

How to boost Bio-economy right now?

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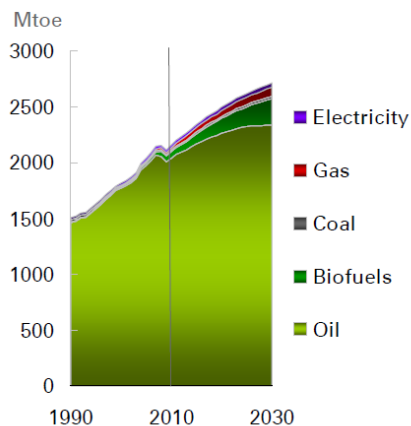


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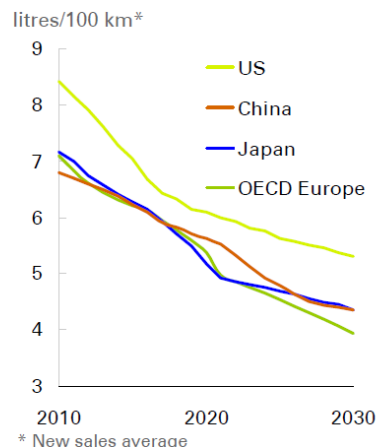
Trends (1)

Bioenergy in transport

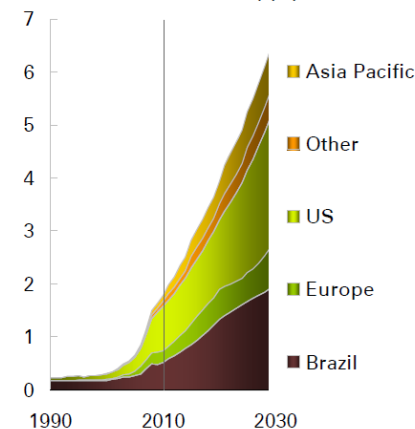
Energy in transport



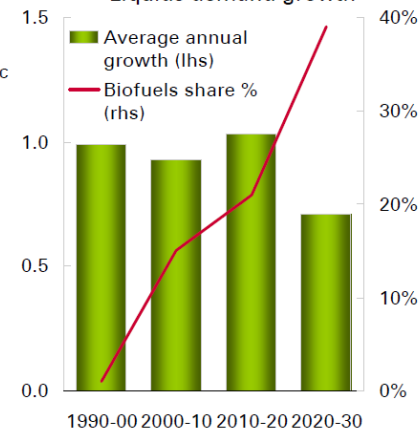
Passenger car fuel economy



Mb/d Biofuels supply



Mb/d Liquids demand growth



Allikas: 2030 Energy Outlook-BP

Biofuel is a niche player:

- A mean to decrease GHG (CO₂, CH₄, N₂O) emissions from the life-cycle of transport fuels at least 10% before 31.12.2020

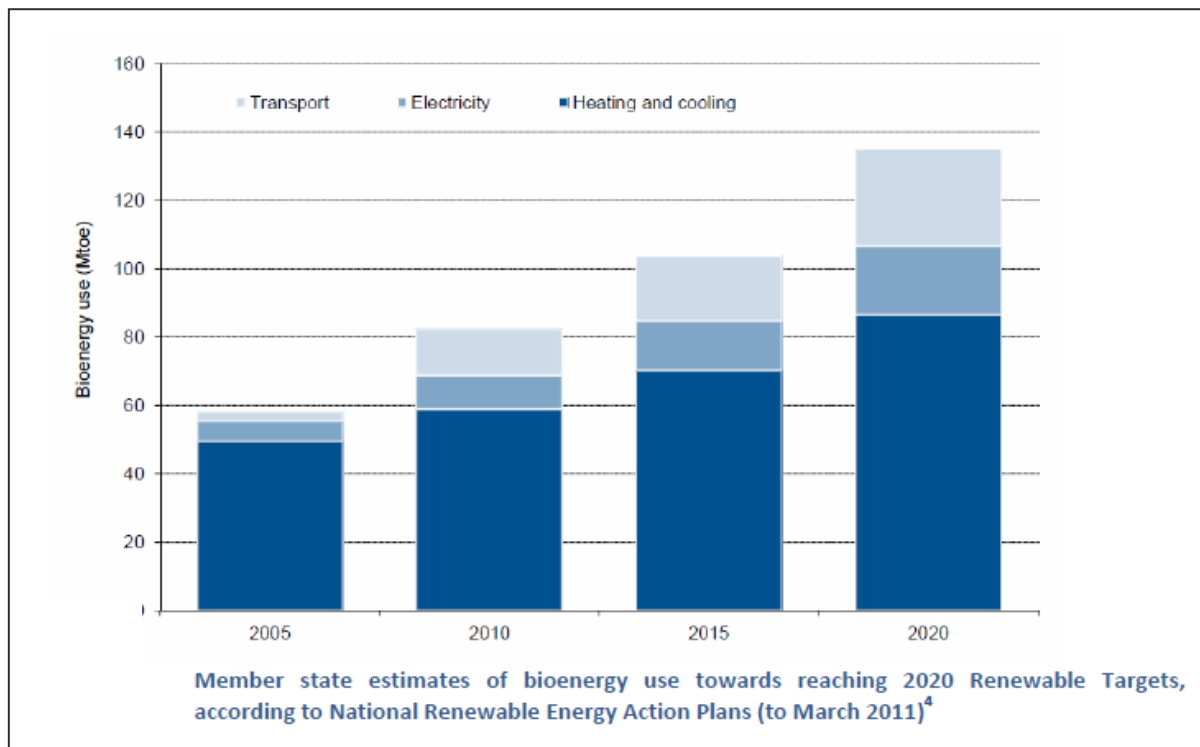
Production of biofuels must be sustainable

