

**Market introduction of next generation biofuels  
Industrial view**

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# TransEco Coordinated Research Effort 2009 - 2013

## Energy Efficiency and Alternative Energies in Road Transport

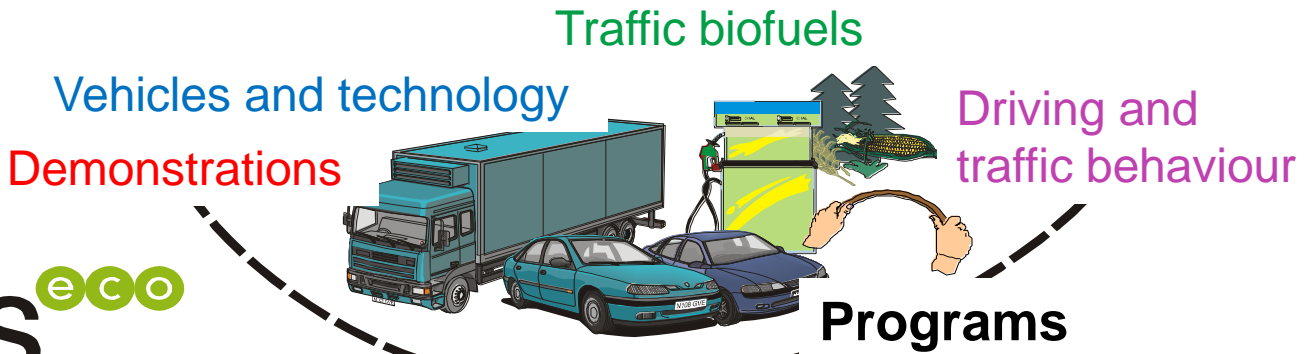
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Action level

Local administration



State administration



Companies, organisations



Knowledge



Customers

Decision makers

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# EU directives

## RED directive 2009/28/EC:

- Renewable energy (fuels + electricity) in traffic at least **10%** 2020
  - Finnish target **20%** 2020
- Decrease of greenhouse gases 35% compared to fossil fuels and 50% (60% new production) since 2017
- Fuels, where waste or other inedible raw materials are used, can be multiplied by 2 in obligation calculation

## Traffic fuel directive 2009/30/EC:

- Ethanol content max volume 10% in gasoline = **6,7 % energy**
- FAME content max volume 7% in diesel = **6,4 % energy**

# EU directives

## Solution examples in Finland

2011 **6% energy** = 225 kte/a (gas./diesel = 0,9)

- Gasoline 50%E5 + 50%E10 (mean E7) 80 kte/a = 2,1%e
- FAME Diesel B0-B7 (mean 1%) 10 kte/a = 0,3%e
- HVO Diesel 135 kte/a = 3,6%e

2020 **20% energy** = 750 kte/a (gas./diesel = 0,7)

- New traffic fuel directive max E20 and B10 ?
- Gasoline 80%E10 + 15%E20 + 5%E85 (mean E12) 165 kte/a = 4,7%e
  - where 40kt/a waste ethanol (x2)
- Biogas 10 kte/a (x2) 20 kte/a = 0,5%e
- FAME Diesel B0-B10 (mean 1%) 15 kte/a = 0,4%e
- BTL diesel 200 kte/a (x2) 400 kte/a = 10,7%e
- HVO diesel 140 kte/a = 3,7%e

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# Bio based diesels

1st Generation  
In production: Now

1st-2nd Generation  
Since 2007

2nd Generation  
c. 2017

Vegetable oils

Vegetable oils

Animal fats

Biomass

Esterification

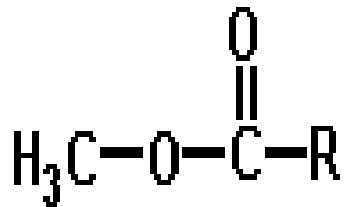
Hydrotreating

Gasification  
Fischer-Tropsch

FAME

HVO

BTL



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# HVO-diesel process



Bio oils

Feed tank

Pretreatment

Sludge

Hydrogen



HVO-Unit

Bio fuel gas

Water

Biogasoline

HVO diesel



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# Neste Oil HVO Capacity 2 milj. tons/a

