



Anselm Eisentraut
Bioenergy Analyst

Outlook for Biofuels in the Medium- and Long-Term

Antwerp, 17.11.2011



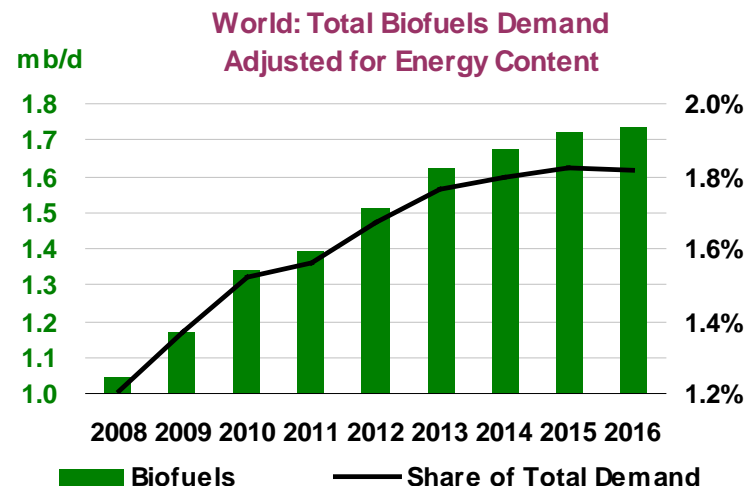
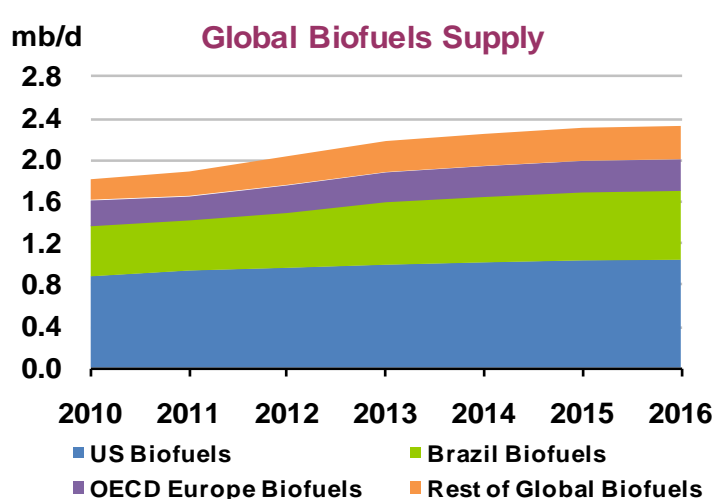
MEDIUM-TERM
OIL & GAS
MARKETS

2011



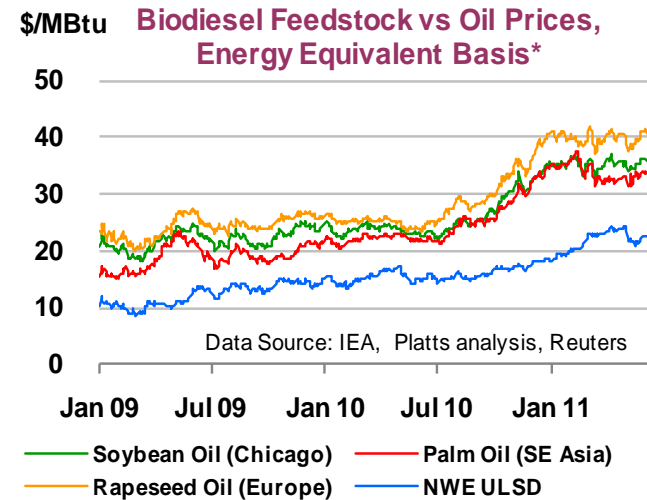
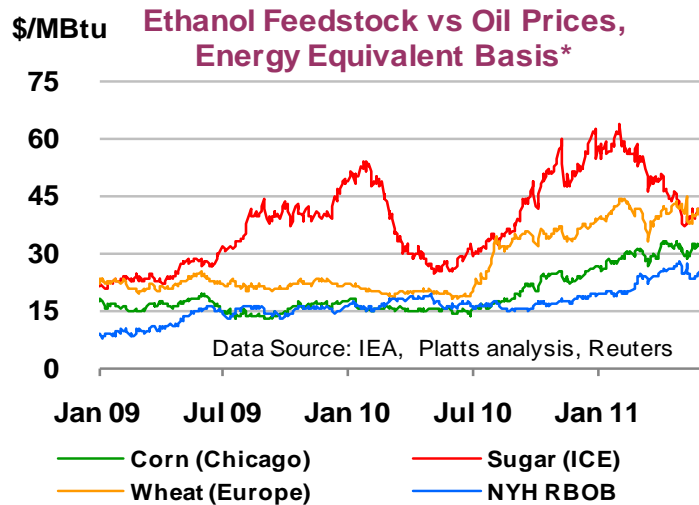
International
Energy Agency

