BIOFUELS IMPLEMENTATION - LEAP TO 2nd GENERATION BIOFUELS IN FINLAND

" 25 % market penetration of biofuels in 2030 "

EC Biofuels Directive 5.75 % in 2010

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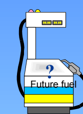
Bonn 15.5.2007
UNFCCC – SBSTA 26

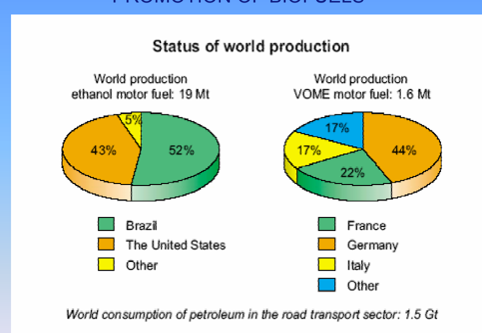


- General trends in Europe
- Implementation of the EC Biofuels Directive
- Limitations of the 1st generation biofuels
- The benefits of the 2nd generation biofuels
- Implementation activities in Finland
- Concern of raw material supply, land use change
- Conclusions

EUROPE - GENERAL TRENDS

- The European Union is highly committed to the Kyoto protocol and the reduction of greenhouse gas emissions
- CO_2 emissions in transportation are expected to grow while other sectors (power generation, industry, households etc.) will be able to reduce CO_2 emissions
- A voluntary agreement between the automotive industry (ACEA) and the Commission to limit CO_2 emissions of passenger cars
  - 140 g/km by 2008, corresponding to 6 l gasoline/100 km
  - 120 or 130 g/km binding requirement for 2012 under discussion, the automotive industry calls for help from the fuel industry
- Bio- and alternative fuels are interesting both for **security of supply and CO_2 reduction. How to implement in national energy strategies ?**
- **March 2007 – EC commitment to mandatory 10 % biofuels target in 2020.**

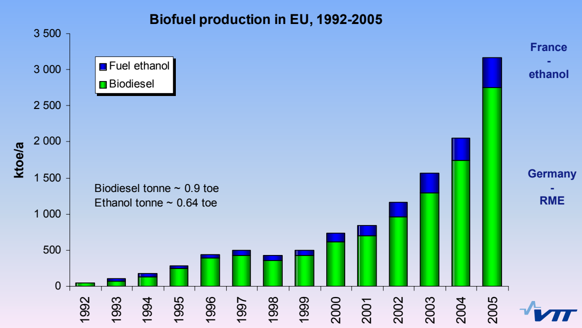
PROMOTION OF BIOFUELS



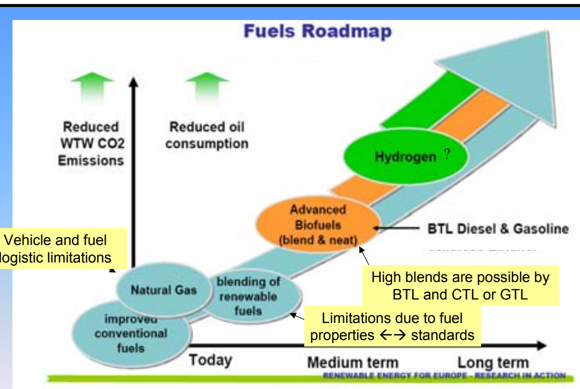
All alternative motor fuel together ~ 50 Mtoe (3.3 %)
Biofuels ~ 22 Mtoe (1.5 %)

In Europe Biodiesel Production Dominates

18 Mtoe of biofuels needed in 2010 to fulfill the EU target of 5.75% (energy)
In 2005 the share of biofuels was about 1%

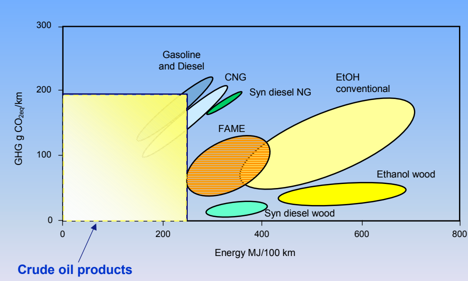


Source: European Biodiesel Board, System Solaires EurObservER 2005 & http://europa.eu.int



