



# Fuels for trucks

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Renewable energy carriers for heavy duty vehicles

Magnus Swahn

# Kort introduktion av mig

## Tidigare

- ASG (idag DHL)
- Green Cargo (tidigare SJ Gods)
- Trafikverket
- Sveriges Transportindustriförbund

## Nuvarande

- **Conlogic**
- [magnus.swahn@conlogic.se](mailto:magnus.swahn@conlogic.se)
- [www.conlogic.se](http://www.conlogic.se)
- **Nätverket för Transporter och Miljön**
- [info@ntmcalc.org](mailto:info@ntmcalc.org)
- [www.transportmeasures.org](http://www.transportmeasures.org)

NTM Network 2018.ppt (Microsoft PowerPoint) - Microsoft PowerPoint

https://www.transportmeasures.org/en/ NTM Network for Transport Meas... Arkiv Redigera Visa Favoriter Verktyg Hjälp What is Diesel Fuel Båtar Home - Research Participa... Home - Research Participa... Förslag på webbplatser WebSlice-galleri Sida Säkerhet Verktyg ? Log in

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NETWORK FOR TRANSPORT MEASURES

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CALCULATION OF ENVIRONMENTAL IMPACT

**NTM ECAP**  
DEFAULT AND BENCHMARK TRANSPORT DATA

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NEWS & BLOG

**NEWS**  
12 April, 2018  
**NTM participates at conference heavy duty vehicle transport**  
NTM attends a conference the 19th of May on future heavy duty vehicles transport. In the future there is a requirement on low emitting engines meanwhile providing high performance –this a pre-condition for a broad ...

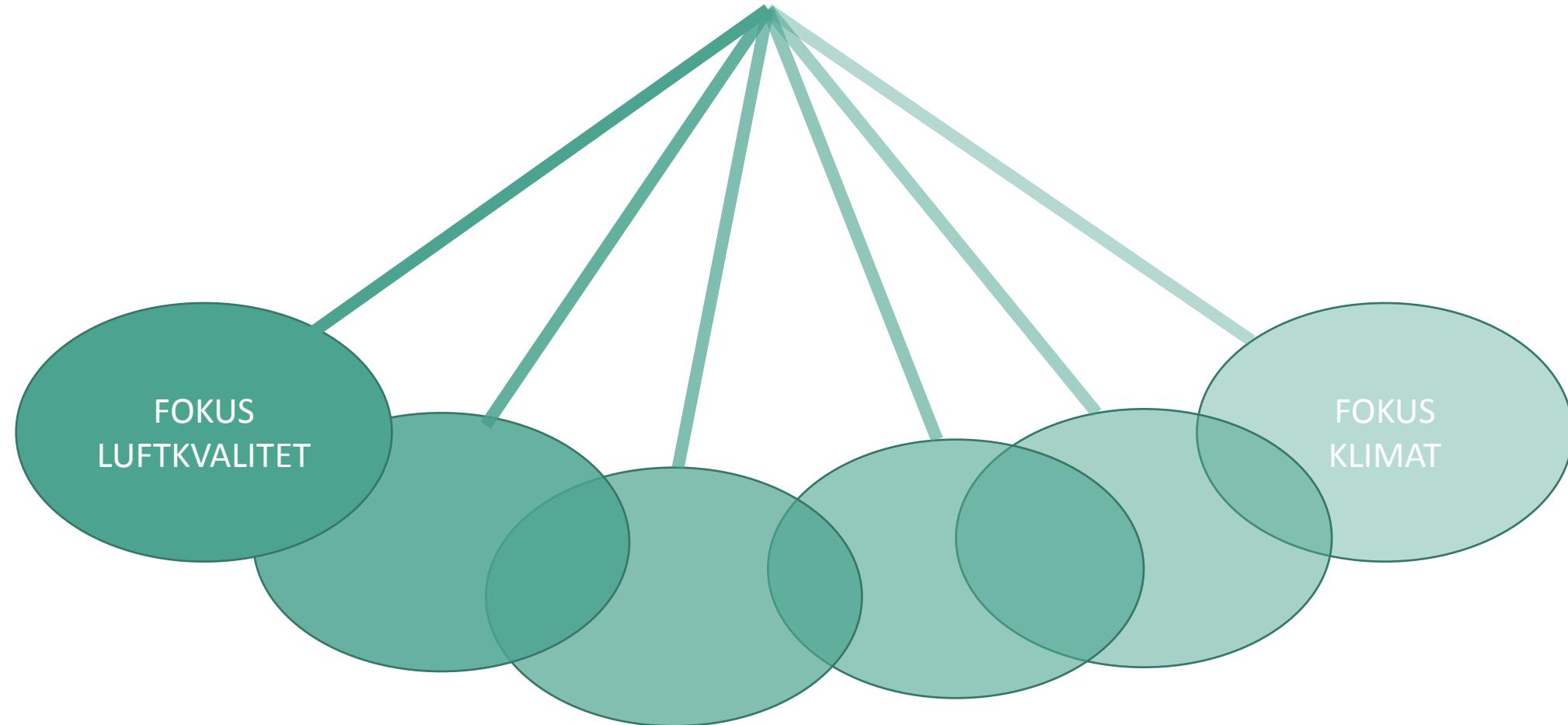
**NEWS**  
16 March, 2018  
**NTM annual breakfast member meeting in Stockholm the 18th of April**