Trends (2): Biomass usage in Europe

National plans about bioenergy in European energy industry

Official plan from 2010 to 2020:

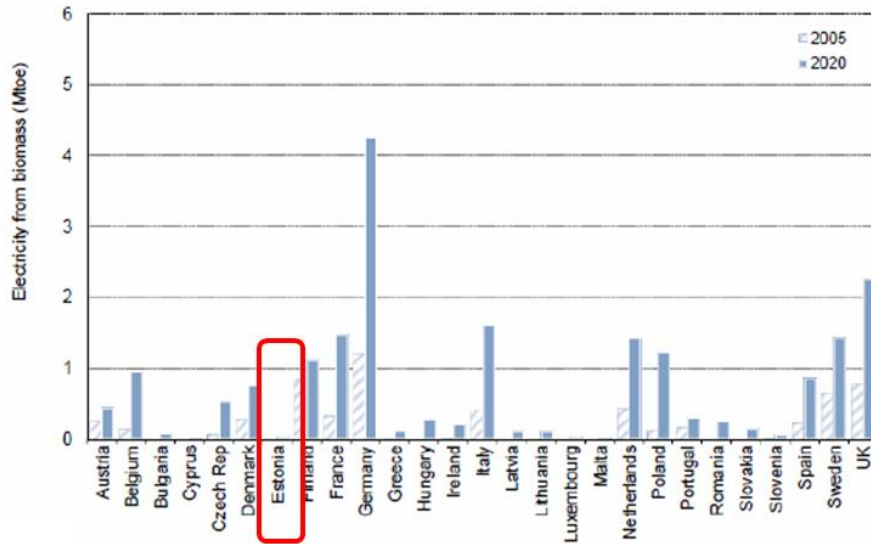
- **25%** increase the use of bioenergy in heating and cooling
- **Double** the use of biomass in transport and electricity production



Trends (3): Quality of state planning. Estonia has not planned to increase the use of biomass in electricity production. We are donors

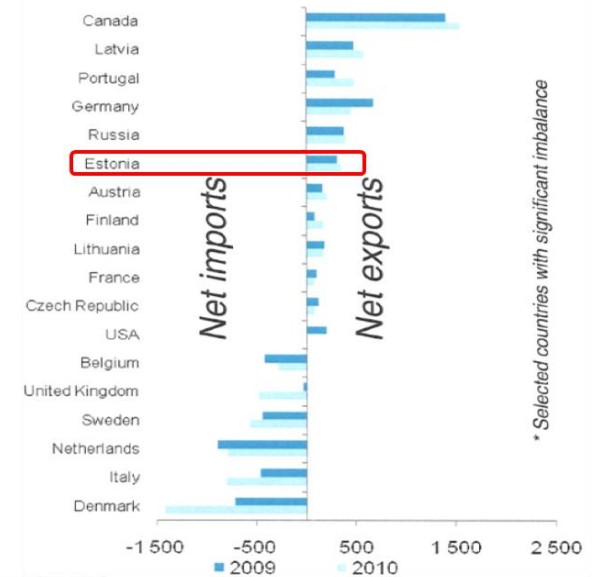
Biofuels and electricity industry

National plans to use biofuels in electricity production



Electricity from biomass in 2005 and 2020, according to National Renewable Energy Action Plans (Mtoe)

Balance of biofuel import and export



Allikas: Pöyry, 2012

* Selected countries with significant imbalance



What we believe in?

The miracle that makes the global energy system running so smoothly is called the market.

When shortages threaten, prices go up, demand and supply adjust: fuels are substituted, trades are made, innovation is stimulated, new products appear.

People cope - if they get the chance. It's what people in the industry modestly call: business as usual.