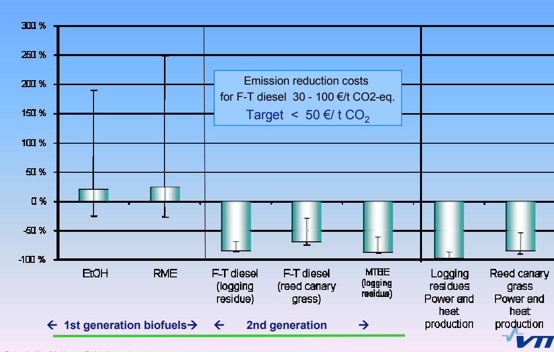
Source: Anders Röj 2006

WELL-TO-WHEEL ANALYSIS
Light duty vehicles



Source:Concawe/JRC

Relative Impact of Biofuels on Greenhouse Gas Emissions
- WTW results in Finnish conditions



Source: Soimakallio, Mäkinen, Pahkala et.al

FUEL DIRECTIVES AND STANDARDS

- fuel quality has to be controlled –
- revision of the fuels Directive under way

Directives 98/70/EC & 2003/17/EC
• power of law
• emphasis on environmental properties
• covers fuels with more than 70 % of mineral oil
• revision under way

Biofuels Directive 2003/30/EC
• targets for bio proportion (2 % for 2005 and 5,75 % in 2010, energy content)
• indicative targets (could change)

European fuel standards (EN)
• not binding, not the power of law
• approved praxis
• emphasis on operational properties
• gasoline (228), diesel (590),
• biodiesel (14214), LPG (589)

RME max. 5 % (v/v)

Ethanol max. 5 % (v/v)

World-Wide Fuel Charter
• wish list by the auto manufacturers

2nd generation biofuels - even up to 30 % blends are possible without modifications

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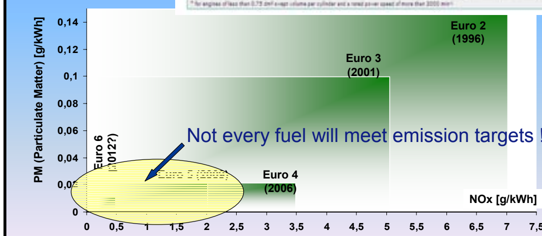
EU Emission Standards for HD Diesel Engines, g/kWh (smoke in m⁻¹)

Tier	Date	Test	CO	HC	NOx	PM	Smoke
Euro I	1992, < 85 kW	ECE R-49	4.5	1.1	8.0	0.612	
	1992, > 85 kW		4.5	1.1	8.0	0.36	
Euro II	1996.10		4.0	1.1	7.0	0.25	
	1998.10		4.0	1.1	7.0	0.15	
Euro III	1999.10, EEVs only	ESC & ELR	1.5	0.25	2.0	0.02	0.15
	2000.10	ESC & ELR	2.1	0.66	5.0	0.10 0.13*	0.8
Euro IV	2005.10		1.5	0.46	3.5	0.02	0.5
Euro V	2008.10		1.5	0.46	2.0	0.02	0.5

* [illegible]



Source: Volvo, DieselNet

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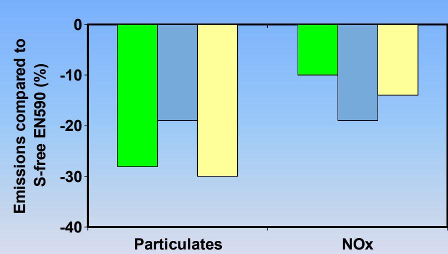
New Synthetic Biodiesel and Exhaust Emissions

Euro 4 truck engines



100 % NExBTL

ESC = European steady state cycle
ETC = European transient cycle

Details: 5th Int. Colloquium Fuels, Ostfildern, Jan 12 - 13, 2005

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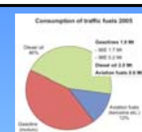
The Transportation Biofuels story in Finland