VOICE FOR SUSTAINABLE TRANSPORT



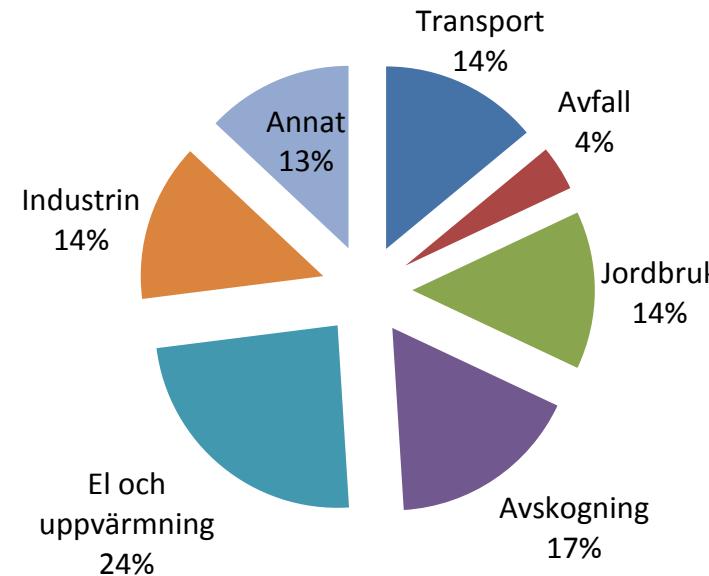
125 % 13:01 2018-04-17 Länkar SV

# Vad händer i vår omvärld?

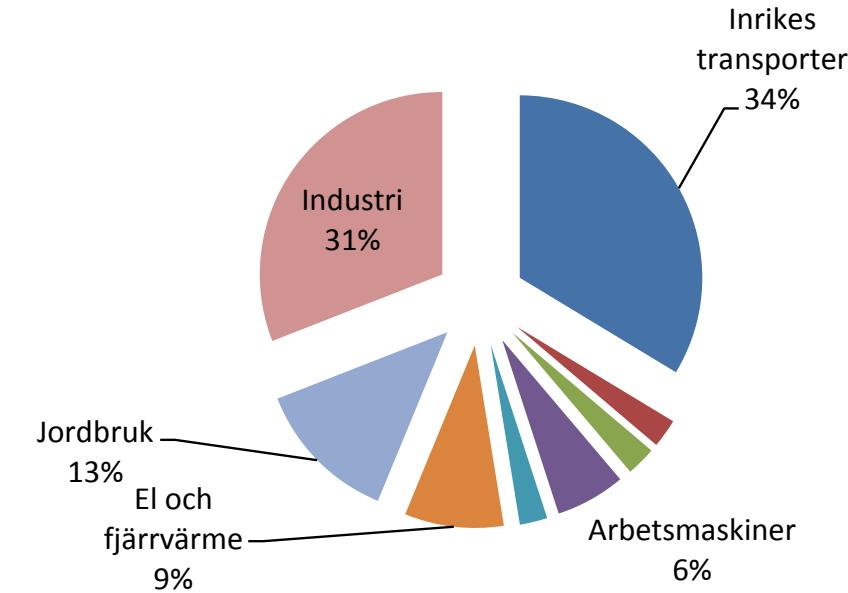


# Nuläget för transporterna och klimatet i Sverige

## Globala utsläpp av växthusgaser



## Svenska utsläpp av växthusgaser

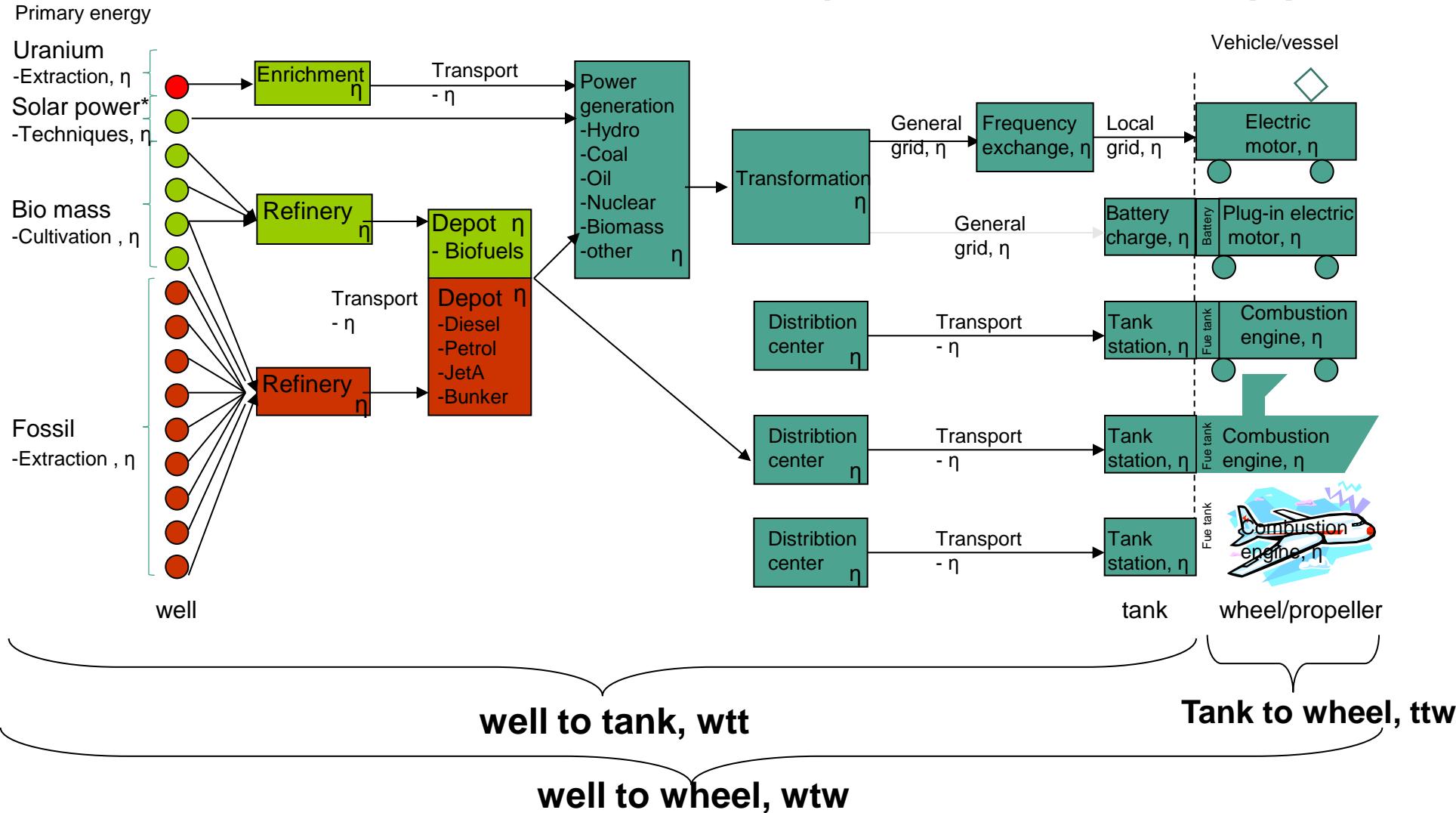


