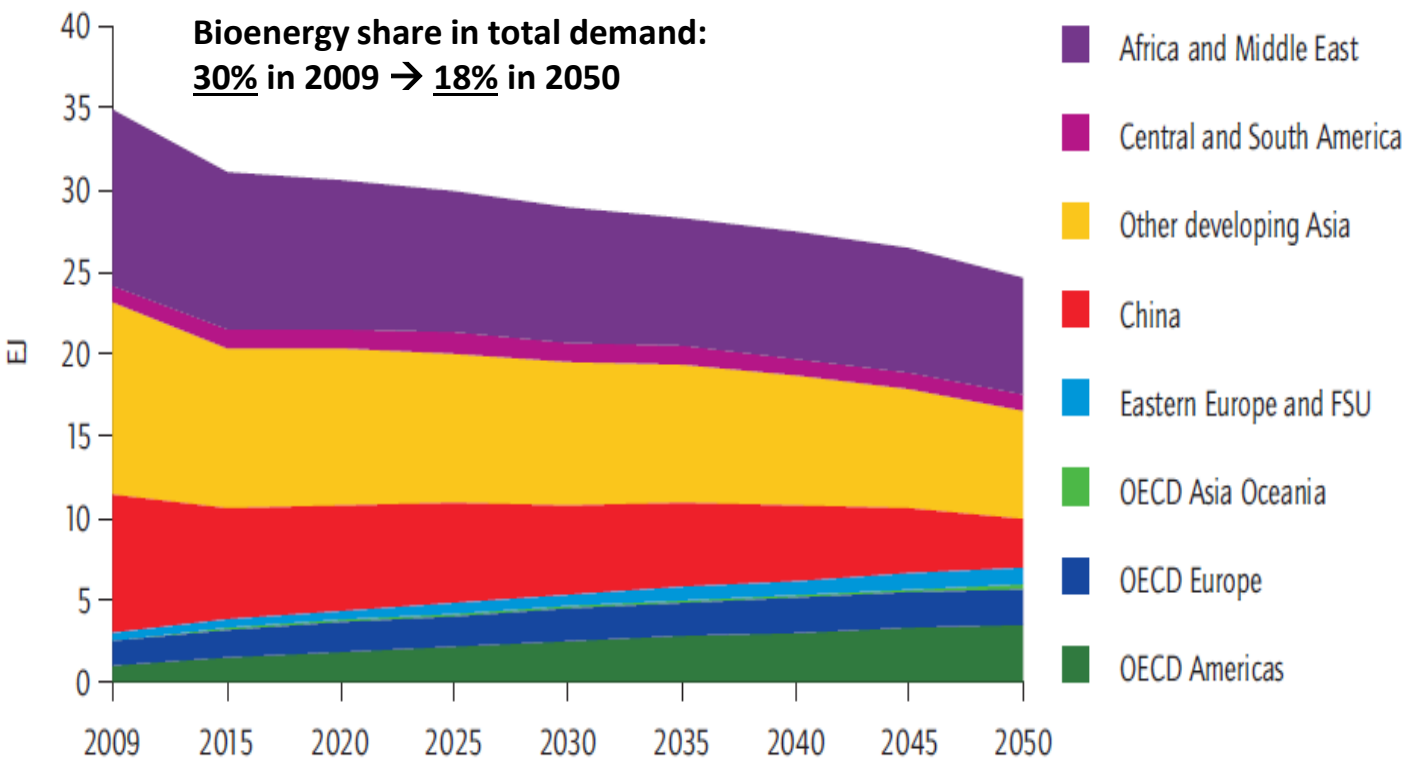|	Basic and applied R&D	Demonstration	Early commercial	Commercial
Biomass pretreatment	Hydrothermal treatment		Torrefaction	Pyrolysis	Pelletisation/ briquetting
Anaerobic digestion	Microbial fuel cells			2-stage digestion / Biogas upgrading	1-stage digestion / Landfill gas / Sewage gas
Biomass for heating			Small scale gasification	Combustion in boilers and stoves
Biomass for power generation				
Combustion		Stirling engine	Combustion with ORC	Combustion and steam cycle
Co-firing		Indirect co-firing	Parallel co-firing	Direct co-firing
Gasification	Gasification with FC	BICGT / BIGCC	Gasification with engine	Gasification with steam cycle