**European Energy Review. June 15, 2012*



Eesti Energia

What we believe in? (2)

Do what is competitive

: Overview of conversion technologies and their current development status

	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 1-stage digestion Biogas upgrading 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

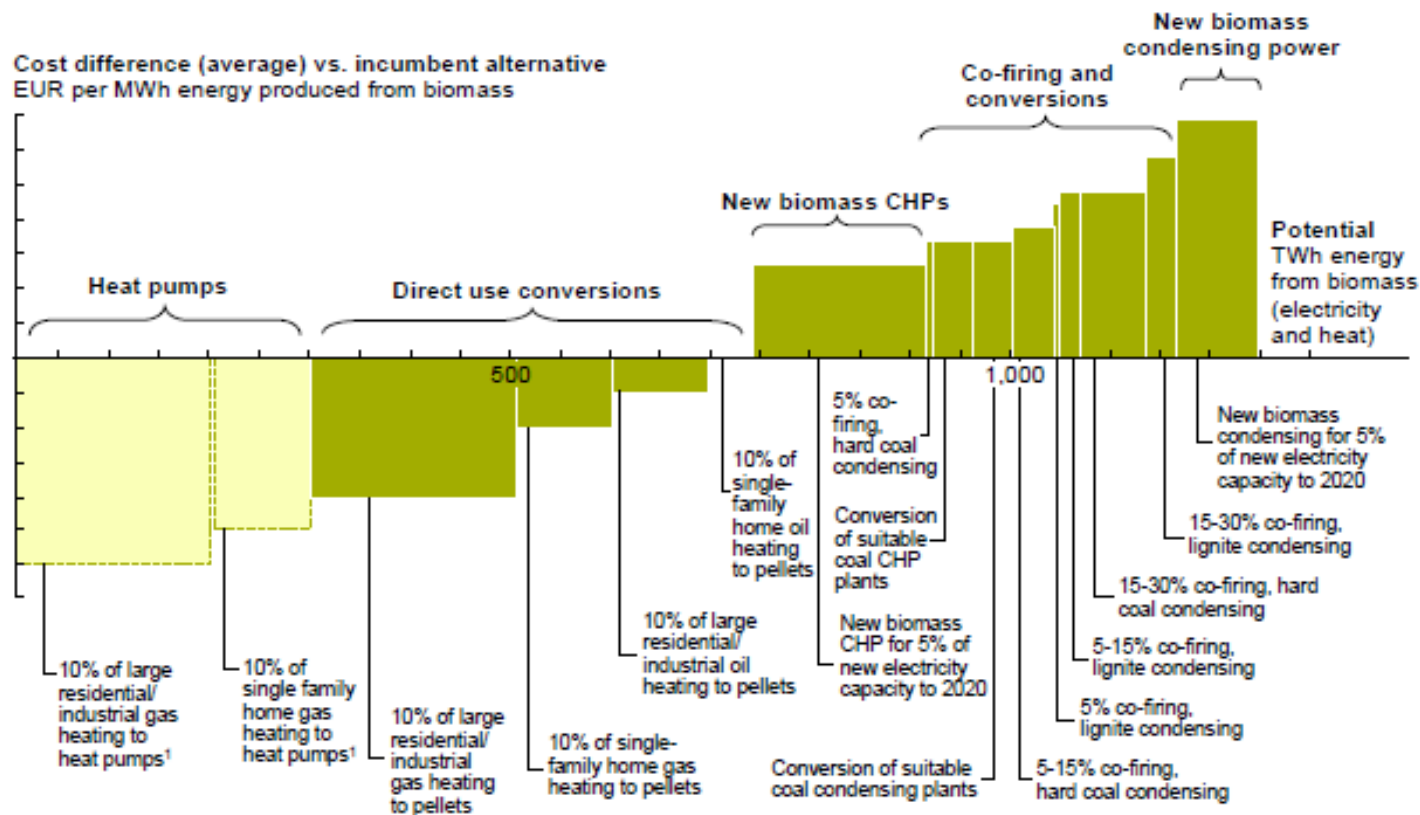
Source: Modified from Bauen *et al.*, 2009



Level of competitiveness of biomass

Exhibit 7

2020 cost curve scenario for biomass energy – decision maker perspective



MAIN ASSUMPTIONS: 30% co-firing possible in all hard coal and lignite plants; CO2 price 40 EUR/ton; Hard coal price 54 EUR/ton; Lignite 10 EUR/ton; Biomass 26 EUR/MWh (130 EUR/ton); Plant efficiencies: condensing 40%, Dedicated condensing 35%, CHP 85% (el. 30%, 55 EUR per MWh el. In heat sales revenue)
¹ Heat pumps can be driven by electricity from any fuel. These estimates illustrate the option of using biomass to produce electricity and then using this electricity to drive heat pumps

Source: Biomass for heat and power – opportunity and economics.
 European Climate Foundation, Sveaskog, Södra, Vattenfall, 2010



Eesti Energia

What Eesti Energia is doing?