Global Biofuel Production – Medium-Term Outlook



- Global biofuels production rises from 1.8 mb/d (105 billion L) in 2010 to 2.3 mb/d (135 billion L) in 2016
 - A total increase of 0.5 mb/d...
 - ...equivalent to an average yearly growth of 4.3% or 90 kb/d
- On an energy adjusted basis versus oil, biofuels supply increases from 1.3 mb/d (2.4 EJ) in 2010 to 1.7 mb/d (3.4 EJ) in 2016
 - Energy adjusted supply growth to meet 9% of gasoline and gasoil growth, with ethanol at 24% of gasoline growth and biodiesel at 4% of gasoil growth
 - Yet, in 2016, biofuels satisfy only 1.8% of total global demand

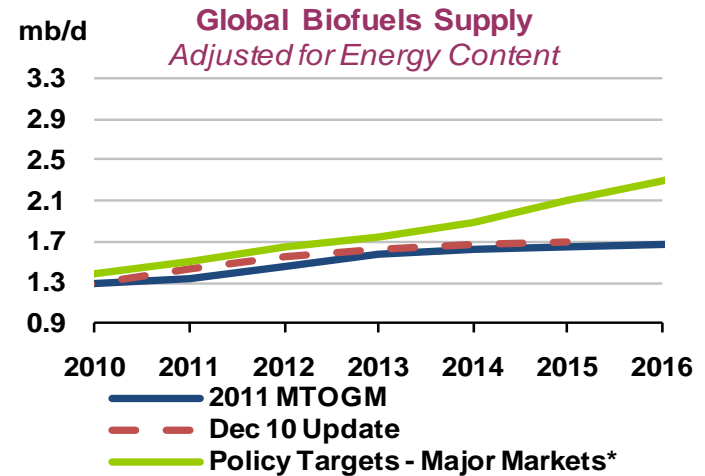
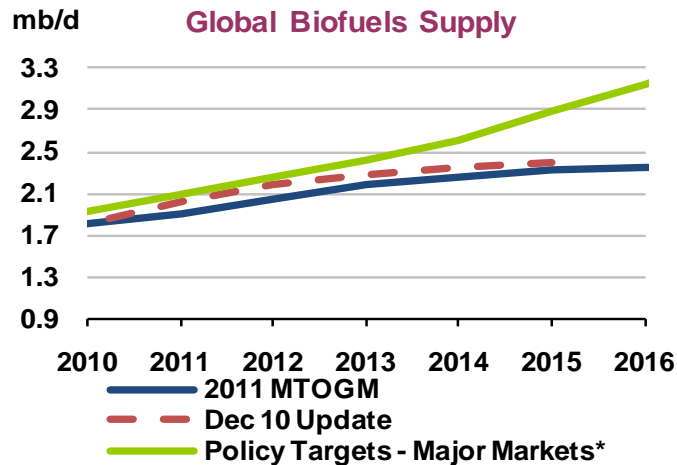
Ever-present feedstock price risk...



* Agricultural prices expressed in terms of the energy value of liquid fuels – ethanol or biodiesel – produced. Values are indicative and do not reflect local price or operating cost differentials nor revenues from co-generation or by-products such as dried distillers grains.