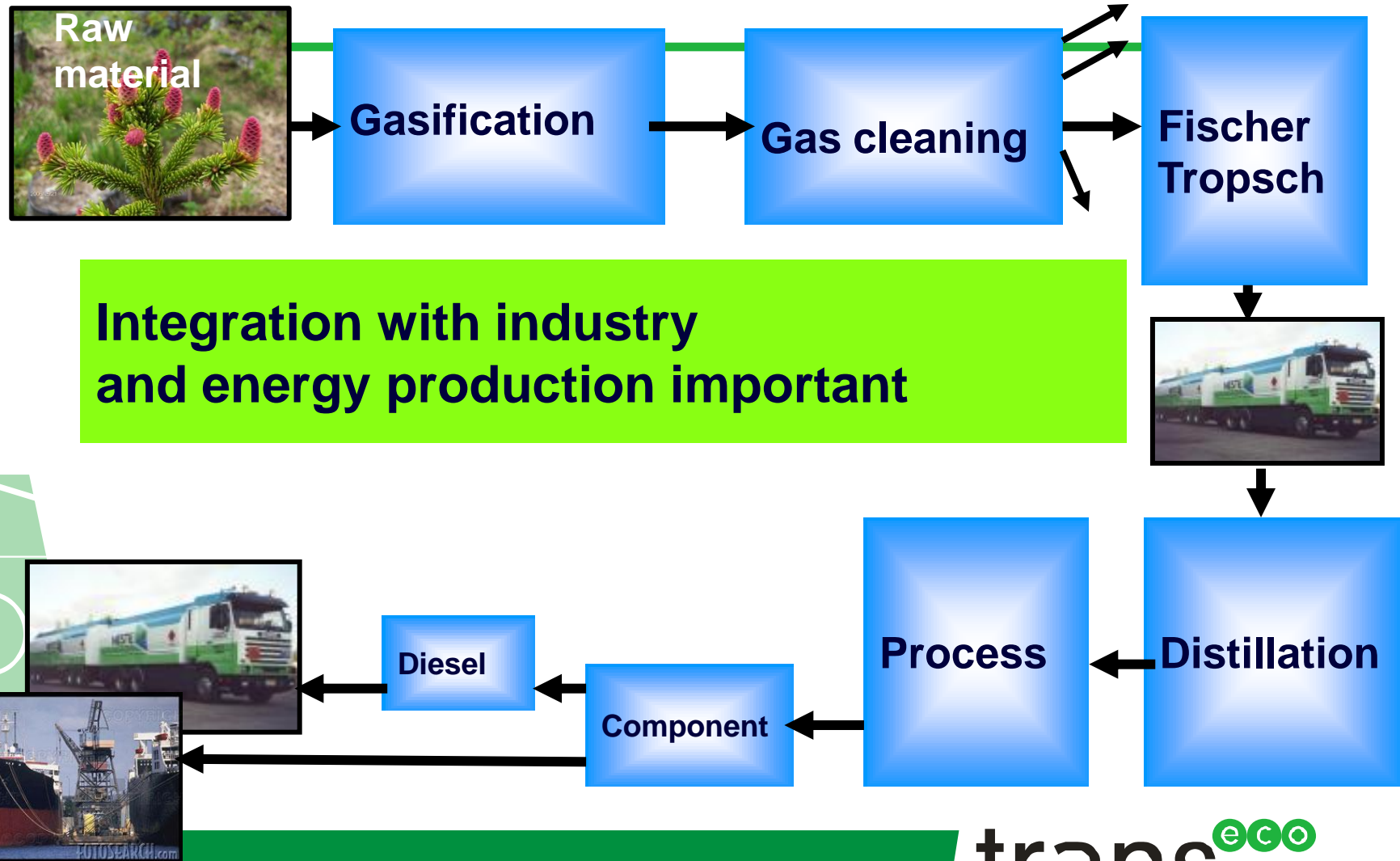


|              |                |      |
|--------------|----------------|------|
| 1. Porvoo 1  | 200 000 tonnes | 2007 |
| 2. Porvoo 2  | 200 000 tonnes | 2009 |
| 3. Singapore | 800 000 tonnes | 2010 |
| 4. Rotterdam | 800 000 tonnes | 2011 |