1. WASTE-TO-ENERGY PLANT
2. BIOFUELS IN ELECTRICITY PRODUCTION
3. BIO-ETHANOL



1. New Waste to Energy unit



Fuel: 220 000 t/y
municipal solid waste
(MSW)

Energy: 138 GWh/y

Heat: 400 GWh/y

Investment:

~100 MEUR

EPC contract with CNIM
(France)

17 MWeI & 50 MWth Waste to Energy
CHP by 2013 in Iru Power Plant



Eesti Energia

Description of WtE plant

WtE type and parameters

Electrical capacity

Thermal capacity

Efficiency

Annual waste incineration capacity

Annual heat production

Annual electricity production

CHP Hours annually

Condensing mode annually

CHP

with the grate boiler (Martin),
semi-dry flue gas cleaning (LAB)

17,3 MW

50 MW

82 - 84 %

220 000 t/y (LHV 10,5 MJ/kg)

330 GWh

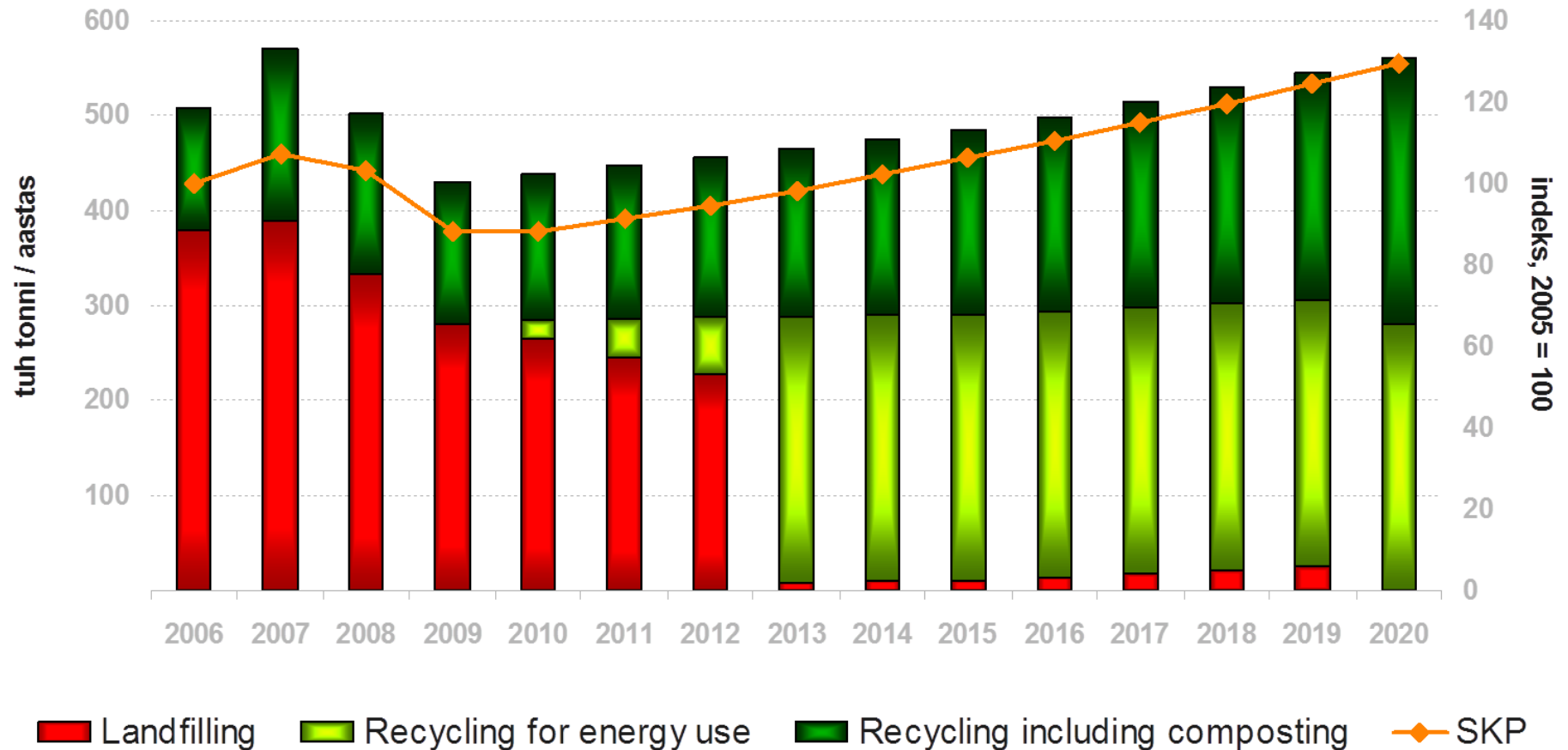
136 GWh

6400 h

1600 h



Expected impact to waste management



2. Biomass will replace fossil fuels in electricity production

Bio-Electricity in Estonia

- Replacement of fossil fuels with biomass is the cheapest way of increasing share of electricity produced from renewables.

Overview of bioenergy power plant conversion efficiencies and cost components

Capacity	<10 MW	10-50 MW	>50 MW	Co-firing*
Typical power generation efficiency (%)	14-18	18-33	28-40	35-39
Capital costs (USD/kW)	6 000-9 800	3 900-5 800	2 400-4 200	300-700
Operating costs (% of capital costs)	5.5-6.5	5-6	3-5	2.5-3.5

*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. Efficiencies refer to a plant without CCS.