- **Slowing production growth due to rising agricultural feedstock prices**
 - Difficult weather, strong emerging market demand, and increased energy costs have all tightened commodity balances
 - Feedstock prices likely to remain volatile
- **In the medium-term, agriculture markets should adjust over time and conversion costs should continue to fall, supportive of increased biofuels output**

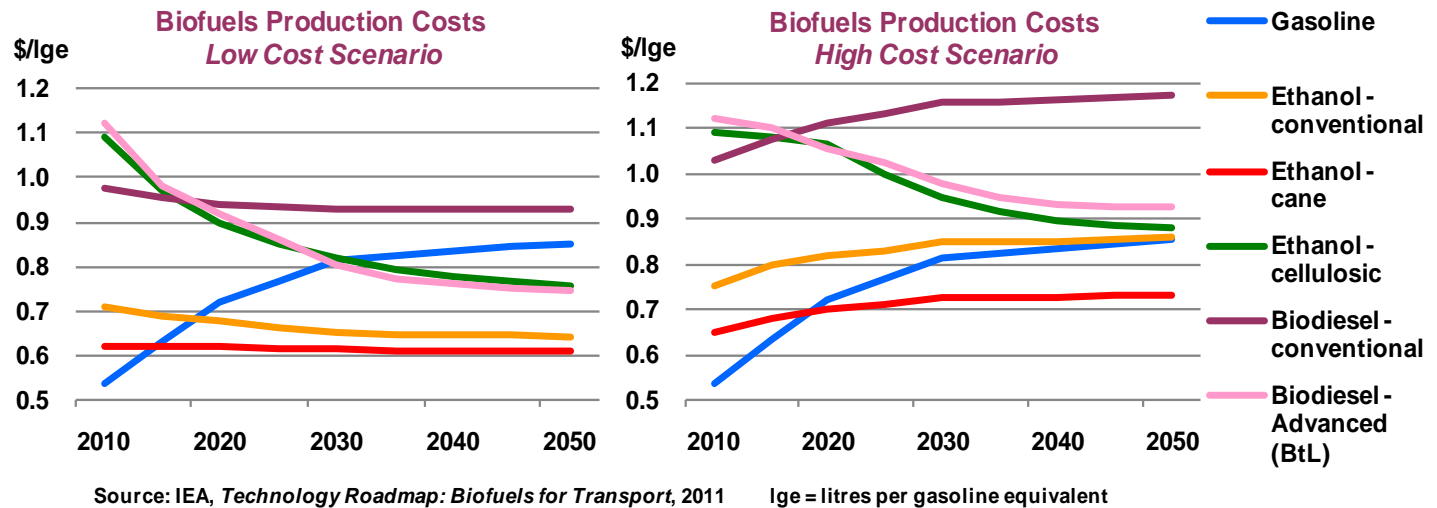
... though policy support remains



*Implied output from national level usage and/or production targets in the US, Canada, Brazil, Argentina, Colombia, Peru, the European Union, Japan, Korea, Australia, China, India, Indonesia, Malaysia and Thailand

- **Government policies – blending mandates, production subsidies and blenders' credits – are now in place in more than 50 countries**
 - Mandates/targets rise, with Argentina, Canada, Thailand, Peru, Malaysia and Germany all increasing blending volumes... but financial incentives under threat in age of fiscal austerity
- 2010-2016 growth of 520 kb/d undershoots by 670 kb/d potential supply increases, were national level policy targets to be met
- Yet, combined with challenging economics, other policy actions – concerning sustainability, domestic pricing, advanced biofuels, food security, technical specifications and infrastructure – may impact potential output

Advanced biofuels to play important role... in the long run



- IEA's biofuels technology roadmap sees advanced biofuels playing significant role in long term transport emissions goals – vision would require 225 kb/d (gasoline equivalent) by 2016
- Yet, medium term is highly uncertain - notably regarding financing and production economics – despite production targets/incentives in US and EU
- Producers face challenge of reducing capital requirements, improving conversion efficiency and sourcing feedstocks
 - Advanced biofuels may reach cost parity by 2030, though individual producers may achieve breakthroughs before than
 - But if oil price rises accompanied by higher agricultural prices, competitiveness could shift further out
- Over medium term, capacity may rise from 20 kb/d in 2010 to 100-130 kb/d in 2016

2010

2015

2020

2025

2030

2035

2040

2045

2050



Technology Roadmap

Biofuels for Transport



IEA Technology Roadmaps

- Roadmaps are intended to:
 - 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

For more information: www.iea.org/roadmaps

- IEA Technology Roadmap - Biofuels for Transport

- Developed under consultation of industry, governmental and research institutions as well as NGOs
- Closely linked to forthcoming Technology Roadmap on **Bioenergy for Heat and Power**



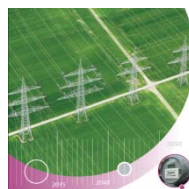
Technology Roadmap
Concentrating Solar Power