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# BTL-diesel 2017 =>



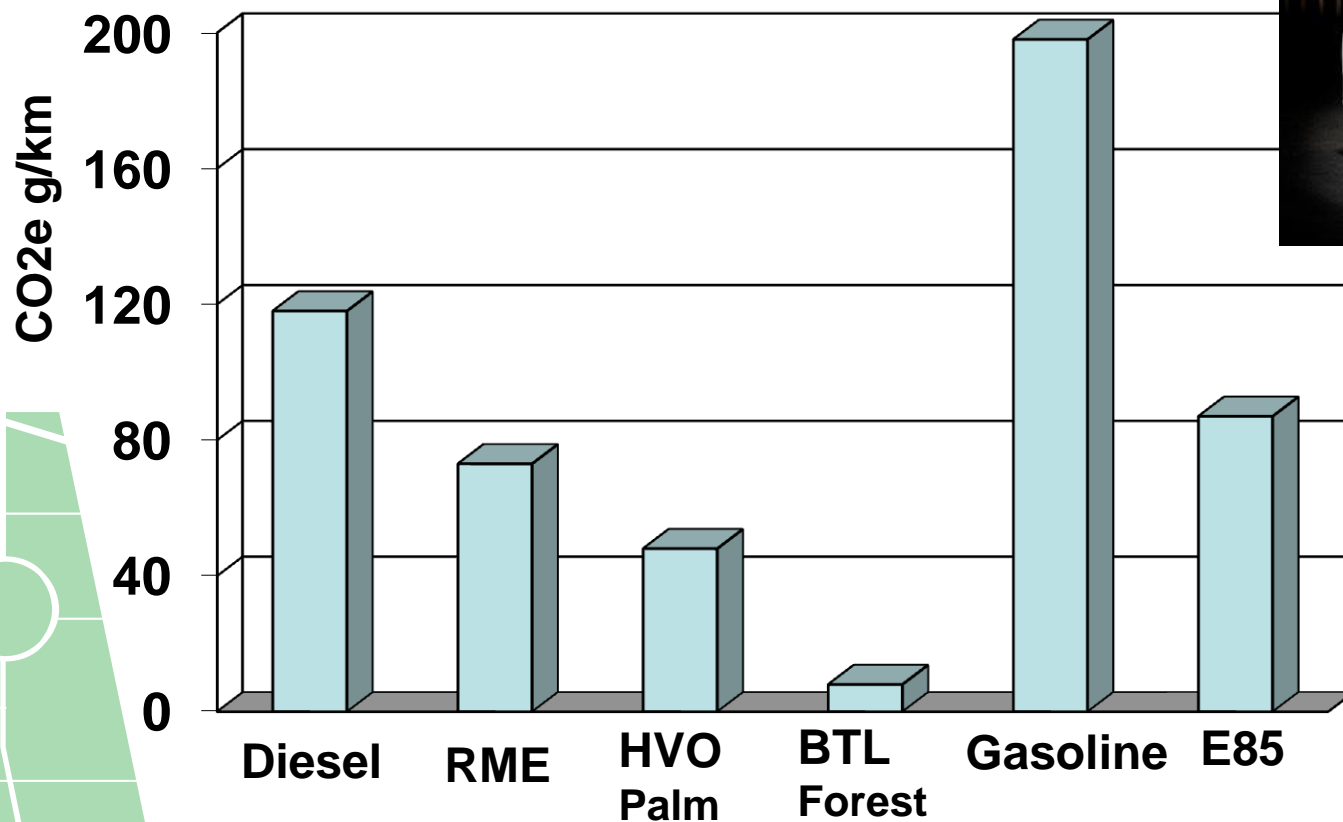
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# HVO/BTL = high quality diesel

- Fully compatible in any blends with fossil diesel – same logistic
- Cold properties -5...-35°C
- Low exhaust emissions: NOx -10%, part. -30%,...
- Fulfil CEN CWA 15940 paraffinic diesel standard
  - Paraffinic, high setane, no aromatics, sulphur free
- Less maintenance: lub oil; injection system
- Particulate filter regeneration interval longer
- Excellent customer experiences since 2007
- Wide raw material options: vegetable oils, animal fats, waste, side streams, algae and bacteria oils

