

Bioenergy

the biggest renewable by far



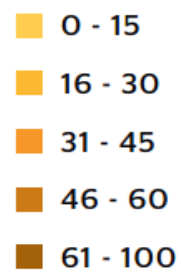
Joona Turtiainen
Finnish Energy

Wood You
Believe
in Forests?

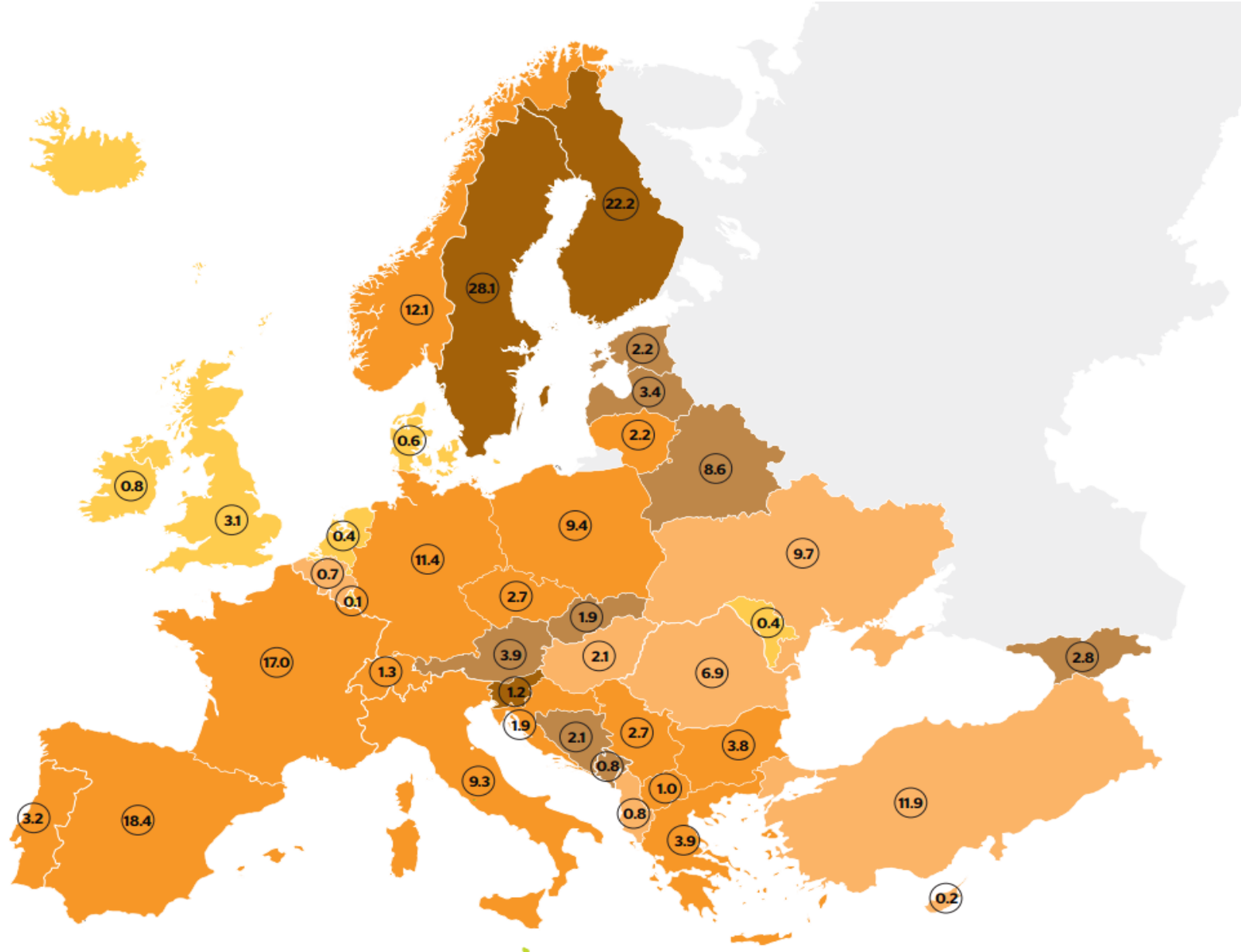
The sustainable forestry event
Tuesday 1 Dec. at 10.15 hours
Pavilion of the Nordic Council of Ministers
Hall 2B, room 65