Concentrated Solar Power



Technology Roadmap
Electric and Plug-in Hybrid Vehicles

Electric & Plug-in Hybrid Vehicles



Technology Roadmap
Smart Grids

Smart Grids



Technology Roadmap
Solar photovoltaic energy

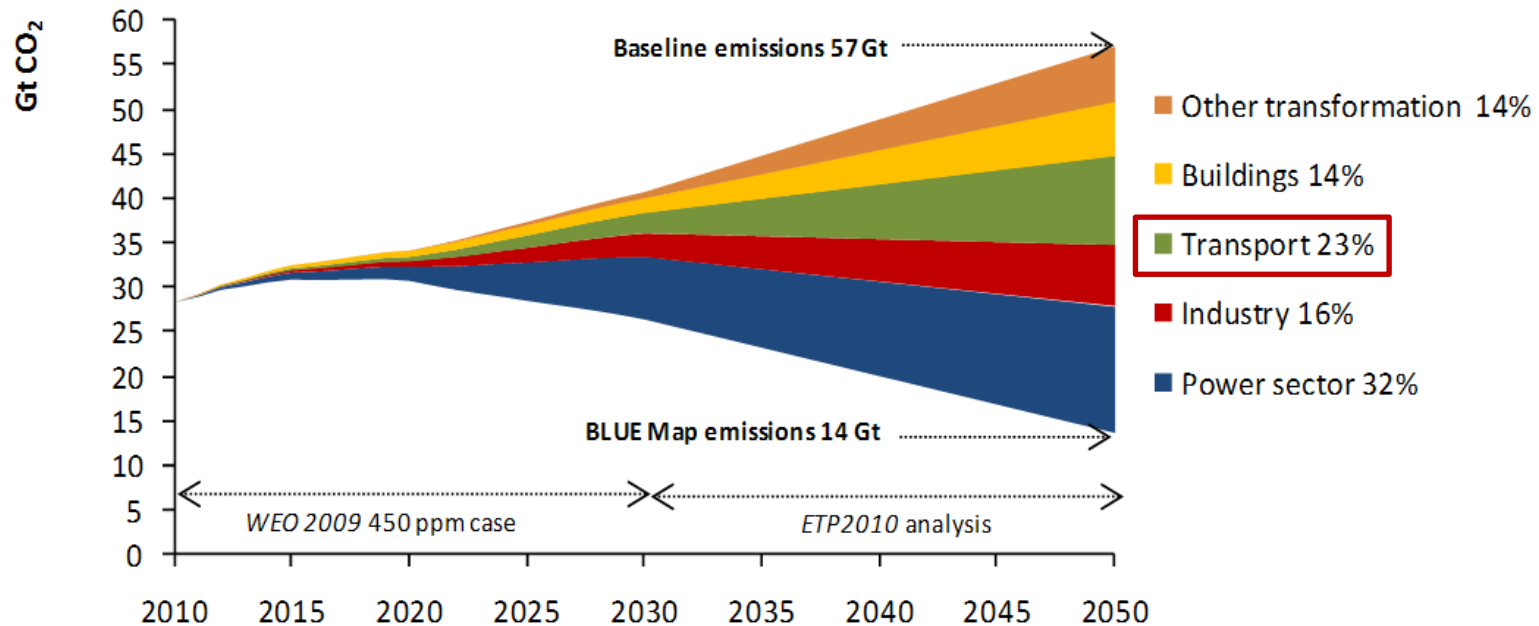
Solar Photovoltaic Energy



Technology Roadmap
Wind energy

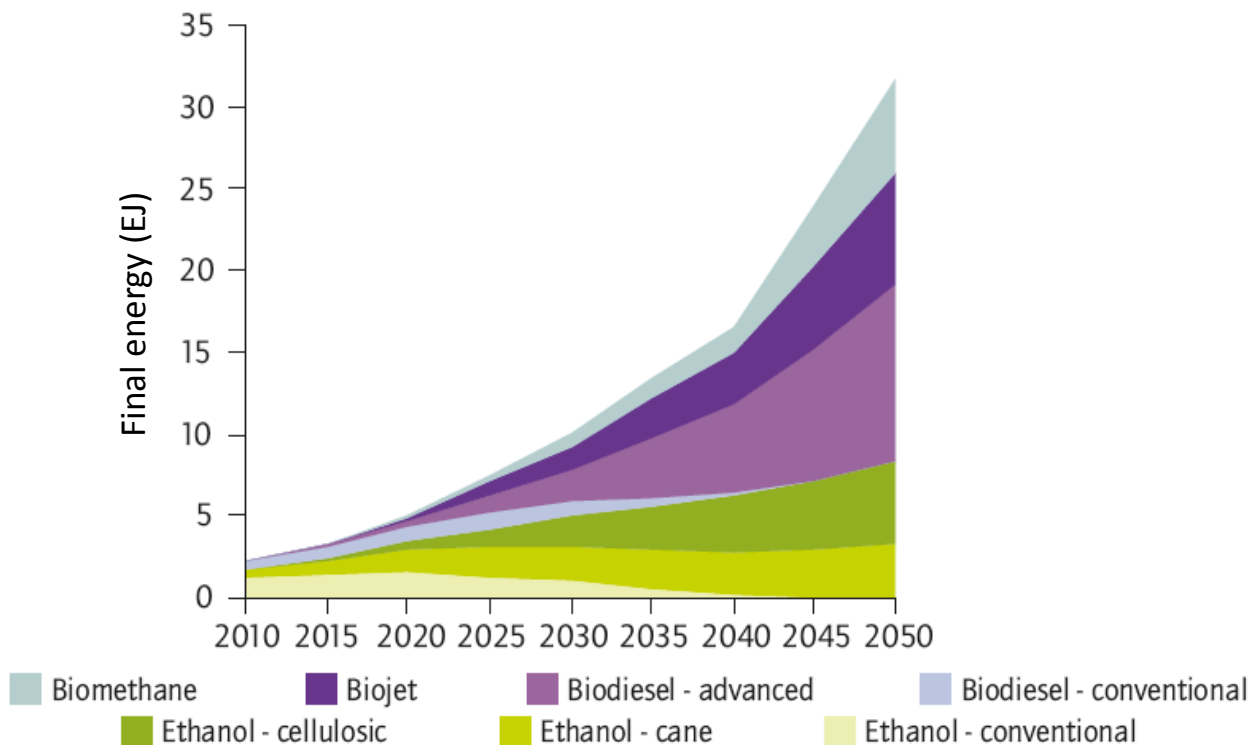
Wind Energy