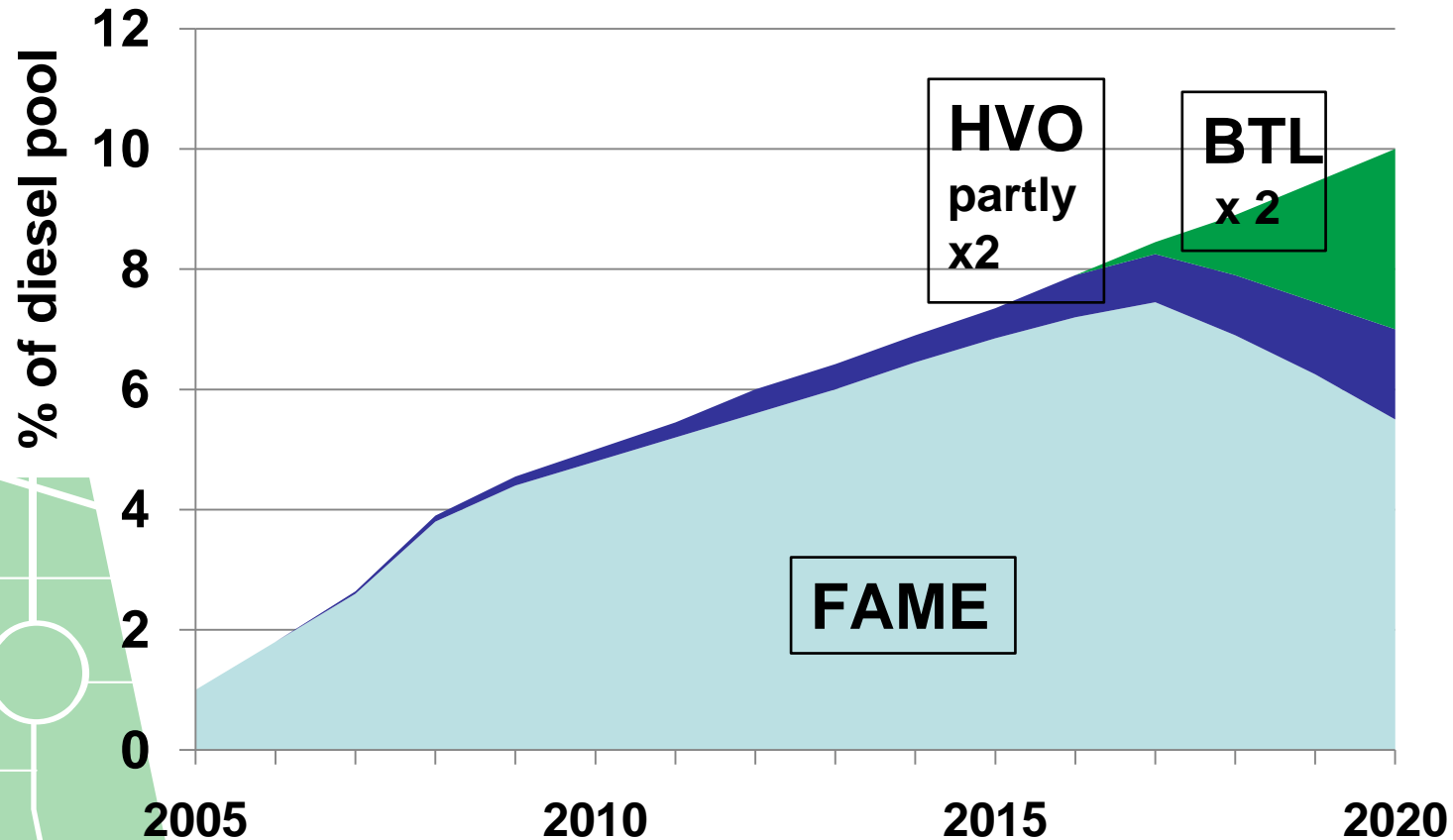
# GHG emissions CO<sub>2</sub>e g/km

Volvo V50 1,6D DRIVE, Volvo V50 1,8 F



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# European biodiesel target



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# 3 ways to use HVO/BTL diesel