Share of forest area (%)



(3.5) Forest area (million ha)



Forest energy in Finland and globally

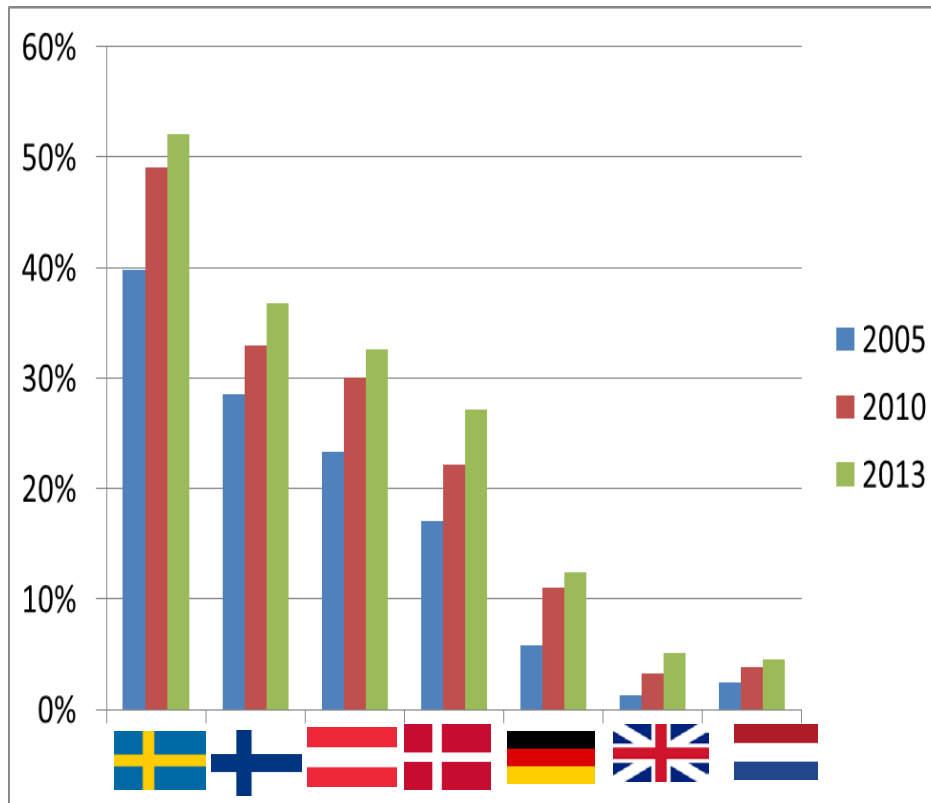


- Forest covers 76% of Finland
- < 100 km radius for fuel supply
- Forests are the biggest energy source
- 36% renewable energy, of which 4/5 is bioenergy
- 4/5 of which is by-products and residues