EU: transporter står för drygt 20 %

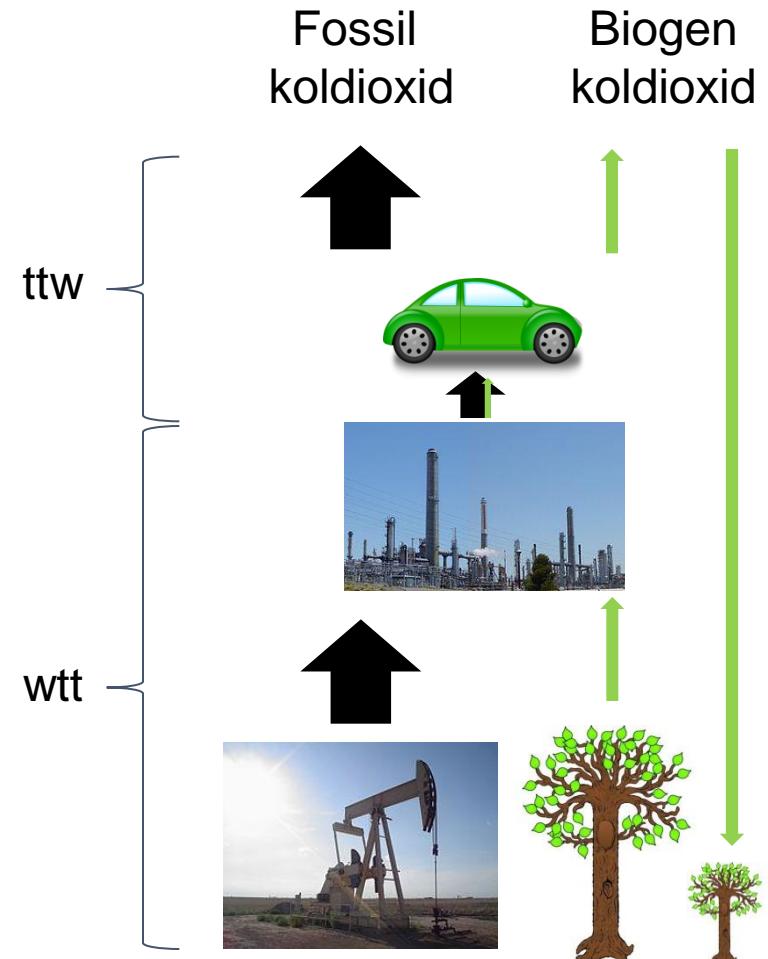
Med utrikes transporter (flyg och sjö) utgör transporterna 43% av de svenska utsläppen

Personbilarna står för ca 60 procent och **godstransporter för resterande 40**

# Hur ska man fastställa transporternas utsläpp?



# Vad som redovisas kan skilja sig



	CO <sub>2</sub> total	CO <sub>2</sub> e
Well to tank, wtt :	CO <sub>2</sub> biogen	CO <sub>2</sub> fossil CH <sub>4</sub> N <sub>2</sub> O
Tank to wheel, ttw :	CO <sub>2</sub> biogen	CO <sub>2</sub> fossil CH <sub>4</sub> N <sub>2</sub> O
Well to wheel, wtw :	CO <sub>2</sub> biogen	CO <sub>2</sub> fossil CH <sub>4</sub> N <sub>2</sub> O