The BLUE Map Scenario – Towards a low-carbon energy sector



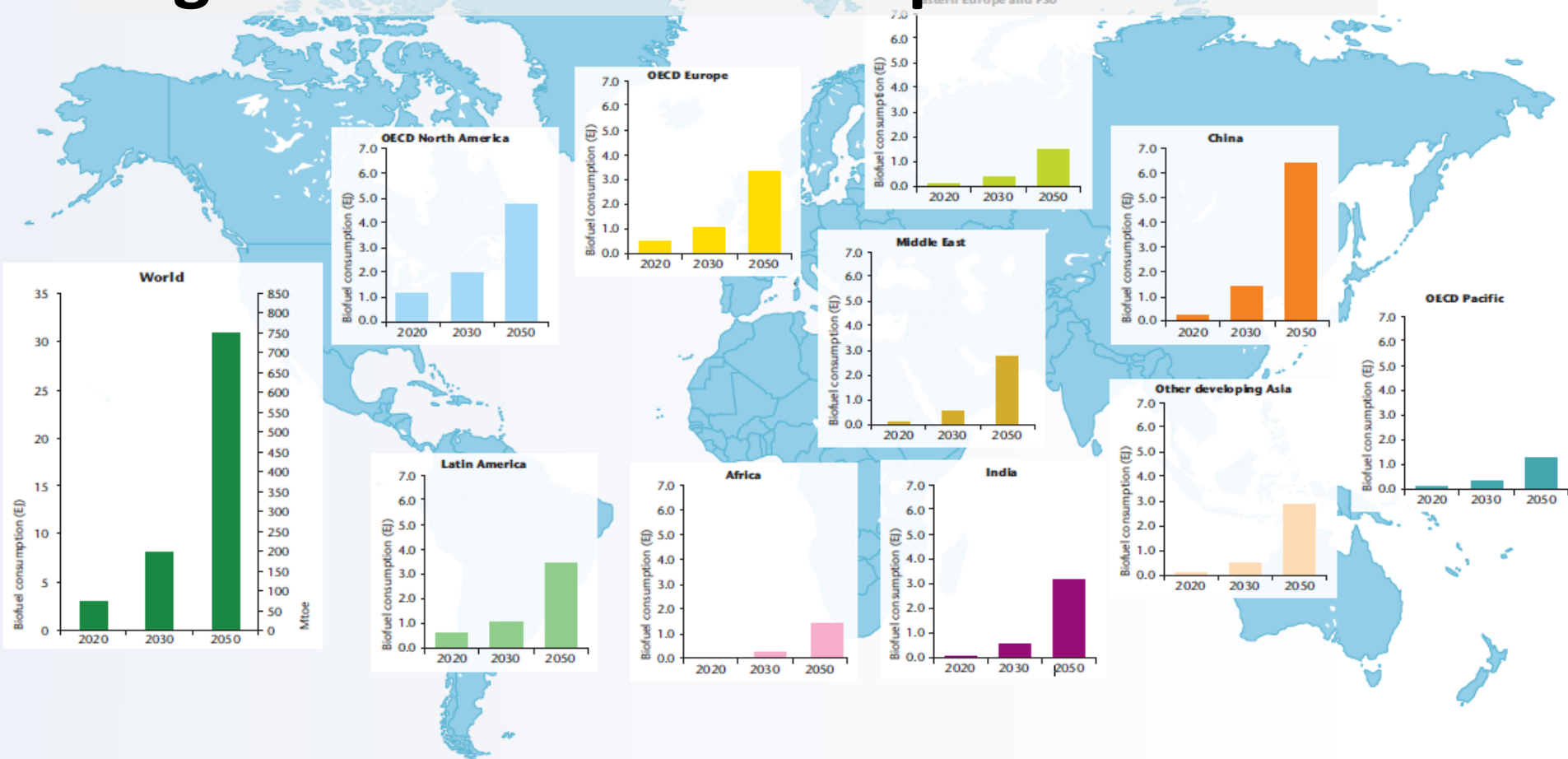
- **Baseline Scenario** – business-as-usual; no adoption of new energy and climate policies
- **BLUE Map Scenario** - energy-related CO₂-emissions halved by 2050 through CO₂-price and strong support policies
 - Serves as basis for all IEA Technology Roadmaps
 - **23% of global emission savings occur in the transport sector**