## 1. Blending some percents into EN 590 diesel fuels

- Fulfil biomandates
- Base diesel can contain 0 ... 7 % FAME-biodiesel
- **HVO: fully fungible into diesel fuel**
- For higher bioenergy targets, like  $\geq 10$  energy-%, automotive companies support  $\leq 7$  % FAME + x ... xx % HVO



# 3 ways to use HVO/BTL diesel

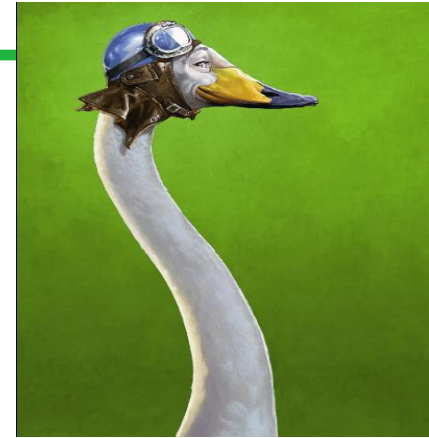
## 2. Blending tens of percents into diesel fuels

### a) Premium diesel fuel for retail

- cold start, exhaust emissions, noise, less maintenance (cetane, low aromatics)
- sold in Finland with excellent experience

### b) Upgrade diesel to meet EN590

- utilize HVO blending value at refinery
  - density  $\approx 785 \text{ kg/m}^3$ , 0-aromatics, 0-sulfur
  - very high cetane number
  - Cold properties - 5 ... - 35°C



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# 3 ways to use HVO/BTL diesel

## 3. HVO as such

- Low emission fuels to achieve cleaner local air quality
- for city bus and garbage truck fleets, mine vehicles, ...
- lower NO<sub>x</sub>, particulate and PAH emissions
- excellent for engines, catalysts and particulate filters (DPF)
- HVO meets pre-standard CEN CWA 15940:2009 for paraffinic diesel fuels
- used in Finland by bus fleets and by car customers



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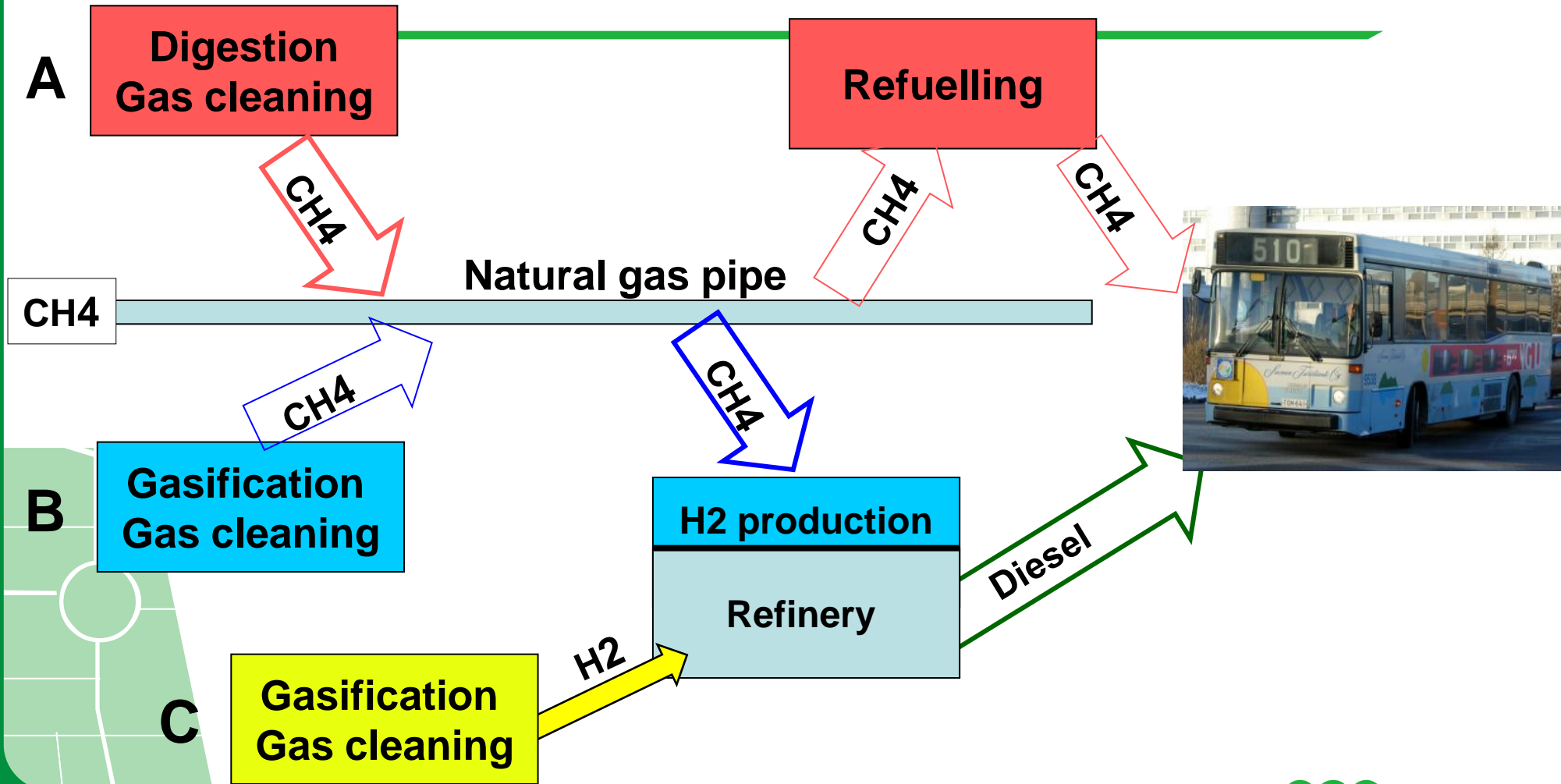
# HVO/BTL and air traffic