CO<sub>2</sub>fossil ttw = min

CO<sub>2</sub>e wtw = max

# Energy carriers definition (draft for discussion)

## 1.1 Finite fuels and electricity (fossil and uranium)

Any liquid-, gaseous-, or solid- substance and electrons produced from;

- Oil
- Natural gas (fossil gas)
- Coal
- Uranium

## 1.2 Renewable fuels and electricity (biofuels and renewable electricity)

Any liquid-, gaseous-, or solid- substance and electrons produced from;

- Biomass (vegetal and animal substances)
- Waste, landfill, manure and sewage
- Hydro power
- Wind power
- Solar power
- Ocean energy
- (- Aero-, geo- and hydrothermal)

## 1.3 Blended fuels and electricity

- Drop in fuels e.g. diesel with FAME, petrol with ethanol and natural gas with biogas
- Electricity production mixes from various power plants, based on national production conditions

## Finite fuels & electricity (Fossil fuels and nuclear generated electricity)

- Diesel
- Gasoline (petrol)
- Liquefied natural gas, LNG
- Compressed natural gas, CNG
- Heavy fuel oil, HFO
- Marine diesel oil, MDO
- Marine gas oil, MGO
- JET A
- Aviation gasoline
- Fossil based electricity
- Nuclear based electricity

## Renewable fuels & electricity (Biogenic fuels and electricity from sun, wind and hydropower)

- Ethanol<sup>1</sup>
- Fatty acid methyl esters, FAME<sup>1</sup>
- Hydro treated vegetable oil, HVO<sup>2</sup>
- Liquefied biogas, LBG
- Compressed biogas, CBG
- Methanol<sup>3</sup>
- Butanol<sup>3</sup>
- Dimethyl ether, DME<sup>3</sup>
- Hydrogen<sup>3</sup>
- Electro fuels<sup>4</sup>
- Renewable fuel based electricity
- Hydro-, wind- & solar based electricity

1) Conventional crop based biofuels (sometimes referred to as 1<sup>st</sup> and 2<sup>nd</sup> generation)

2) Conventional crop based biofuels and advanced biofuels (sometimes named 3<sup>rd</sup> generation) from black liquor, wood, algae, used cooking oil etc)

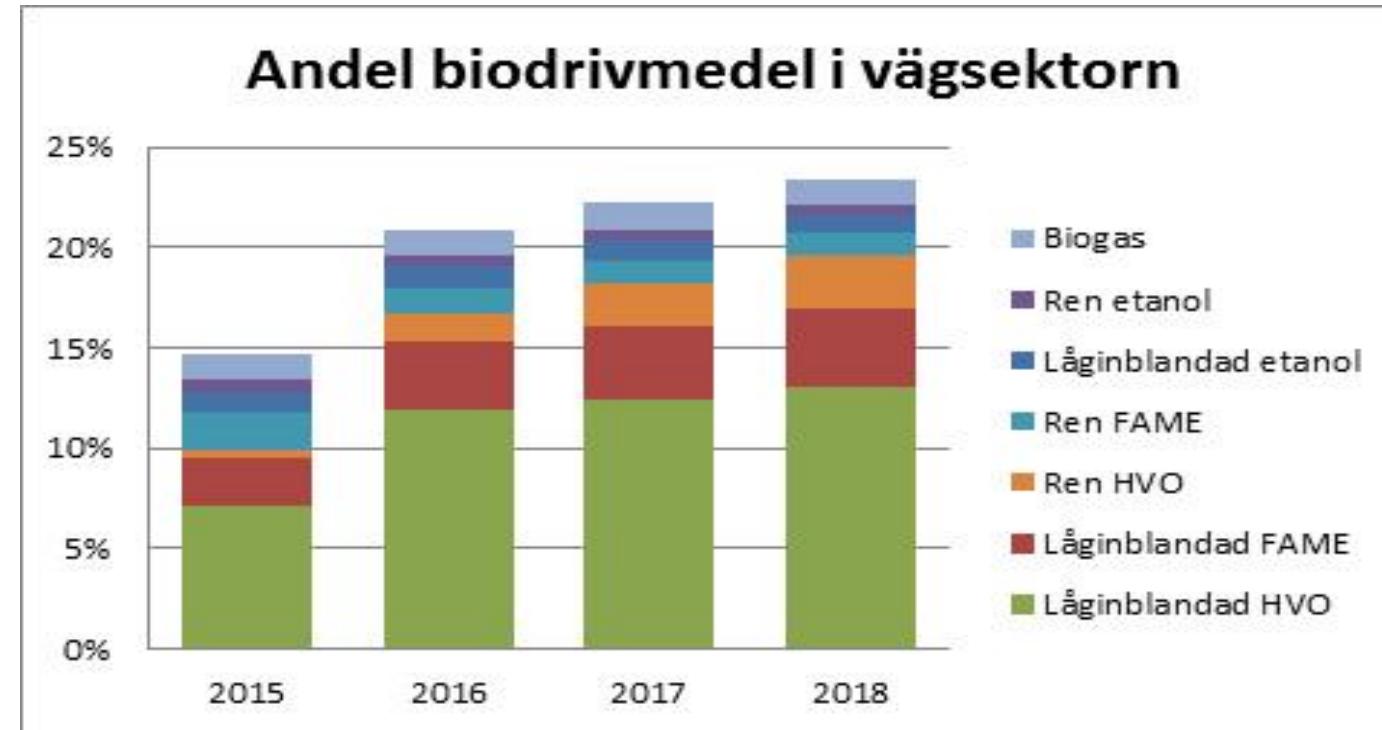
3) Today, often produced from fossil natural gas

