General overview of transport energy use

- Example Sweden

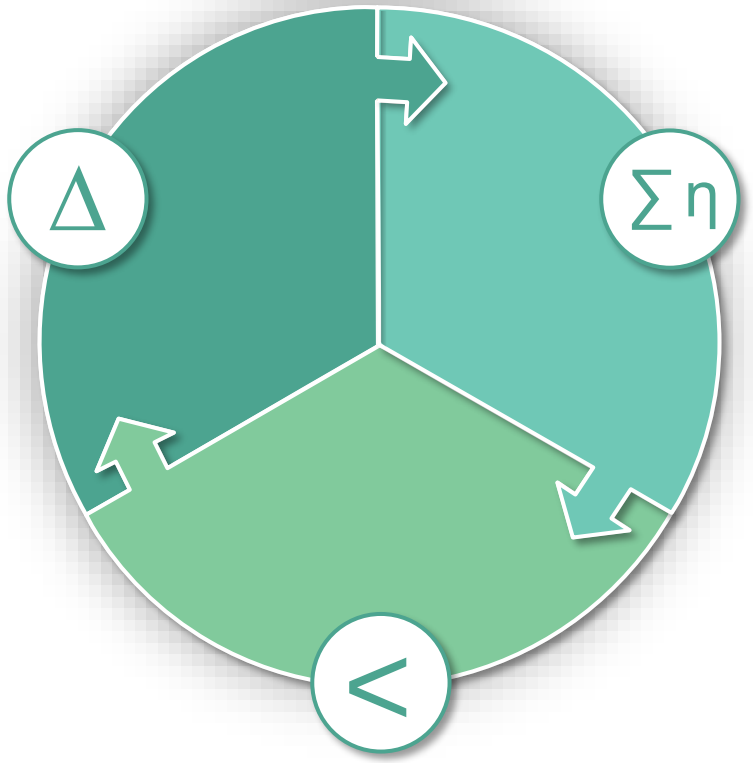
Magnus Swahn

NTM provides:
- support for continuous environmental improvement

Improvement measures

- NTM*Delta* (trail blazers)

Activities
Demand Management
Transport efficiciency
- Utilization degree
New Techniques
- Electrification



Measure and assess performance

- NTM*Calc*

Methods	Data
PCR/EPD	Air **(FC/EC)**
EN 16 258	Rail **(FC/EC)**
GLEC	Road **(FC/EC)**
Learn	Sea **(FC/EC)**
ISO 14 083	Nodes
	Fuels & Electricity
	- HVO
	- **Electric mix**
	- Ethanol
	- Methane
	- FAME
	- Diesel & Petrol

Default data/benhmark
Air
Rail
Road
Sea
Hubs (terminals & warehouses)

Evaluate performance measures
(Tools for transport supplier evaluation)

-NTME_2*cap*

28 years ago (1993) we formed NTM…

Foto: Peter Nordahl

Konferens för miljön

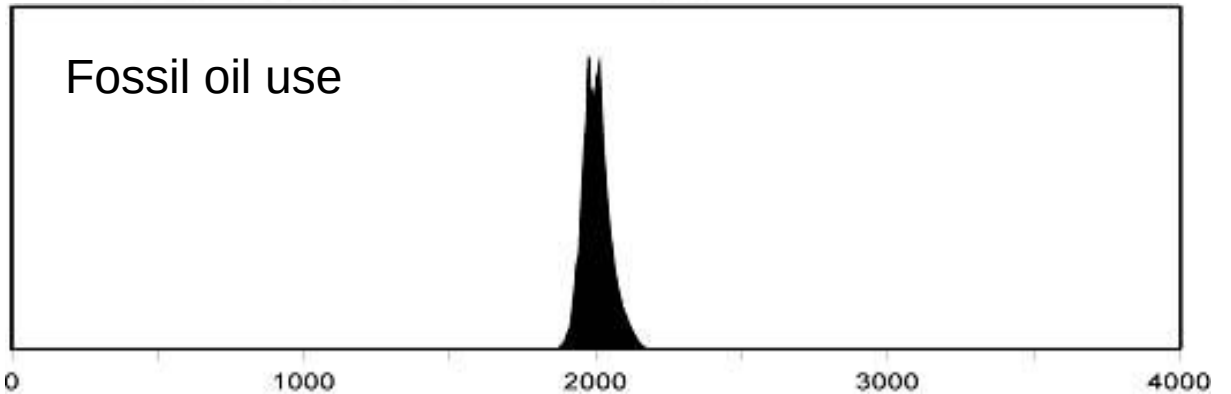
– Det är dags att vi lyfter oss ur symboldiskussionernas träsk och ägnar oss åt de faktiska miljöproblemen, sa kommunikationsminister Mats Odell på en konferens med temat "Godstransporter och miljö" som ägde rum tisdagen den 23 november.