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

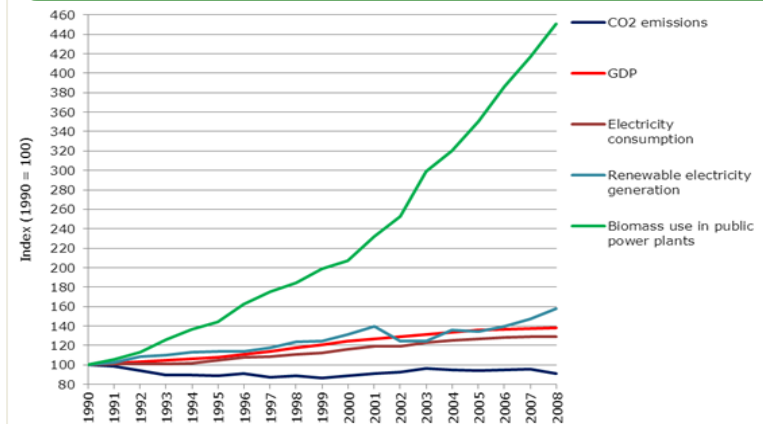


To co-fire or not?

Public discussion in Estonia about the use of biofuels

- Is it important to limit the use of biomass and reserve it only for high-efficiency use?
- Is it wise to limit the use of biomass in certain businesses?
- Should we limit domestic use of biomass even when we are net exporters?

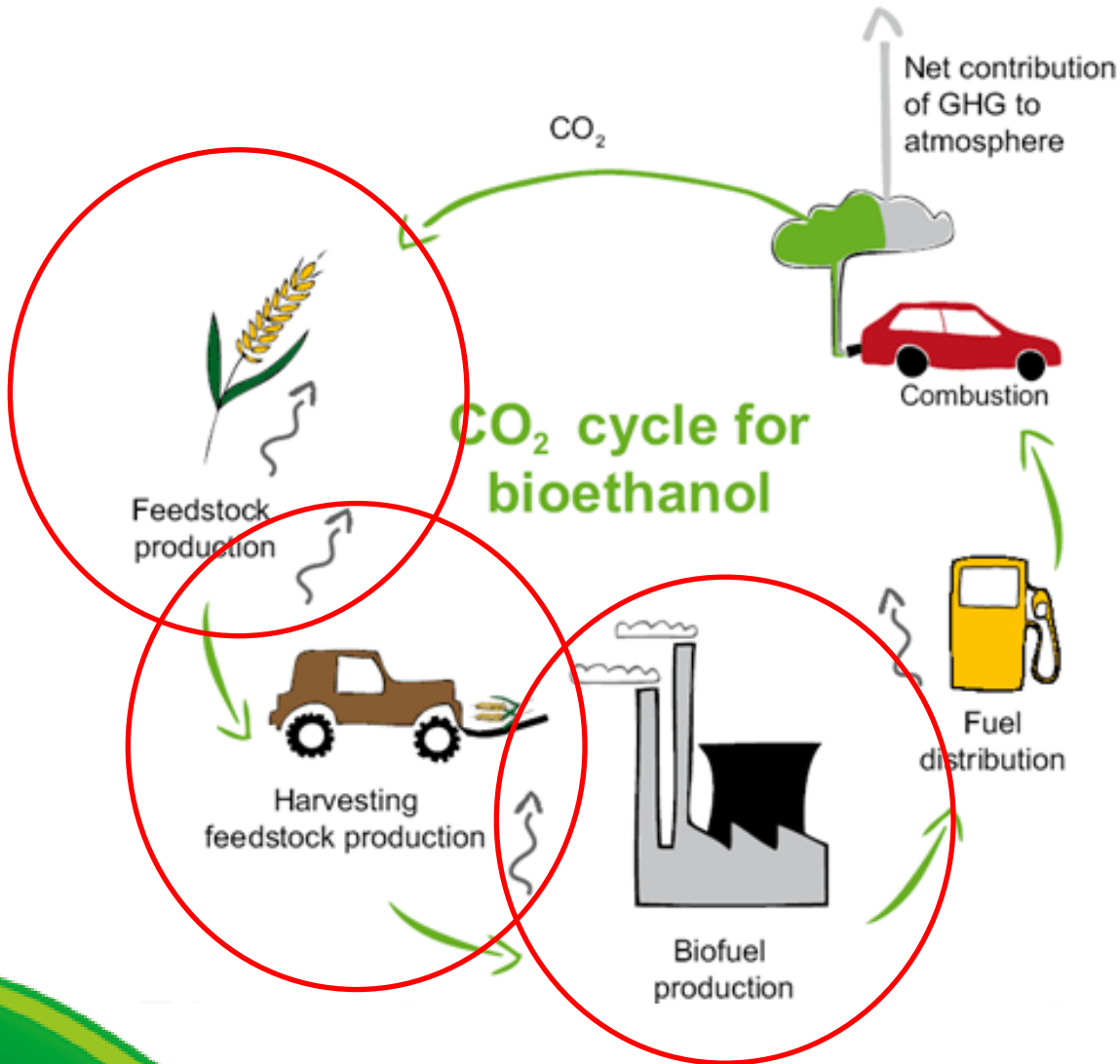
Use of biomass in power plants is main trend in European energy business