Note: ORC = Organic Rankine Cycle; FC = fuel cell; BICGT = biomass internal combustion gas turbine; BIGCC = biomass internal gasification combined cycle

Source: Modified from Bauen et al., 2009

- Some promising technologies still need RD&D support to reach commercial-scale
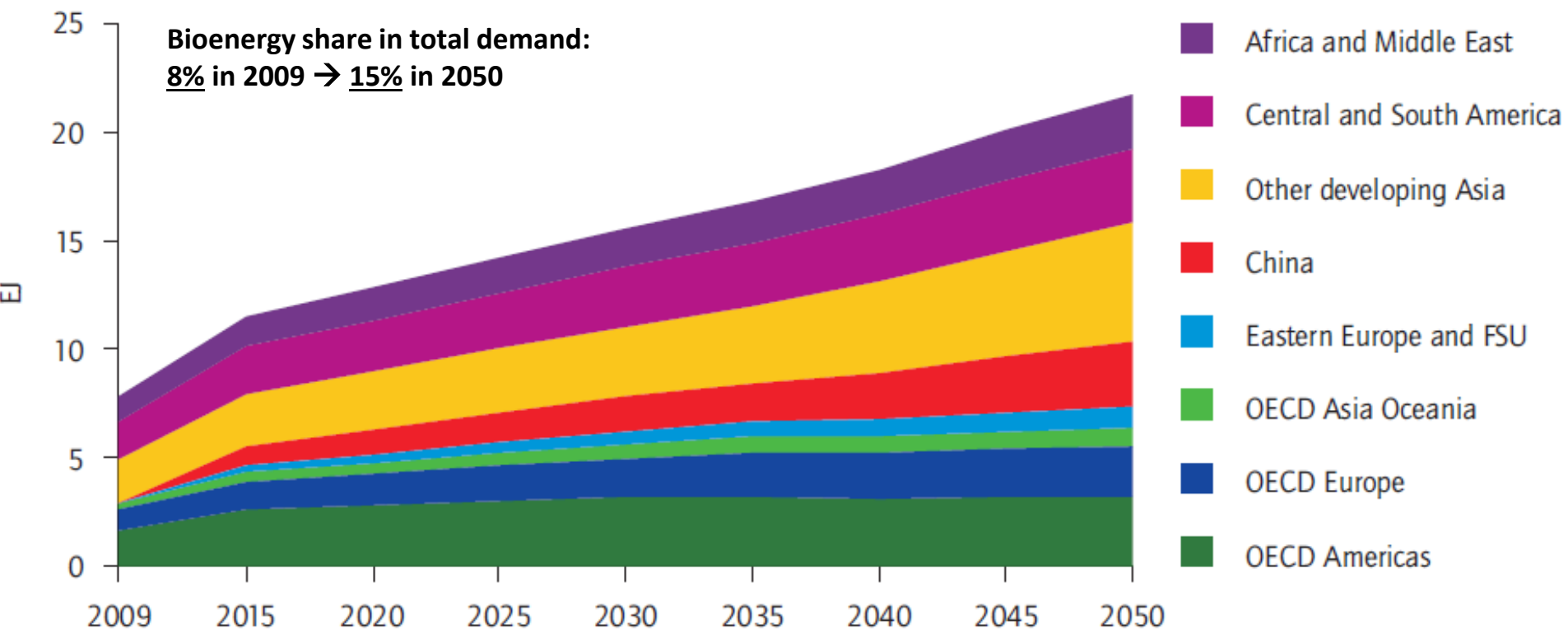
Bioenergy consumption in buildings declines

Bioenergy share in total demand:
<u>30%</u> in 2009 → <u>18%</u> in 2050

Legend:
- Africa and Middle East
- Central and South America
- Other developing Asia
- China
- Eastern Europe and FSU
- OECD Asia Oceania
- OECD Europe
- OECD Americas

Source: www.energyfordevelopment.com

deforested (1990–2000)