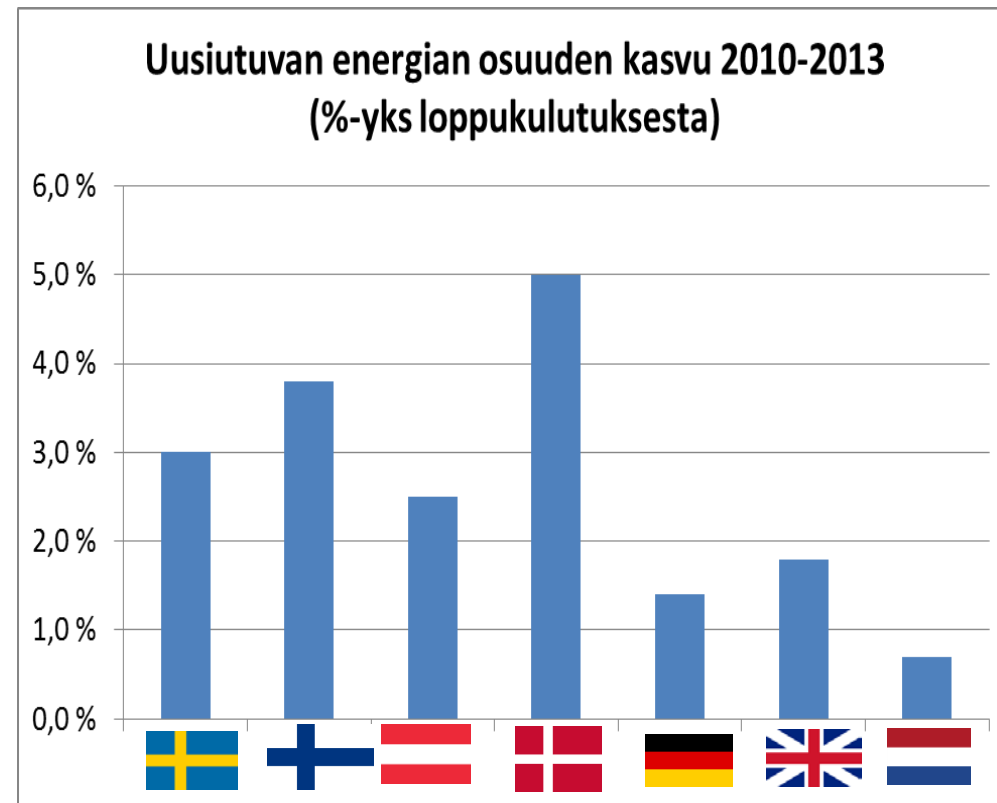


- 30% of land globally
- Bioenergy-related problems linked to international trade?
- Bioenergy 10% of energy
- 73% of renewables is bioenergy