- Possible to blend tens of percents HVO/BTL with JET
- Big market potential
- Production price high comparing fossil JET
  - Mandate or
  - High tax of fossil JET





# Biogas options - Solution = Low tax



# Marketing 1st generation biofuels

- **Fossil fuel qualities have followed gradually vehicle technology development. So no big efforts to market new fuels were needed - lead free gasoline was exception**



100 year



- **Marketing biofuels formed discontinuity**
  - **Properties of biofuels are different**
  - **Some quality weaknesses comparing fossil fuels**
  - **Fuel producer must ensure the quality of end product**

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# Marketing 2st generation biofuels

## Information/Marketing/Lobbying to the consumers, vehicle manufacturers and authorities

- 2<sup>nd</sup> gen. ethanol and FAME – quality defined by fuel standards:
  - => Certify: components fulfils RED and fuel quality directives
- Other alcohols and hydrocarbons (1<sup>st</sup> and 2<sup>nd</sup> gen):
  - => certificates of authority including sustainability
  - => to get favourable laws, taxes and investment support
  - => new standard for fuel alcohols
  - => engine research and vehicle fleet tests, before vehicle manufacturers guarantee their engine with a new fuel
    - => end customers follow normally guarantees
    - => find good properties fulfilling customer needs



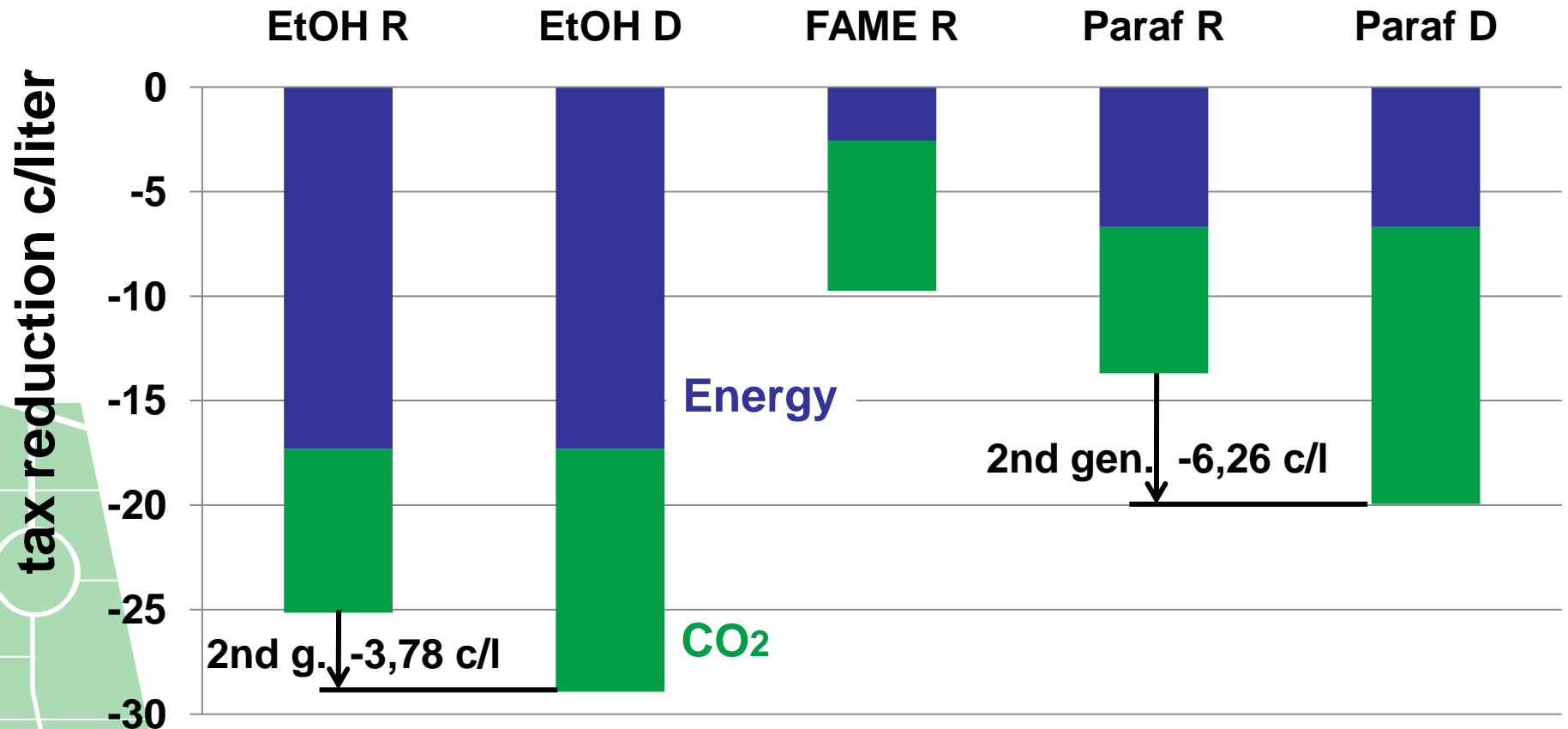
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# Taxation of biofuels in Finland