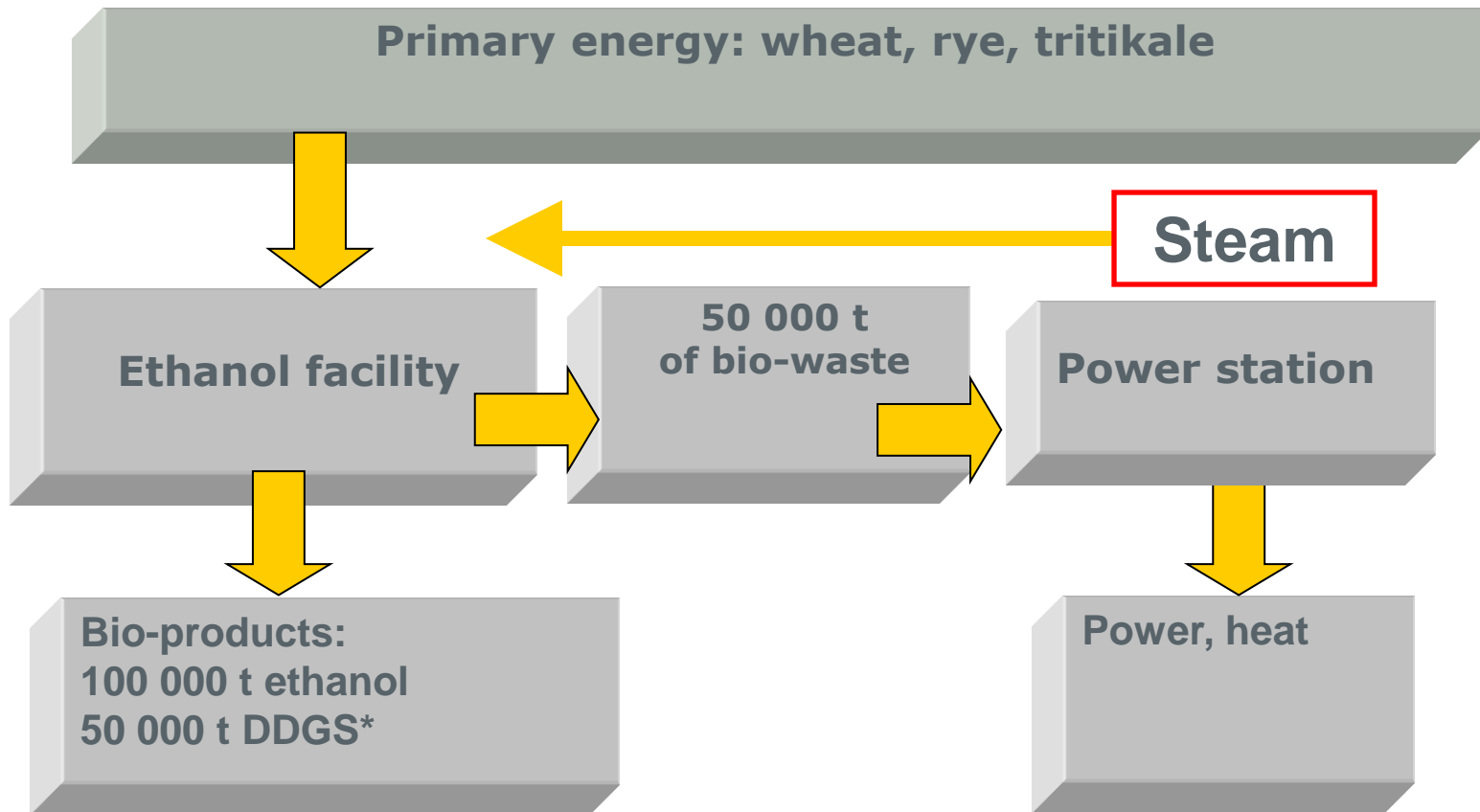
* Allikas: <http://www.eea.europa.eu/data-and-maps/figures/drivers-of-eu-ghg-emissions>