4) Synthetic hydrocarbons

# Ny teknik

"För hundra år sedan innebar alternativa drivmedel allt annat än det man matade en häst med"

Leslie Kendall



Men den förnyelsebara biomassan är en mycket knapp resurs

# Drivmedel och elkraft

- HVO
- El (vatten, kärnkraft, vind, fossilt, sol)
- Metan (LNG, LBG, CNG, BNG)
- Etanol (ED 95, E85)

# Biobränslen och matförsörjning

## EU

- Biogas
- Electricitet
- Vätgas

## Thought for food

A review of the interaction between biofuel consumption and food markets

Author: Dr Chris Malins

September 2017

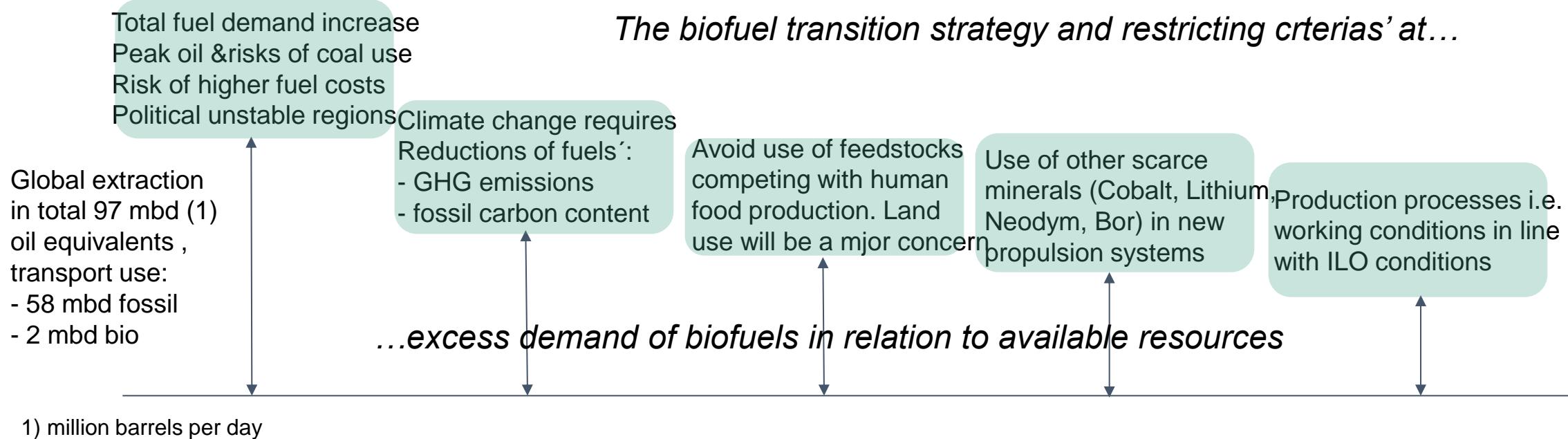


# Fuel and electricity efficiency

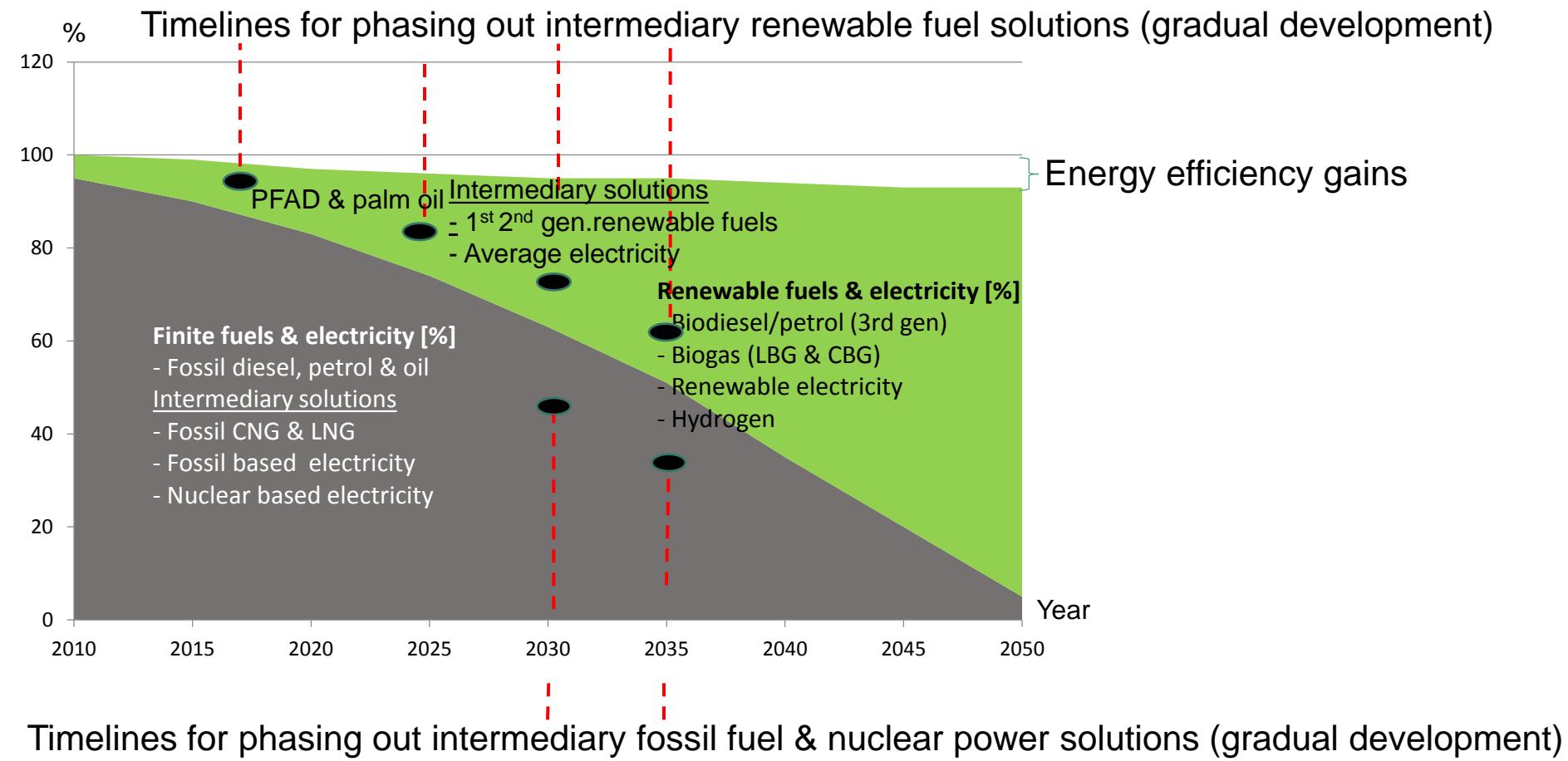
Diesel vehicle			Electric vehicle, power from oil in gas turbine		
	Efficiency	Energy [MJ]		Efficiency	Energy [MJ]
Raw oil		1	Raw oil		1
Extraction	90%	0,9	Extraction	90%	0,9
Fuel production	95%	0,86	Fuel production	96%	0,86
Fuel blend	98%	0,84	Power production (Gas turbine)	43%	0,37
Distribution	96%	0,80	Grid distribution	94%	0,35
On-board storage	100%	0,80	Charging and on-board storage	90%	0,31
Propulsion	44%	0,35	Propulsion	90%	0,28