Konferensen anordnades gemensamt av ASG, Bilspedtion, Sveriges Speditörförbund, Svenska åkeriförbundet, Sveriges Redareförening, SJ Gods och SAS Cargo. Under dagen belystes de olika transportslagens syn på miljöfrågorna samt även Kommunikationsdepartementets, Miljödepartementets och Det Naturliga Stegets åsikter om transporter och miljö. Som avslutning enades man om att skapa ett nätverk för transportsektorn på miljöområdet.

Åsa Lindell, Bilspedition, Mats Odell, konmunikationsminister och Magnus Swahn, ASG AB är överens om att miljöfrågorna är viktiga för transportsektorn.

Anna Granholm

…2050, 29 years ahead the transition is supposed to be ”ready”



Propulsion efficiency (tank to wheel)

Conversion

Energy = **Exergy** + **Anergy**

Q1, heat value — Q2, useful work — Losses

$$\text{Efficiency} = \eta = \frac{Q2}{Q1}$$

Fuels + Oxygen → IC & AT* → **Exergy** + **Anergy** + **Carbondioxide** + **Air polutants** + **Water**

Fossil + Biogenic

Input, Q1 — Output, Q2 (useful work i.e. moving vehicle) — Losses and second order effects

Electricity → Motor → **Exergy** + **Anergy + elsewhere emissions**

Losses and second order effects

* Internal combustion and after treatment of fumes

Transportation transition need 1990 - 2050

In progress (Too slow?)

Challenge

Sweden towards 2030 (NTM ideas from 2018)

Fuel and electricity	2016 [TWh]	%	2030 [TWh]		Comments
Petrol	29	30%	7,8	8%	Replaced by biogas and electricity, 40% blend in of ethanol
Diesel	43	45%	21	22%	Replaced by biodiesel and electricity, 40% blend in of HVO/FAME
Ethanol	1,3	1%	7,2	7%	Increase through drop-in in petrol. EU legislation may delimit
Biodiesel	14,5	15%	34	35%	According to comming reduction quotas from 30% to 40%
Naturgas	0,4	0%	1	1%	May remain due to economic reasons
Biogas	1,2	1%	10	10%	The national biogas strategt assumes 12 TWh for transport
Electricity	3,2	3%	12,6	13%	Estimates as x4
Jet A1	2,2	2%	2,2	2%	Not studied but assumed to increase
Eo1 (oil)	0,4	0%	0,4	0%	Oil for housholds, farmers etc not studied
Eo2 (oil)	0,1	0%	0,1	0%	"
Domestic total	95		96		
International sea	23,4				Not studied
Inteational air	10				"
Total	128,5				
In this scenario, based on the assumption that the increasing use of electricity can be generated through renewable sources:					
Finite fuels				34%	
Renewable fuels				66%	
International air and sea not included					

Source:SCB and modelling Conlogic

Well to wheel efficiency of diesel and electric drive lines

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 energy efficiency point of view, **electric propulsion requires non-fossil electricity production** or higher efficiency as in power/heat production.

2) Adding for example coal based electric generation, ~900-1100 g CO_2 per kWh gives an additional strong argument for non fossil generated electricity

Source: Conlogic

Swedish Energy Agency

Major transport related energy supply challenges

- Fulfil climate and energy efficiency objectives
- Adapt to digitalization, urbanization and globalization
- Industry electricity use is expected to grow in order to phase out fossil fuels and reach climate targets.
- The ability to increase electricity production to meet increasing demand of electricity is crucial.
- Bioenergy (including biofuels) will remain an energy supply pillar in order to fulfil energy and climate targets.
- Swedish targets on energy efficiency until 2050 will not be accomplished. Energy efficiency is expected to become a general EU focus (-32,5% by 2030). Swedish targets defined as “added energy in relation to GDP at fixed prices”