Source:
http://earthobservatory.nasa.gov/Features/Deforestation/printall.php

Forest Cover (percent)
0   25   50   75   100

- **Bioenergy in buildings is pre-dominantly traditional biomass**
  - → subject to low efficiency; negative health and environmental impact
- **New stoves, alternative fuels and more energy-efficient buildings key to reduce traditional biomass use**

Industry set to triple consumption of bioenergy for heat

Bioenergy share in total demand:
8% in 2009 → 15% in 2050

Legend:
- Africa and Middle East
- Central and South America
- Other developing Asia
- China
- Eastern Europe and FSU
- OECD Asia Oceania
- OECD Europe
- OECD Americas

- **Bioenergy is becoming increasingly important for production of <u>high temperature</u> heat**
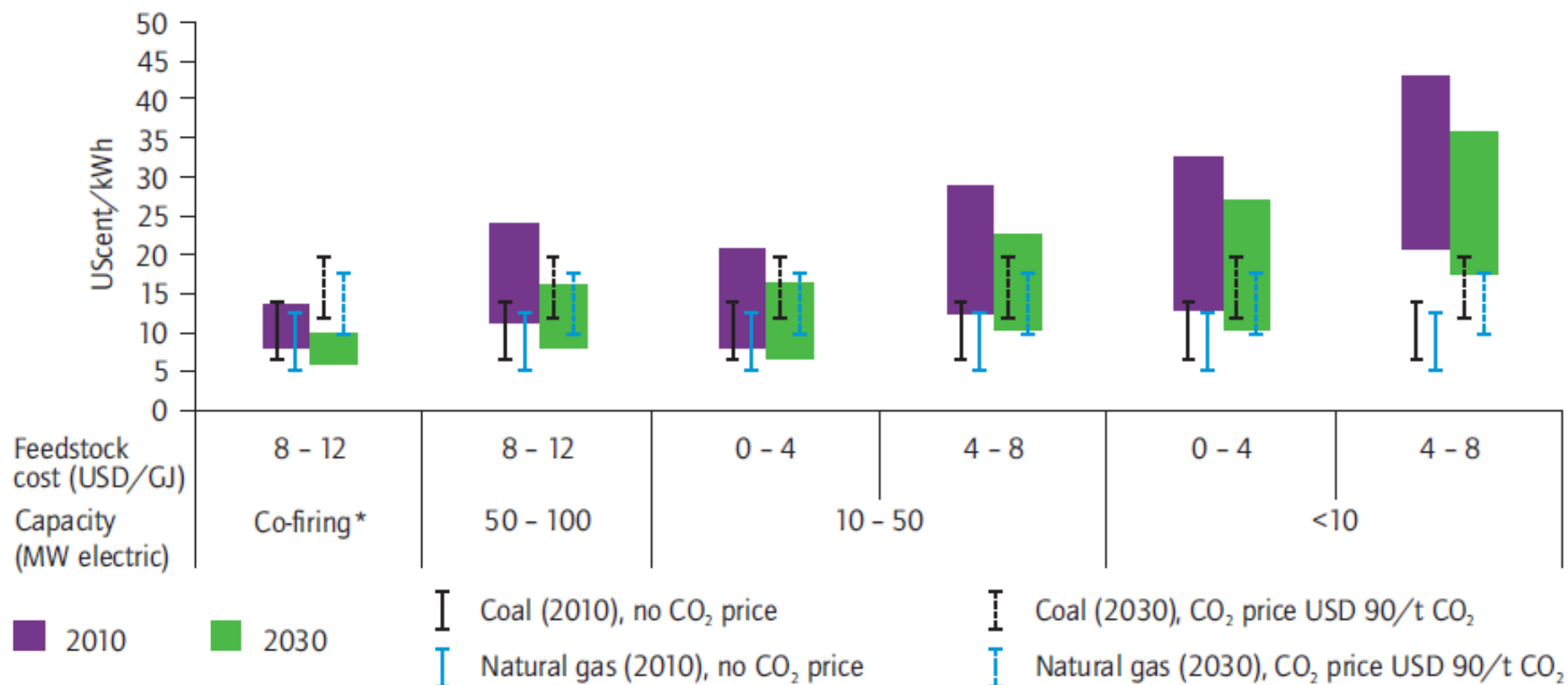
World bioenergy electricity supply to grow more then ten-fold
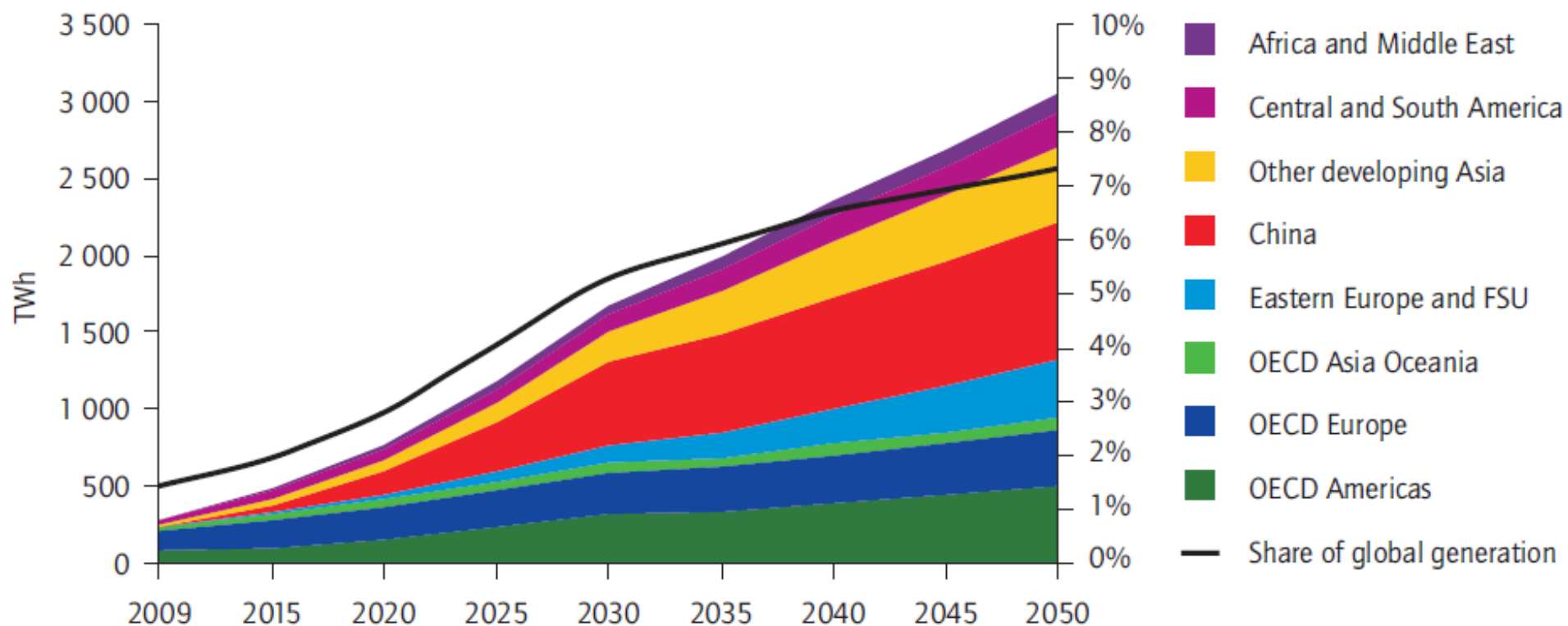
- **Share in total electricity generation increases from 1.5% today, to 7.5% in 2050**
- **Bioenergy provides firm capacity and dispatchable electricity**

# Bioenergy electricity generation costs are strongly scale-dependent

*Co-firing costs relate only to the investment in additional systems needed for handling the biomass fuels, with no contribution to the costs of the coal-fired plant itself. Fossil electricity generation costs are not capacity specific.

Source: IEA analysis based on DECC (2011), IPCC (2011), Mott MacDonald (2011), Uslu et al. (2012).