- Early phase strategy < 2005 - priority on heating and CHP market due to economy. Two reproaches from EC for “slow implementation” of the Biofuels Directive
- Second phase 2005-06 – The recommendations of the national Biofuels Committee to introduce a Law for obligation in order to implement the Biofuels Directive.
- The law was approved by the Parliament in March 2007; 2 % - 2008 -> 5.75 % in 2010
- Major concern on: GHG benefits, high additional cost, share of domestic production ?
- Third phase 2007–> Industrial investments and national RTDDD programme for 2nd generation biofuels development and market introduction. Criteria for improvements.
- Production capacity under construction by 2010 ~ 9 % based on 2nd gen. biofuels.

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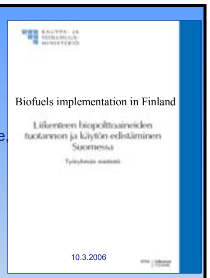
Recommendations of the Finnish Biofuels Committee 10.3.2006



www.ktm.fi

- Intoduction of a law for obligation, flexible in regions and time, starting 2 % in 2008 and 5.75 % in 2010. Proposal 3 %.
- Implementation based on biocomponents, compatible with present fuel logistics and vehicle fleet structure. Biogas has limited potential in city traffic, feeded to the natural gas grid
- Additional cost ~ 30 – 40 snt/litre → < 120 M€/a by 2010, consumer price will increase by 3 snt/liter of oil equivalent. (crude oil ~ 65 USD/barrel, + 50 – 100 % on fossil fuels).
- High priority to 2nd generation biofuels due to benefits in GHG reduction, exhaust emissions and additional cost → RTDDD

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2nd Generation Biofuels in the European Biofuels Technology Platform

Second generation biofuels

Biofuel type	Specific names	Biomass feedstock	Production process
Bioethanol	Cellulosic bioethanol	Lignocellulosic material	Advanced hydrolysis & fermentation
Synthetic biofuels	Biomass-to-liquids (BTL): Fischer-Tropsch (FT) diesel Synthetic (bio)diesel Biomethanol Heavier (mixed) alcohols Biodimethylether (Bio-DME)	Lignocellulosic material	Gasification & synthesis
Biodiesel	Hydro-treated biodiesel	Vegetable oils and animal fat	Hydro-treatment
Biogas	SNG (Synthetic Natural Gas)	Lignocellulosic material	Gasification & synthesis
Biohydrogen		Lignocellulosic material	Gasification & synthesis or Biological process

CRITERIA FOR THE 2nd GENERATION BIOFUELS IN FINLAND
- April 2007 a proposal for public consultation and criteria for support

- better green house gas balance in well to wheel cycle, > 30 % reduction
- sustainability issues in the whole WTW chain
- significant exhaust emission reduction in air quality, PM and NOx. Cold climate.
- additional tax support based on externalities ?
- Improved cost efficiency ~ 65 c/loe, no subsidy demand when oil > 80 US$/brl
- priority on high biofuel blends competible with existing systems.

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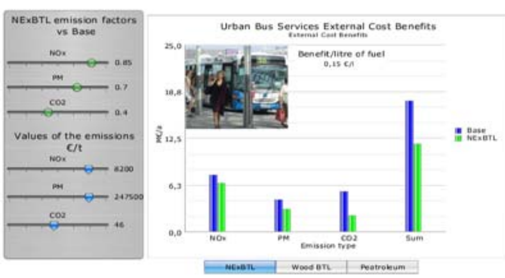
TEC TransEnergy Consulting

EXTERNALITIES OF VARIOUS BIOFUELS IN CITY TRAFFIC



Natural gas busses have externality benefits ~ 25 c/loe due to low NOx and PM emissions. For biogas vehicles ~ 40 c/loe, which has been the argument for total tax reduction in Finland.