Renewables in total final energy consumption



Renewable share of energy



Growth in renewables 2010-2013

**Finnish forests captured
more than 40% of the
national GHG emissions
during 1990–2012.**



80% of Finnish renewable energy is from forests

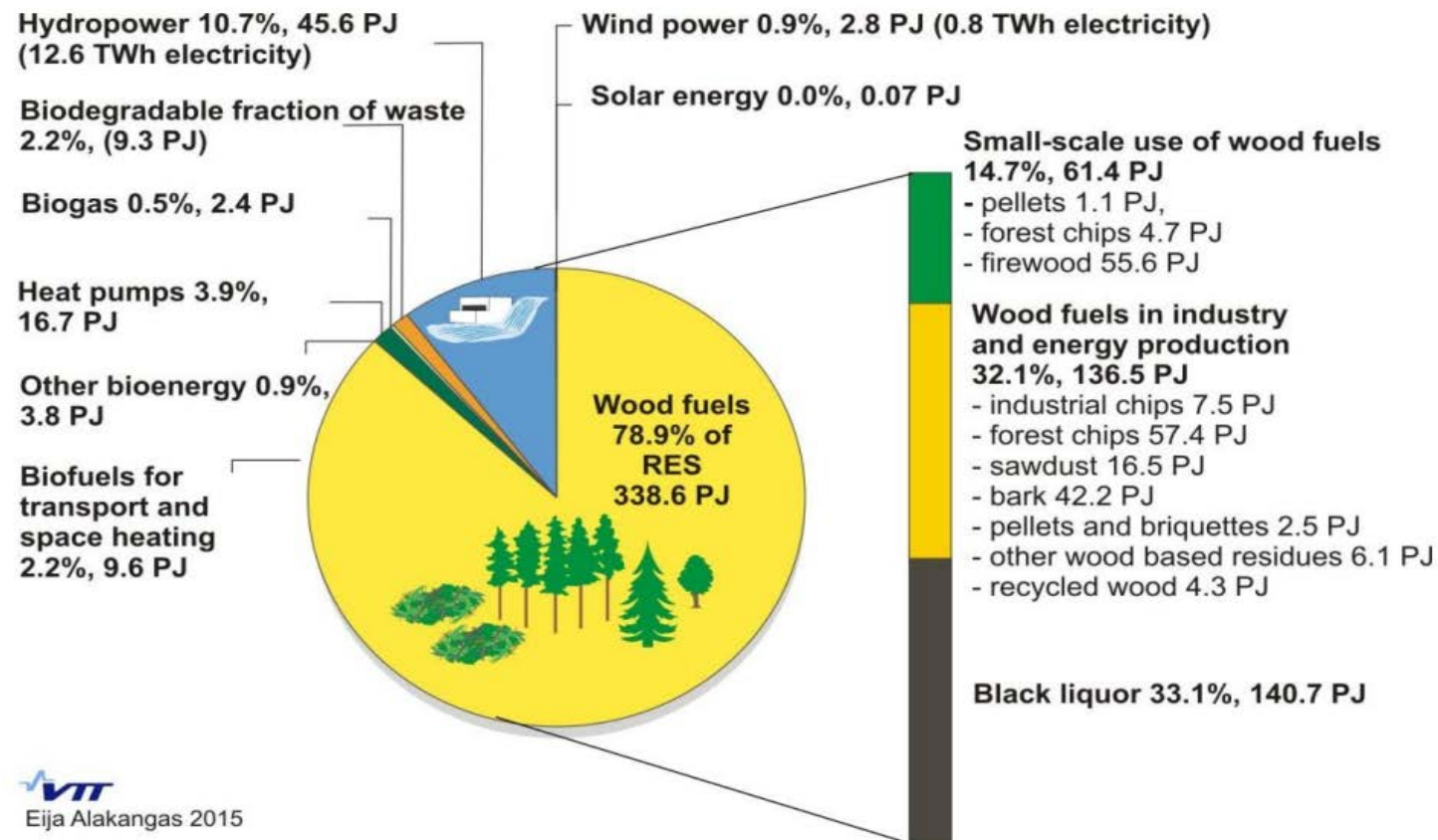


Figure 9 Use of renewable energy in Finland in 2013 (Statistics Finland 2014)⁴.

Increasing use of forest energy

		2012	2030	2050
		TWh	TWh	TWh
Wood used in energy production	Electricity and heat production	15.3	29–34	29–32
	Production of liquid biofuels	0.	7–19	21–33
	Total	15.3	37–53	52–65
Use by wood type	Stumps	2.2	4–6	2–9
	Branches, tops etc.	5.2	11–12	11–14
	Small-dimensioned wood, not including firewood	7.2	18–24	20–25
	Pulpwood (Stemwood)	0.7	0–10	12–27
	Total (TWh)	15.3	34–39	52–63

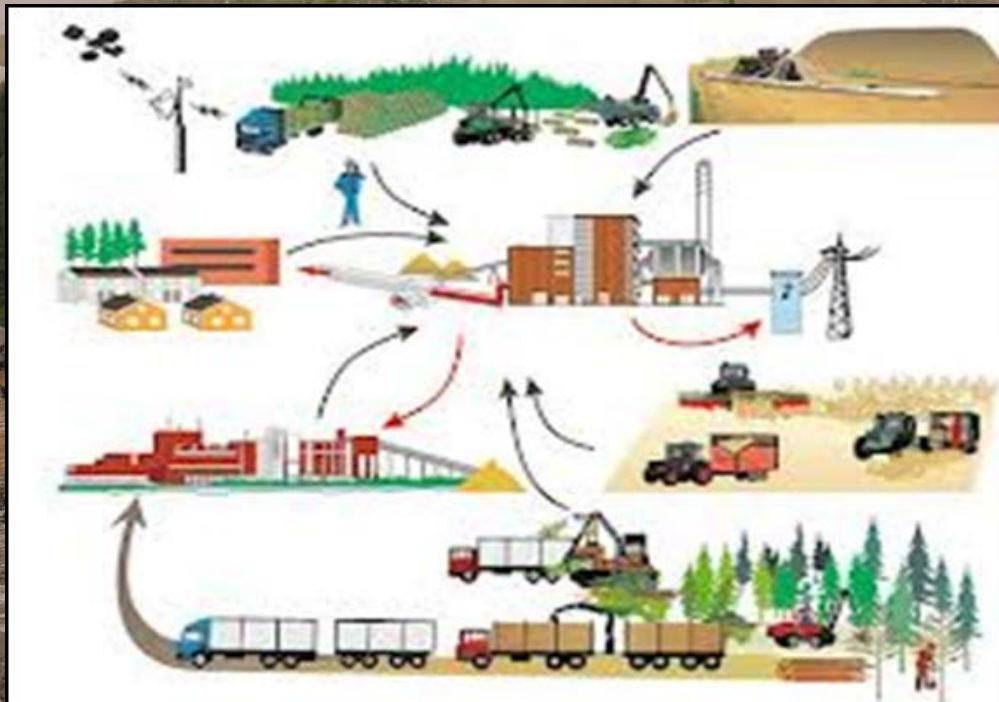
Investments in the bioenergy sector since 2000