2010 from c/litre => 2011 energy c/litre + CO2 c/litre

|                       | Energy       | CO2          | Supply sec. | Total        |
|-----------------------|--------------|--------------|-------------|--------------|
| <b>Gasoline</b>       | <b>50,36</b> | <b>11,66</b> | <b>0,68</b> | <b>62,70</b> |
| <b>Ethanol</b>        | <b>33,05</b> | <b>7,65</b>  | <b>0,68</b> | <b>41,38</b> |
| <b>Ethanol Res</b>    |              | <b>-50%</b>  |             |              |
| <b>Ethanol Double</b> |              | <b>-100%</b> |             |              |
| <b>Diesel</b>         | <b>30,70</b> | <b>13,25</b> | <b>0,35</b> | <b>44,30</b> |
| <b>Paraf.</b>         | <b>24,00</b> | <b>12,51</b> | <b>0,35</b> | <b>36,86</b> |
| <b>Paraf. Res</b>     |              | <b>-50%</b>  |             |              |
| <b>Paraf. Double</b>  |              | <b>-100%</b> |             |              |

# Tax promotion in Finland



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# Conclusions

- **New type of biofuels marketing consider consumers, authorities and vehicle manufacturers**
- **2nd gen. ethanol and FAME do not need marketing, if EtOH and FAME fuel standard are fulfilled**
- **Biofuels and especially 2nd gen biofuels are more expensive than fossil ones => support will be needed**
  - **Taxation**
  - **Mandate**
  - **Investment - especially BTL units**
- **Authority actions should be predictable and decisions should stay long enough**