Advanced biofuels to play a key role in the long-run
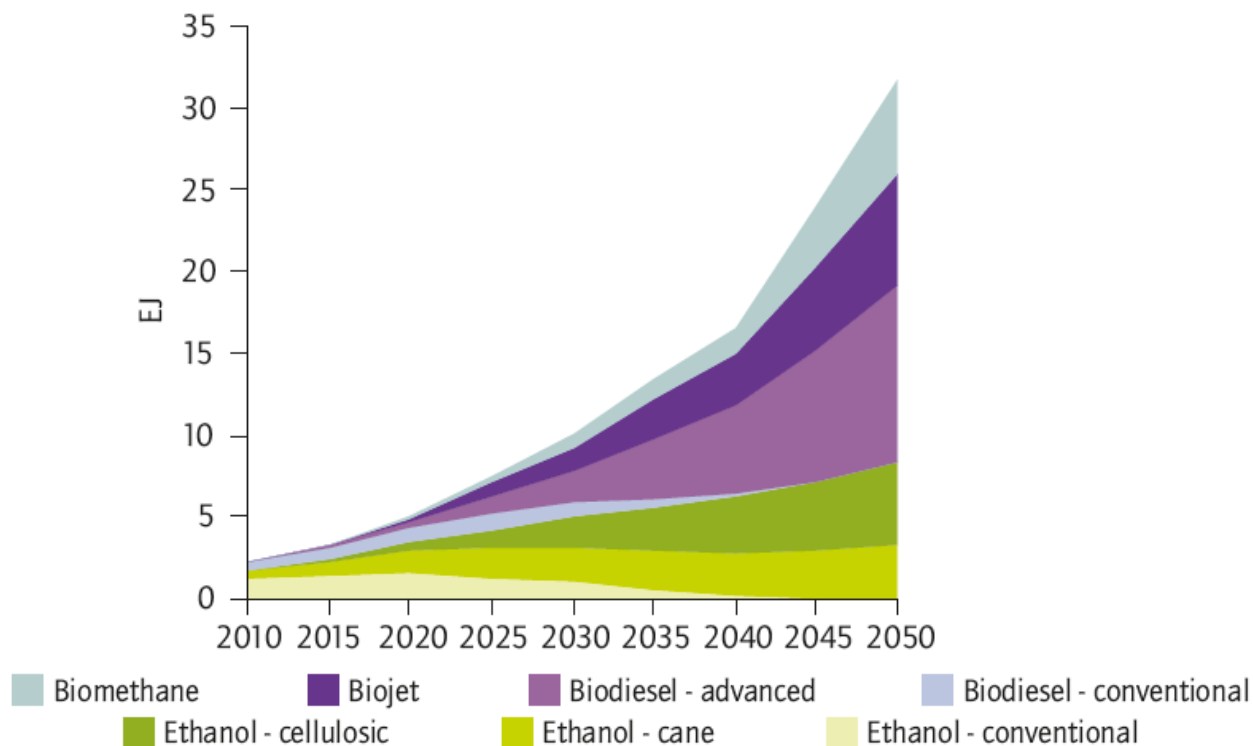
- Global biofuel supply grows from **2.5 EJ** today to **32 EJ in 2050**
  - Biofuels share in total transport fuel increases from **2%** today, to **27%** in 2050

- Biofuels are the only low-carbon fuel alternative for heavy, long-distance transport

- Trade will be needed to balance supply and demand for feedstocks and biofuels

The Need for Regional / National Roadmaps

■ **Bioenergy and biofuels development requires action on regional / national / local level**

- Sustainable biomass potential, land availability
- Access to and suitability of different technologies
- Availability and need for skilled labour
- Impact on environment, local economy

■ **National / regional roadmaps can be powerful tools:**

- Aligning interests and expectations of relevant stakeholders
- Identifying steps and timing needed to achieve a chosen future
- Generating buy-in and support that leads to real action
- Monitoring progress against milestones and adjusting the plan as needed

Thank you for your attention!

- **IEA Technology Roadmap: Biofuels for Transport (2011)**
- **IEA Technology Roadmap: Bioenergy for Heat and Power (2012)**

  www.iea.org/roadmaps

- **Medium-Term Renewable Energy Market Report (2014 edition to be launched 28 August)**

- **Bioenergy Perspectives (upcoming, 2015)**