- **53** new combined electricity and heat plants
 - 2090 MW electric power
 - Mainly domestic fuels
- **300** new heat boilers
 - Biofuels have mainly replaced oil





KERAHA COMBINED HEAT AND POWER PLANT

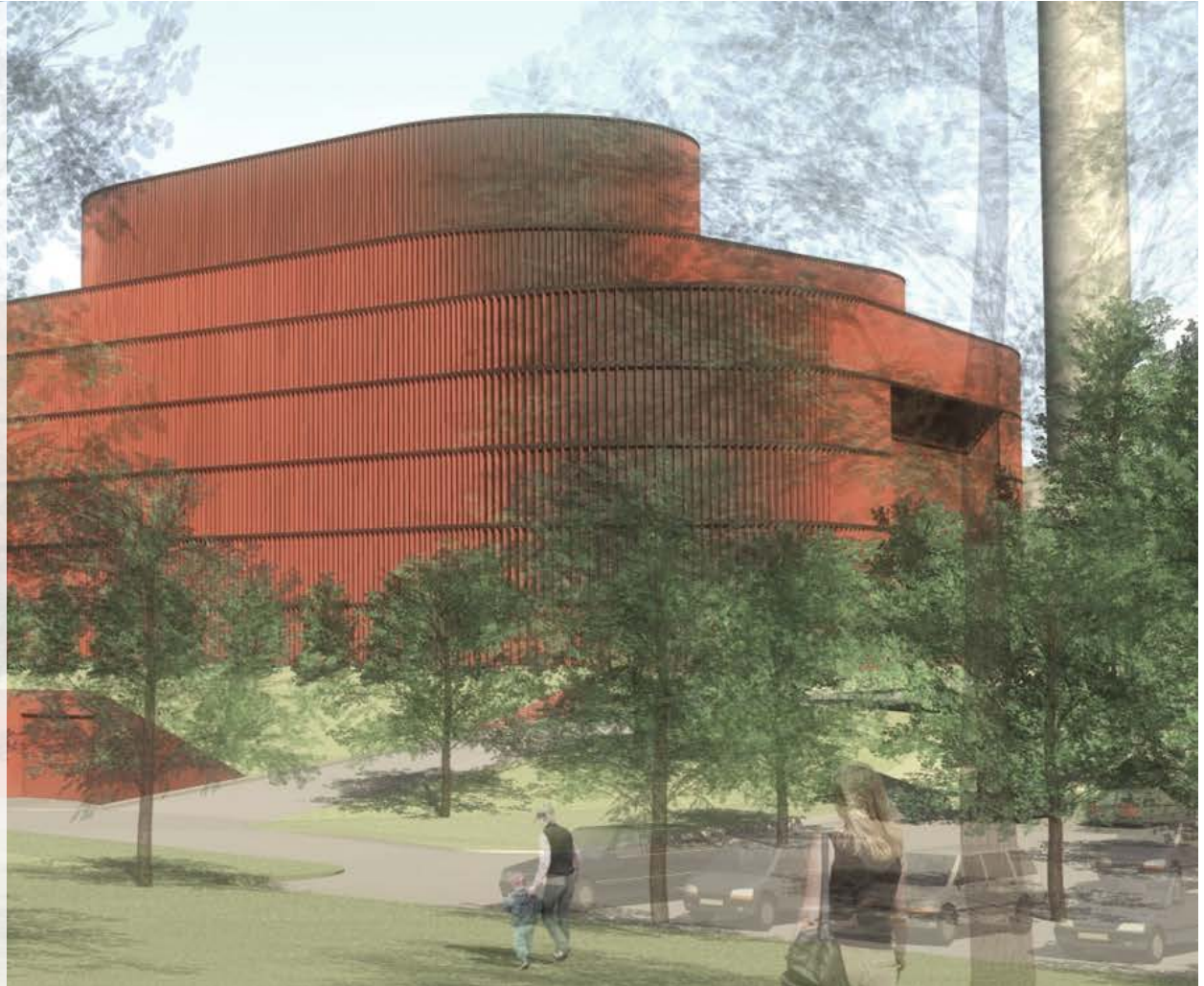


Production volumes

- District heat 300 GWh = 75 % of consumption in Kerava
- Electricity 120 GWh = 25 % of supply