3. Possible bioethanol production for transport

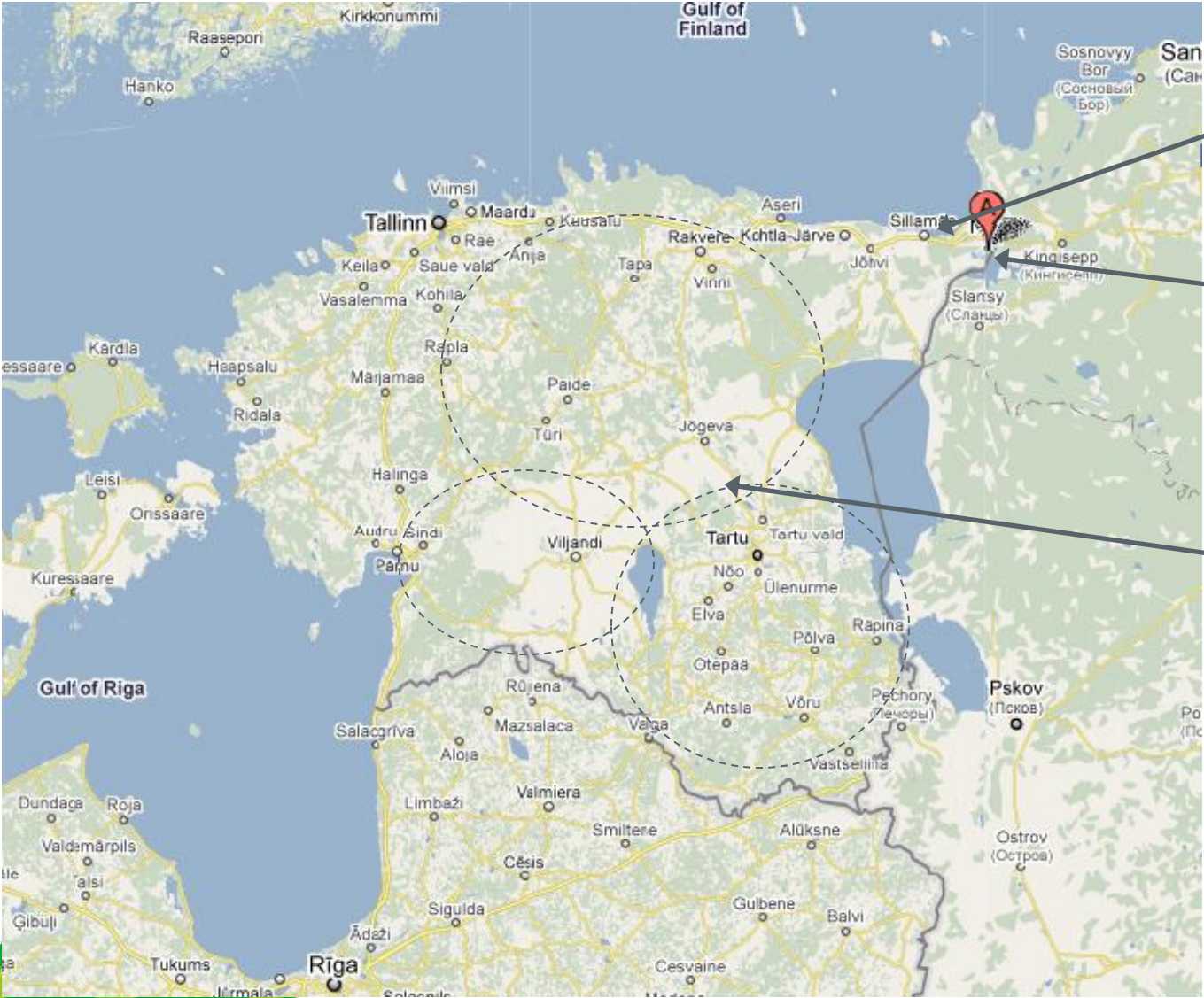


Ethanol facility connected to fossil fired power plant in condensed generation mode



***DDGS: Dried Distillers Grains with Solubles**), a coproduct of the ethanol production process, is a high nutrient feed valued by the livestock industry

Logistics is a key driver in large-scale biomass industry



Port of Sillamäe

Plant

Agriculture

Most of the efficiency gains can come from agriculture and technology. Most of CO₂-emissions come from agriculture

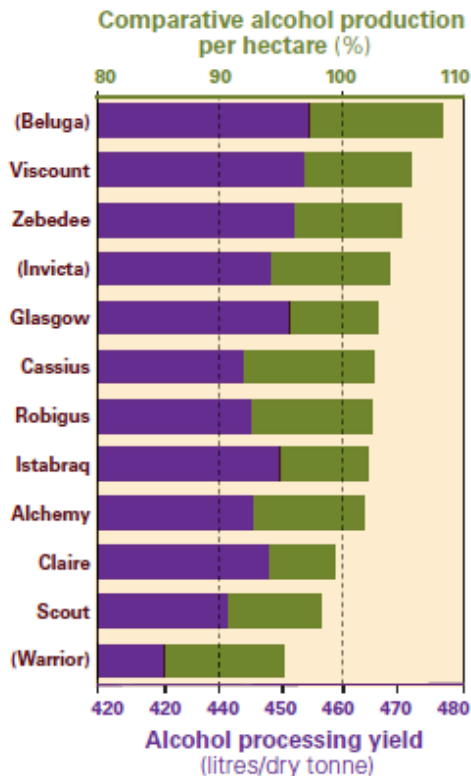


Figure 1. Alcohol processing yield (purple) and comparative alcohol production (purple) and comparative alcohol production (green) of wheat varieties.