IEA Biofuel Roadmap: Vision



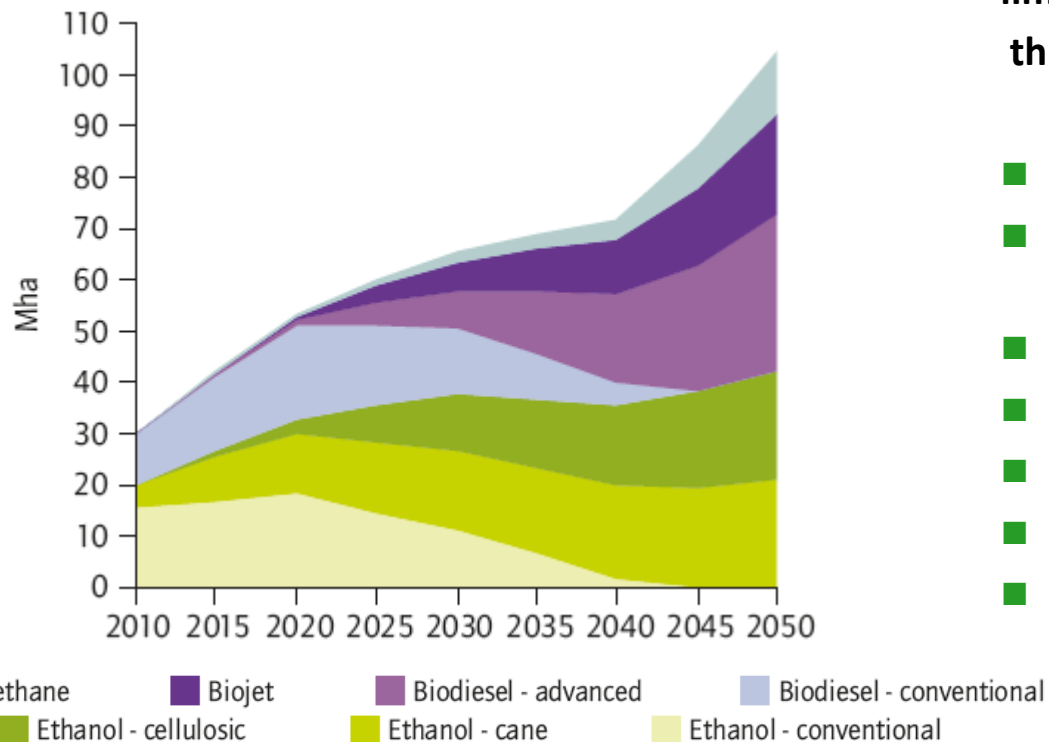
- Global biofuel supply grows from 2.5 EJ today to 32 EJ in 2050
 - Biofuels share in total transport fuel increases from 2% today, to 27% in 2050
 - Diesel/kerosene-type biofuels become particularly important to decarbonise heavy transport modes
- **Large-scale deployment of advanced biofuels will be vital to meet the roadmap targets**