One of world's largest bio-CHP plants soon completed in Sweden

- 1,700 GWh heat and 750 GWh electricity per year
- 100% biofuel, residues from forest industry
- CO₂ reduction 650,000 tonnes per year.
- Fuel from Sweden, Finland, the Baltic States and Russia. Investment cost EUR 485 million.



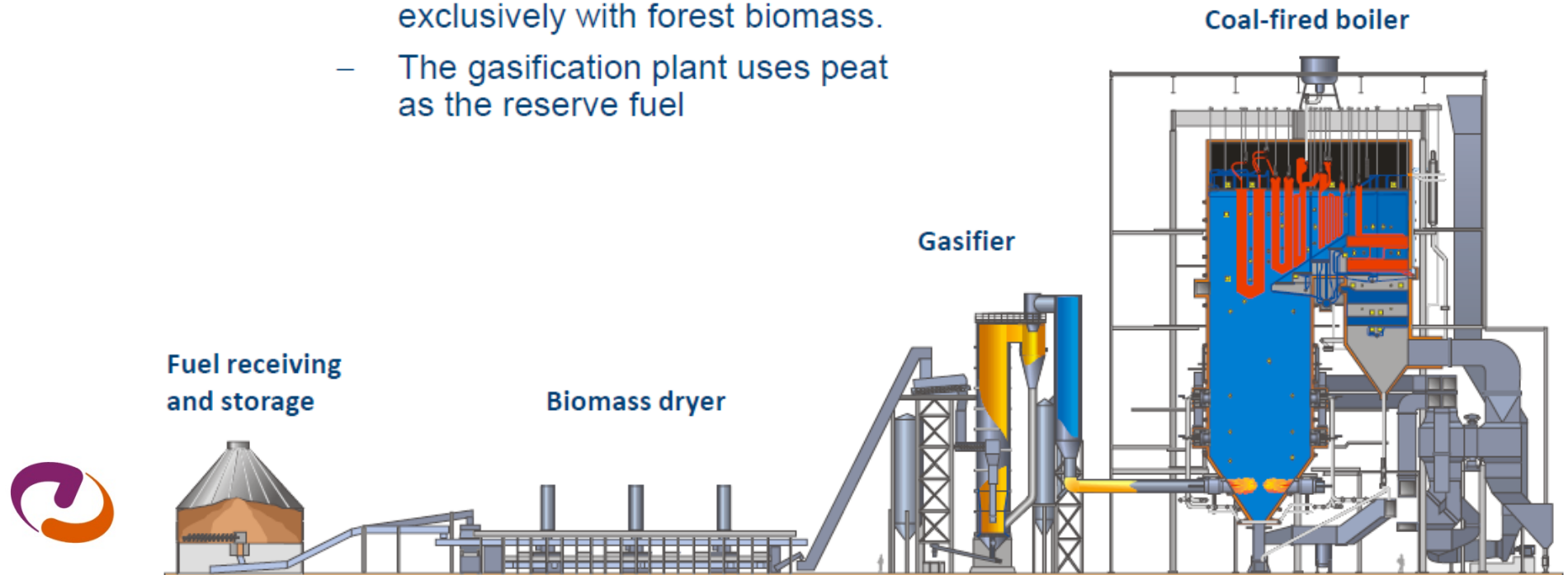
Bio-oil from forest – Fortum's pyrolysis plant

- Pyrolysis oil production plant integrated into a CHP plant - the first in the world.
- Domestic raw material: harvesting residues, saw dust, energy thinning wood.
- Fortum Otso® - pyrolysis oil replaces fossil fuel oil in heat production.
- Investment cost EUR 30 million.