- 2020 (base year 2005); -20%
- 2030 (base year 2005); -50%

Source: SEA

Five scenarios – Swedish Energy Agency, SEA

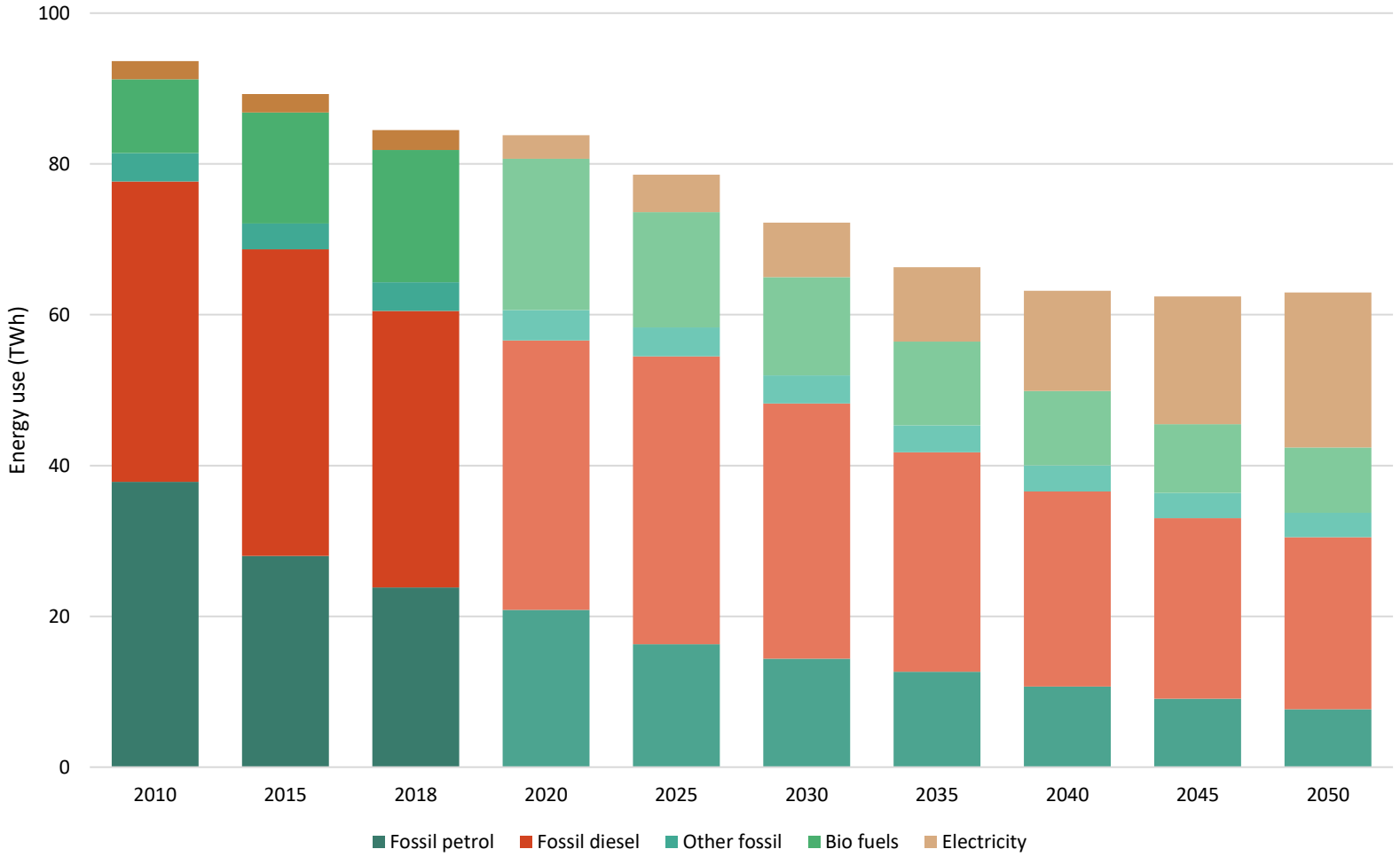
Based on 35 % renewable energy in 2020

2030 42-44% renewable energy at present blend in quotas

79-80% at increasing blend in quotas and tax exemptions on renewable fuels.