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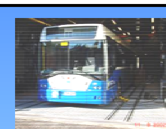
HELSINKI VISION FOR THE FUTURE



- ***Metropolitan Helsinki provides among the cleanest public transport in Europe!***
- In 2010 the share of biofuels in Helsinki bus services could be as high as 50 %. There are some 1,400 buses and 100 refuse trucks in Helsinki
- Focused use of high concentration (30 – 100 %) second generation biofuels for improved urban air quality
- Fuel qualities compatible with existing refuelling infrastructure and existing vehicles
- EU level project under development
  - large scale field testing (Finland, France, Sweden)
  - involvement of engine manufacturers, optimisation of fuel parameters
  - start-up of standardisation of high concentration biofuels

- Initiative by Helsinki City Transport and Helsinki Metropolitan Area Council

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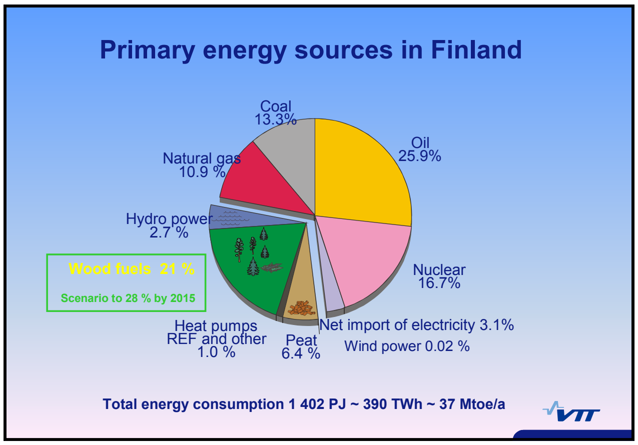

Primary energy sources in Finland
Coal 13.3%
Oil 25.9%
Natural gas 10.9 %
Hydro power 2.7 %
Wood fuels 21 %
Scenario to 28 % by 2015
Nuclear 16.7%
Heat pumps REF and other 1.0 %
Peat 6.4 %
Net import of electricity 3.1%
Wind power 0.02 %
Total energy consumption 1 402 PJ ~ 390 TWh ~ 37 Mtoe/a
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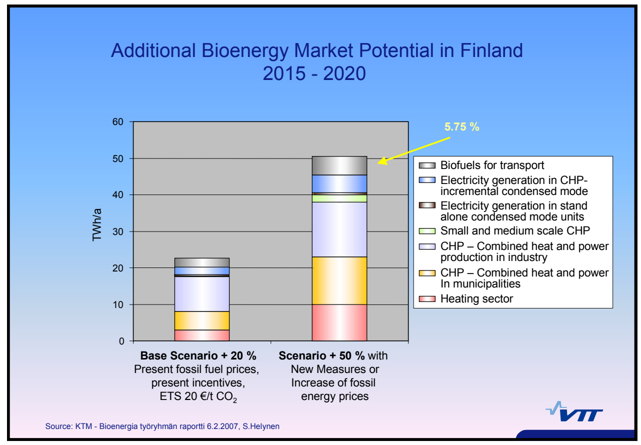

Additional Bioenergy Market Potential in Finland
2015 - 2020
TWh/a
60
50
40
30
20
10
0
5.75 %
Biofuels for transport
Electricity generation in CHP-incremental condensed mode
Electricity generation in stand alone condensed mode units
Small and medium scale CHP
CHP – Combined heat and power production in industry
CHP – Combined heat and power In municipalities
Heating sector
Base Scenario + 20 %
Present fossil fuel prices, present incentives, ETS 20 €/t CO_2
Scenario + 50 % with New Measures or Increase of fossil energy prices
Source: KTM - Bioenergia työryhmän raportti 6.2.2007, S.Helynen
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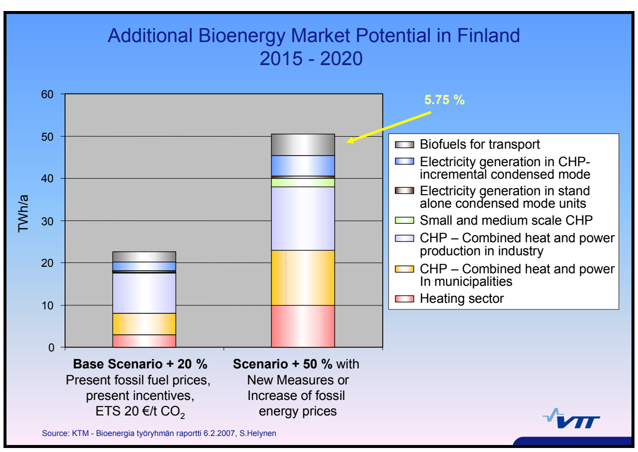