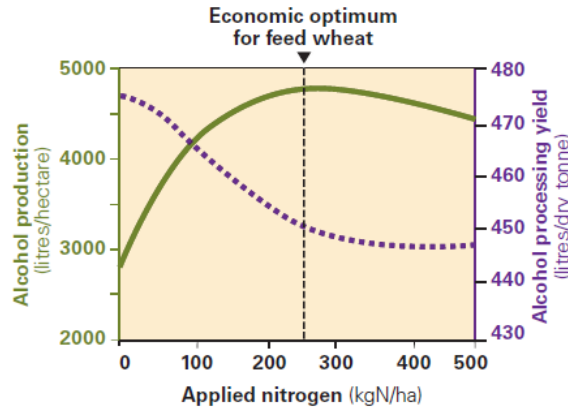
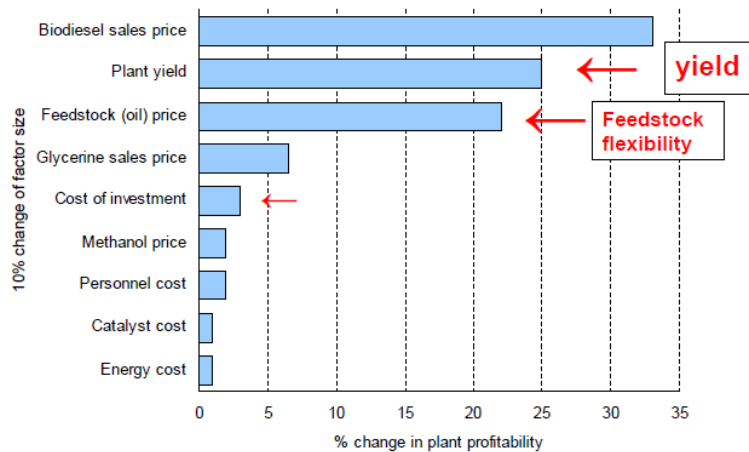


Figure 2. N response of alcohol production and processing yield

CO ₂ emissions (g/MJ):	
• Agriculture	40,04
• Transport	1,84
• Production	0,19.

Process technology influences 2 key criteria for profitability:



Longer grants and modification of taxation

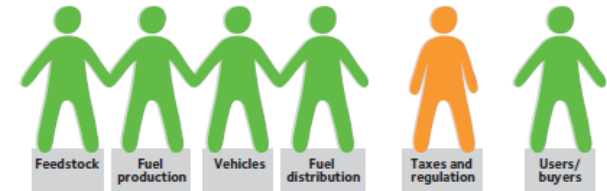
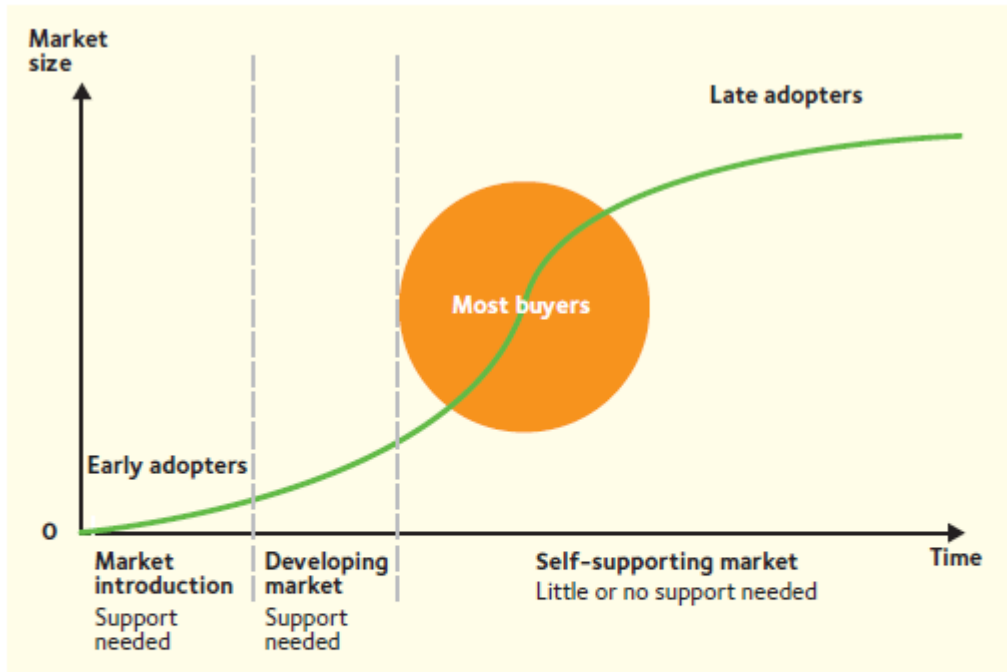


Fig. 6 S-curve showing the relationship between time and market penetration of new technology. "Support needed" indicates the need for some degree of incentives (such as reduced tax) to assist market development during the early phases. This support can be phased out once the market has matured. "Early adopters" are buyers with specific knowledge or motivations that make them purchase early and with less reference to criteria such as cost or fuel availability than buyers who purchase in the later market phases. Source: BEST D5.12, *Promoting Clean Cars – Case Study of Stockholm and Sweden* (2009).

Summary:

How to boost Bio-economy right now?

1. Do things right now
2. Sourcing is crucial
3. Less fragmented funding over several years for projects which are not jet competitive