Gasified biomass replacing coal with Vaskiluoto bio-gasifier

- Gasification of wood, peat and field biomass results in product gas that is fired together with coal in the existing boiler
 - The gasification plant can be fired exclusively with forest biomass.
 - The gasification plant uses peat as the reserve fuel



Carbon neutrality

Figure 7. Illustration of outcomes of carbon stock models using different spatial boundaries

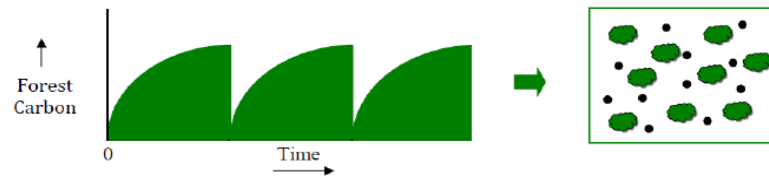


Fig 7a. Plot level taken from time of harvest



Fig 7b – Increasing plot level approach taken from time of harvest

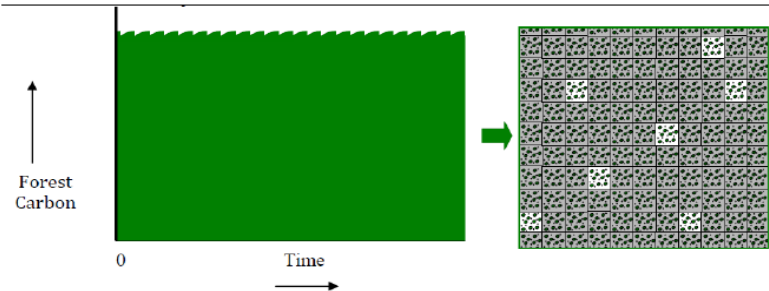
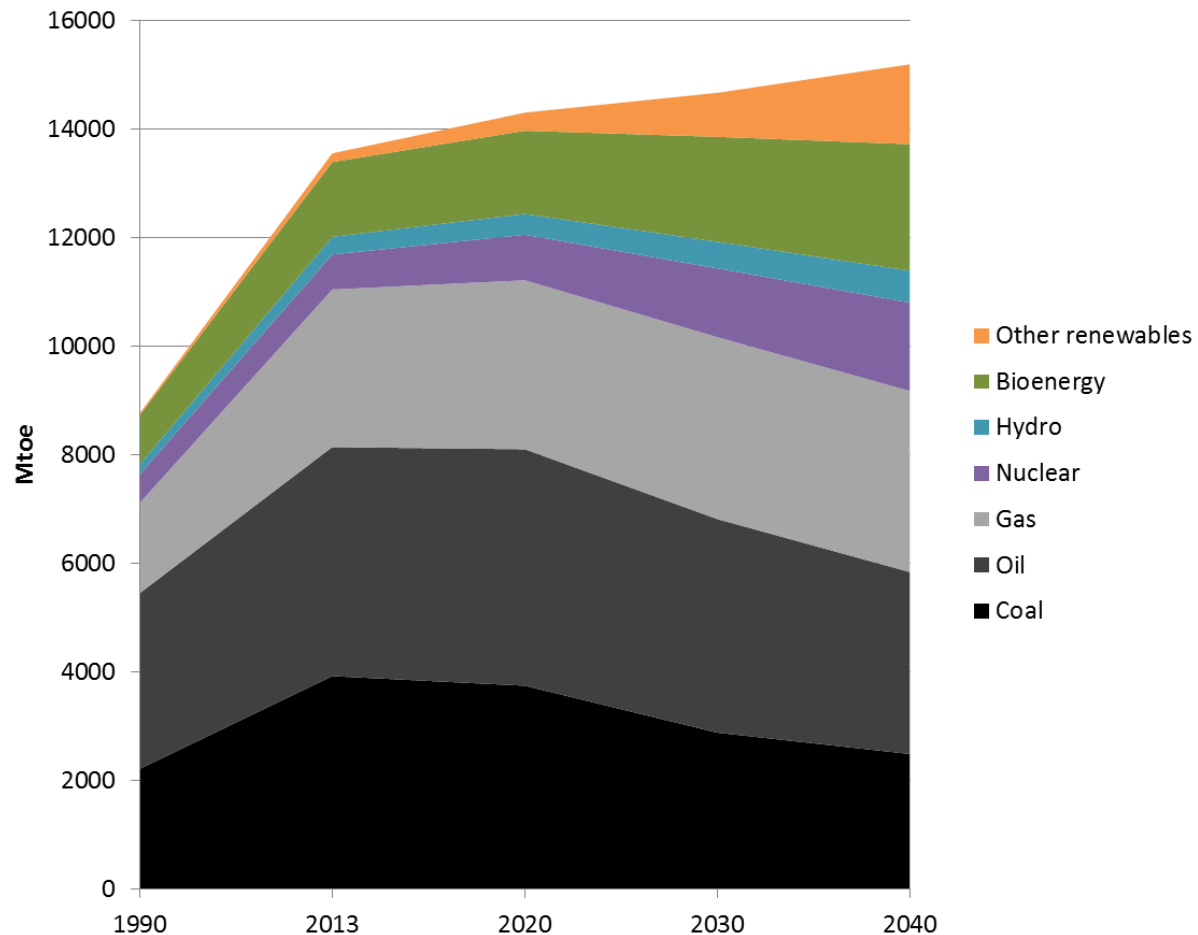