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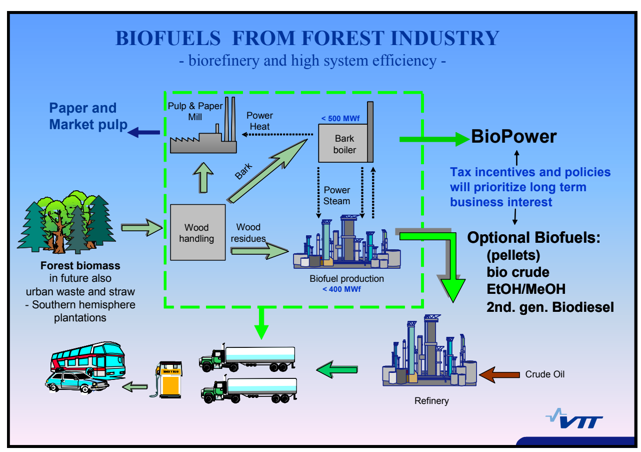

BIOFUELS FROM FOREST INDUSTRY
- biorefinery and high system efficiency -
Paper and Market pulp
Pulp & Paper Mill
Power Heat
< 500 MWf
Bark boiler
BioPower
Tax incentives and policies will prioritize long term business interest
Bark
Power Steam
Wood handling
Wood residues
Forest biomass
in future also urban waste and straw
- Southern hemisphere plantations
Biofuel production
< 400 MWf
Optional Biofuels:
(pellets)
bio crude
EtOH/MeOH
2nd. gen. Biodiesel
Crude Oil
Refinery
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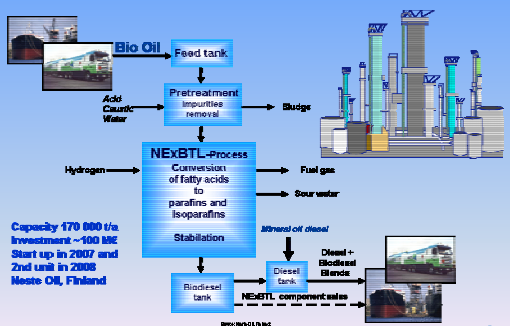
Synthetic Biodiesel NExBTL – start up in June 2007



CONCLUSIONS

- 1st generation biofuels have opened the market – a challenge for large introduction:
  - no clear environmental benefits; low GHG reduction potential
  - concern on end use properties, today max. 5 % vol-%
  - excellent success stories like ethanol in Brazil
- 2nd generation biofuels give clear benefits:
  - superior end use properties in diesel fleets
  - reduction of tail pipe emissions and GHG
  - strong RTDDD activities in Germany, France, Sweden and Finland
- The bioenergy covers today 21 % of primary energy demand in Finland, focus has been in heat and electricity generation due to cost competence. The potential by 2020 ~ 28 % (+ 50 %)
- Flexible law for biofuels obligation, 5.75 % in 2010, market and technology competition
- Present industrial investments announced on 2nd generation ~ 9 % in 2010. Synthetic biodiesel products from oils, fats and forest residues, EtOH from industry residues
- Helsinki bus transport opens a large platform for new 2nd generation biofuels products
- Strong RTDD programme; syngas based FT biodiesel, biogas, EtOH concepts and bio crude co-processing. National demonstration programme ~ 30 M€ and Tekes Biorefine ~ 130 M€. International co-operation needed – a global challenge.