Regional Biofuel Consumption



- Biofuel use will increase considerably in all regions
 - Biofuel demand driven mainly by OECD countries until 2020
 - In 2050, non-OECD countries account for 70% of total biofuel consumption
- Trade will be vital to supply biomass and fuels to regions with strong demand

Land Requirements



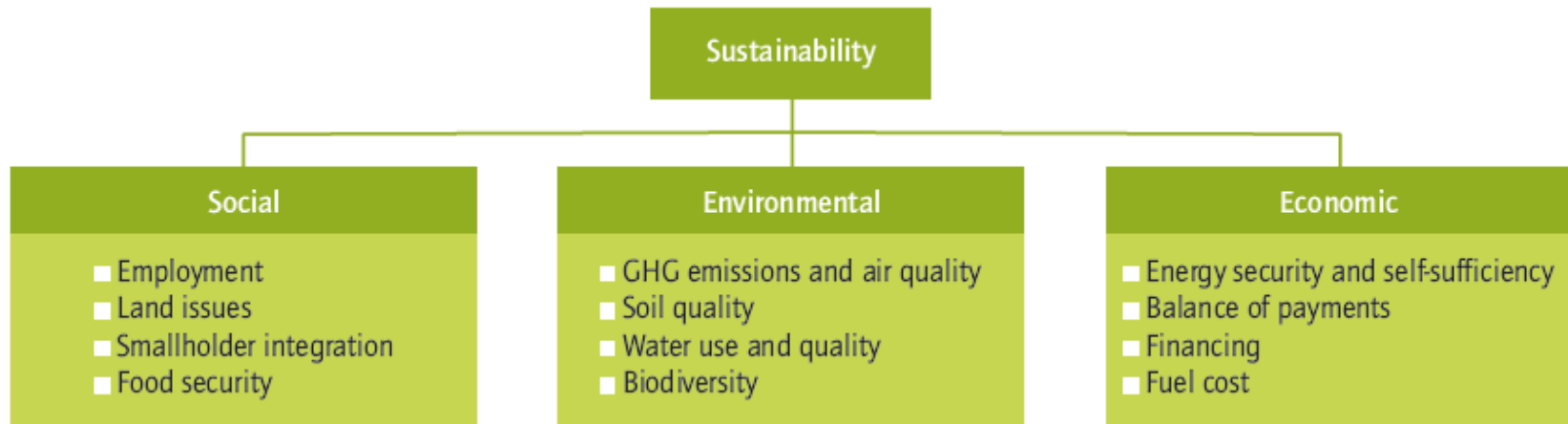
Pressure on agricultural land can be limited and risk of ILUC can be mitigated through:

- Productivity improvements
- Efficient use of co-products (biorefinery concept)
- Use of residues and wastes
- Use of pasture/ unused land
- Potential for wood biomass
- Biomass cascading
- Land-use zoning and sustainable land-use management schemes

Note: This is gross land demand, excluding land-use reduction potential of co-products