Fig 7c. Landscape level taken from time of harvest

Source: Bowyer et al (2012)

IEA World Energy Outlook 2015 450 ppm scenario



Balancing the benefits

Replacing fossil fuels

Maximising carbon sinks



Sink to surpass emissions – despite growth in use

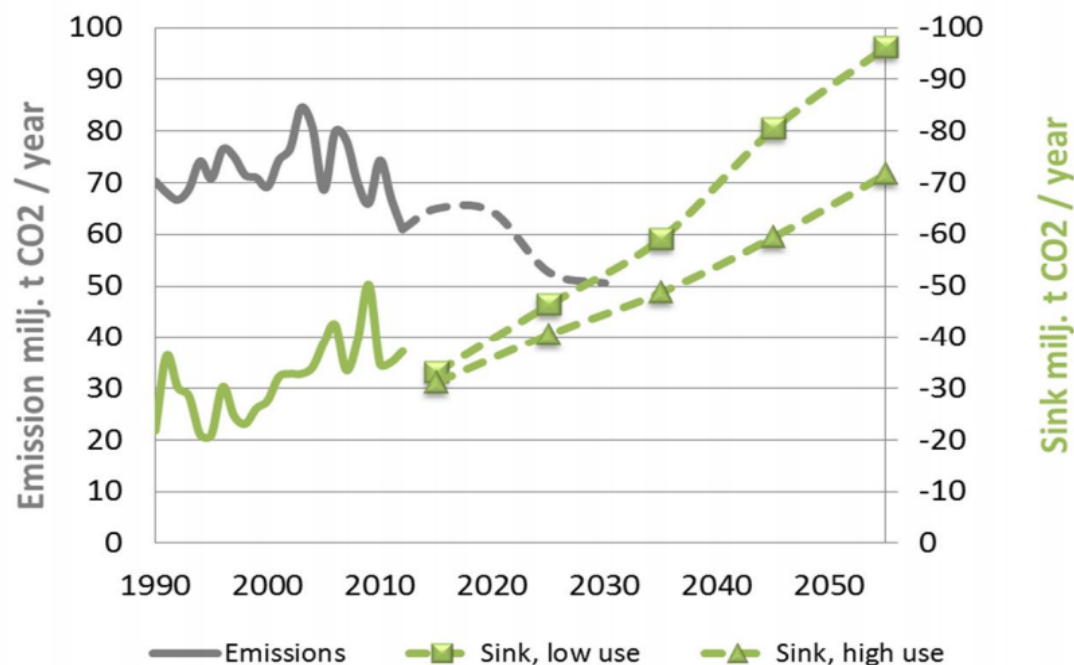


Figure 12 Development of Finnish GHG emissions excluding LULUCF (grey lines) and forest carbon sink (green lines): past values (solid line) are from the Finnish GHG inventory⁶ and projections presented for low- and high-use scenarios (dashed lines) are from Low Carbon Finland scenarios². The forest sink is expected to exceed the total GHG emissions after 2030–2040.