- 1) From an efficiency point of view, electric propulsion requires non-fossil electricity production.
- 2) Adding for example coal based electric generation, ~700-900 g CO<sub>2</sub> per kWh gives an additional strong argument for non fossil generated electricity

# Phase out finite fuels & electricity delimitations



# Phase out finite fuels & electricity from finite source



Källa: Conlogic

# Sverige fram till 2030?

Drivmedel och el	2016 [TWh]	%	2030 [TWh]	Kommentar
Bensin	29	30%	13	14% Ersatt av biogas samt el
Diesel	43	45%	35	37% Ersatt av biodiesel
Etanol	1,3	1%	2	2% Svårt att se ökning med EUs regelverk
Biodiesel	14,51	15%	20	21% Enligt kommande reduktionsplikt
Naturgas	0,43	0%	2,4	3% Behövs som backup för biogas
Biogas	1,15	1%	10	11% Biogasstrategi anger 12 för transport
El	3,15	3%	9	10% Enkelt beräknat som trefaldigat
Flygbränsle	2,16	2%	2,16	2% Ej studerat, men ökar sannolikt
Eo1	0,39	0%	0,39	0% Eldningsolja ej studerat
Eo2	0,05	0%	0,05	0% "
Inrikes totalt	95,14		94	
Utrikes sjöfart	23,4			Ej inkluderat
Flygbränsle utrikes	10			"
Totalt	128,54			

Med detta scenario samt under antagandet att ökande andel el kommer från förnybart: 44% förnybart

Notera att utrikes sjö och flyg inte ingår i detta

Finite fuels

Renewable fuels

# Future fuels overview – long term

Fuels & energy carriers	Primary energy source		
	Short term (2018-)	Medium term (2025-)	Long term (2045-)
Biodiesel (FAME towards HVO <sup>(1)</sup> )	Wood, waste & FAME	Wood, waste	Algae <sup>(2)</sup> , Electro fuels <sup>(3)</sup>
Ethanol, methanol & butanol	Wood and crops	Wood and crops	Algae, Electro fuels
LBG , CBG & LNG, CNG <sup>(4)</sup>	Residues, waste & fossil gas	Residues & waste	Residues & waste
Electricity: grid, batteries, hydrogen <sup>(5)</sup>	Hydro, wind & sun	Hydro, wind & sun	Hydro, wind, sun, Electro fuels
Dimethylether, DME	Wood & black liquor	Wood & black liquor	Algae, Electro fuels
Methanol (sea)	Wood & fossil gas	Wood & biogas	Algae, Electro fuels
Jet A (air)	Fossil oil	Wood & waste	Algae, Electro fuels

1) Palm oil and PFAD excluded as feedstocks

2) If feasible, much R&D remains

3) Electro fuels based on CO<sub>2</sub> and water in combination of excess of electricity producing synthetic hydrocarbons, much R&D remains

4) CNG and LNG could potentially pave the way for LBG and CBG. Use of fossil gas requires a plan towards use of biogas

5) In a fuel cell or in a combustion process