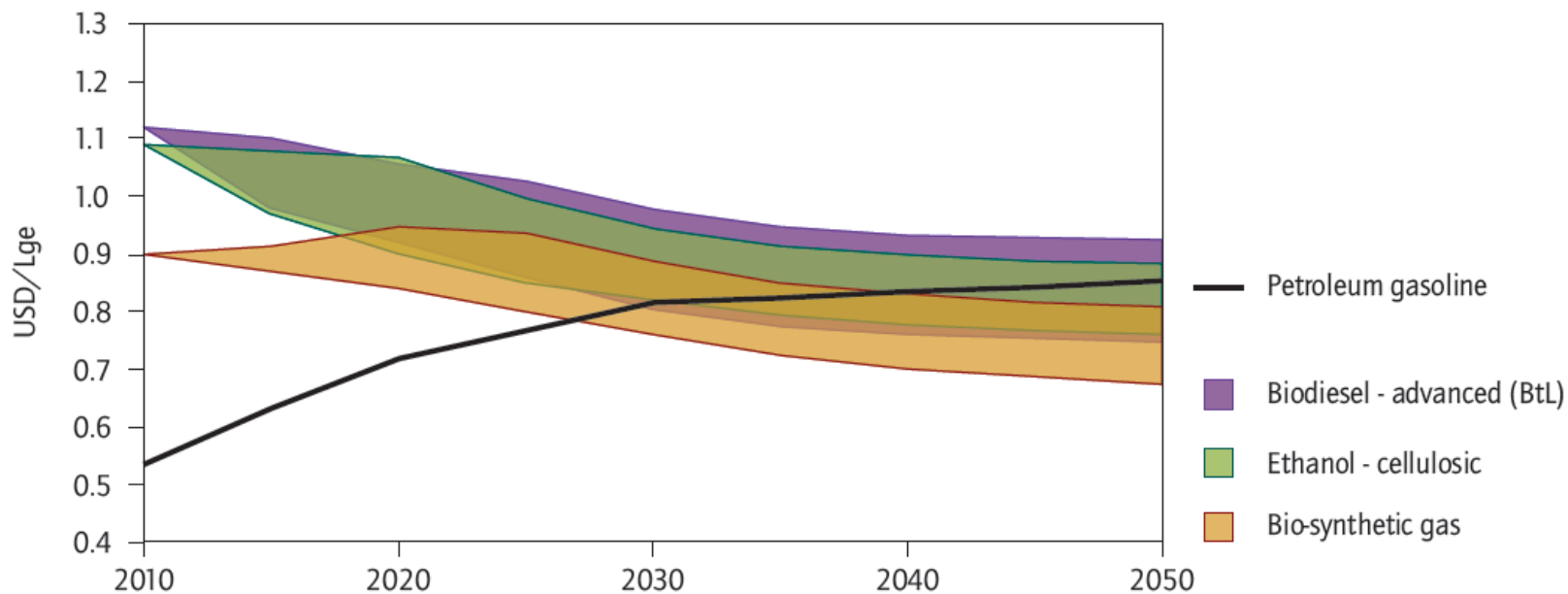
- Land required to produce biofuels increases from **30 Mha** today to **100 Mha** in 2050, in addition to **1 billion tons of residues**
 - Sustainable land expansion will be challenging given increasing demand for food and biomaterial
→ Sound policies needed!

Sustainability of Biofuels



- Sound policies are needed to ensure biofuels are produced sustainably
- Adoption of internationally aligned sustainability certification for biofuels based on international sustainability criteria (developed *e.g.* by the Global Bioenergy Partnership)
- However, most sustainability issues are relevant to the whole agricultural/ forestry sector
- In the long-term, a sustainable land-use management for all agricultural and forestry land is needed.

Biofuel Production Costs 2010-50



Production costs shown as untaxed retail price

- Most conventional biofuels still have some potential for cost improvements
- Advanced biofuels reach cost parity around 2030 in an optimistic case
- Total expenditure on biofuels 2010-50 sums up to USD 11-13 trillion (*i.e.* 11-12% of total fuel costs)
- **Incremental costs compared to use of fossil fuels are in the range of +/-1% of total fuel cost spending in the next 40 years**

Key policy actions

■ **Stability:**

- Create a long-term policy framework for biofuels.

■ **Innovation and Deployment:**

- Provide sustained funding for advanced biofuels RD&D and commercial deployment.
- Support research efforts on land availability mapping and biomass potential analysis.

■ **Sustainability:**

- Adopt sound, internationally aligned sustainability certification for biofuels.
- Link economic incentives to sustainability performance of biofuels.
- Incentivise use of wastes and residues.

■ **International Collaboration:**

- Engage in international collaboration on capacity building and technology transfer.
- Promote the alignment of biofuel and other related policies (agriculture, forestry, rural development).

Acknowledgements

■ Thanks to the co-authors:

- Adam Brown, Lew Fulton, Jana Hanova and Jack Saddler

- IEA Technology Roadmap - Biofuels for Transport

Available: www.iea.org/roadmaps

- Contact:

Anselm.Eisentraut@iea.org

- Forthcoming:

IEA Technology Roadmap – *Bioenergy for Heat and Power*

Available early 2012