Source: SEA

Total energy use in scenario ”Reference to EU”



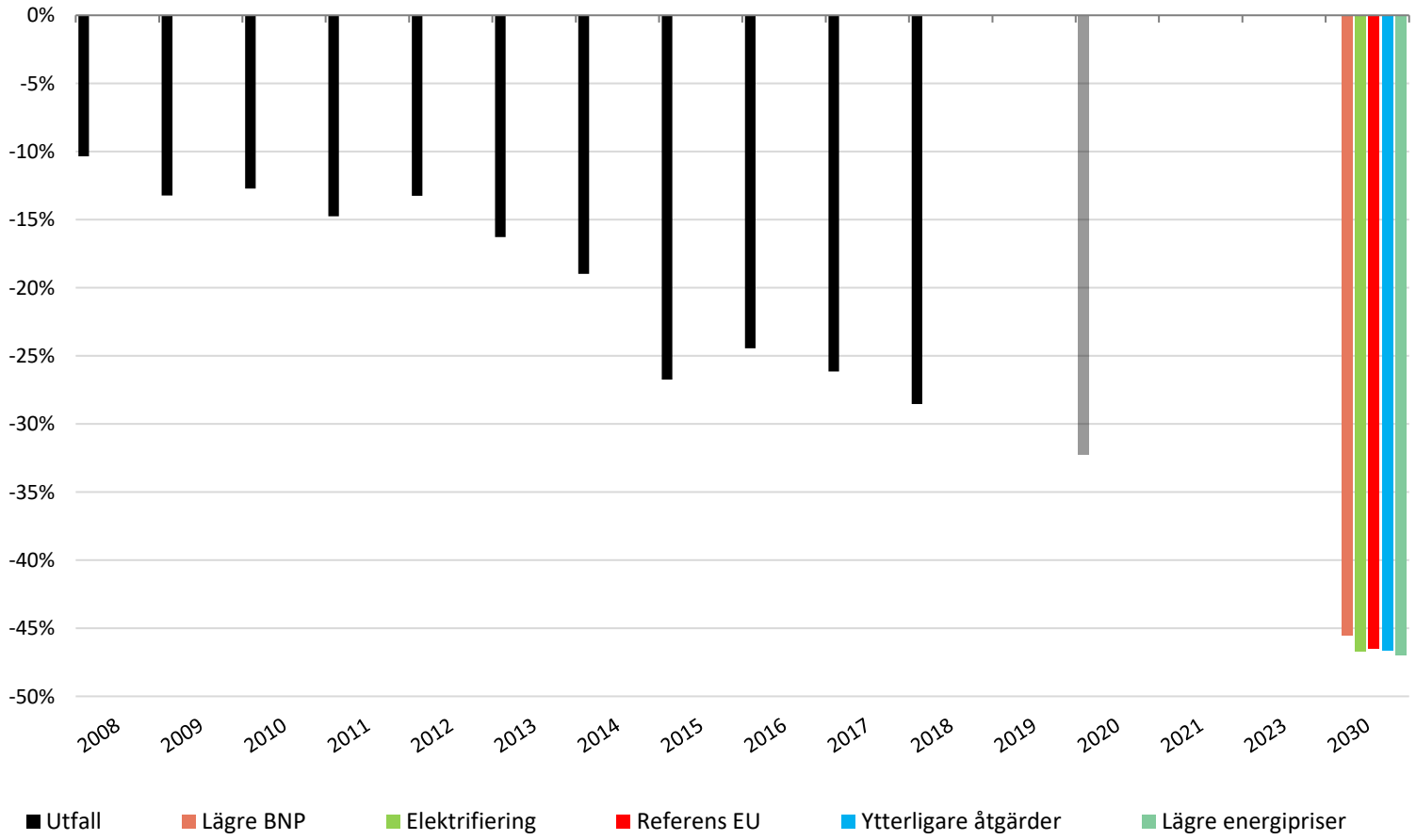
Source: SEA

Total energy use

Total energy use			
Scenarios	2018 [TWh/year]	2050 [TWh/year]	Impact on energy composition
1, 2, 3 and 4	556	446-471	Nuclear power and fossil fuel use decreases. Wind and solar increase
5	556	552	Nuclear power increases and fossil fuel use decreases

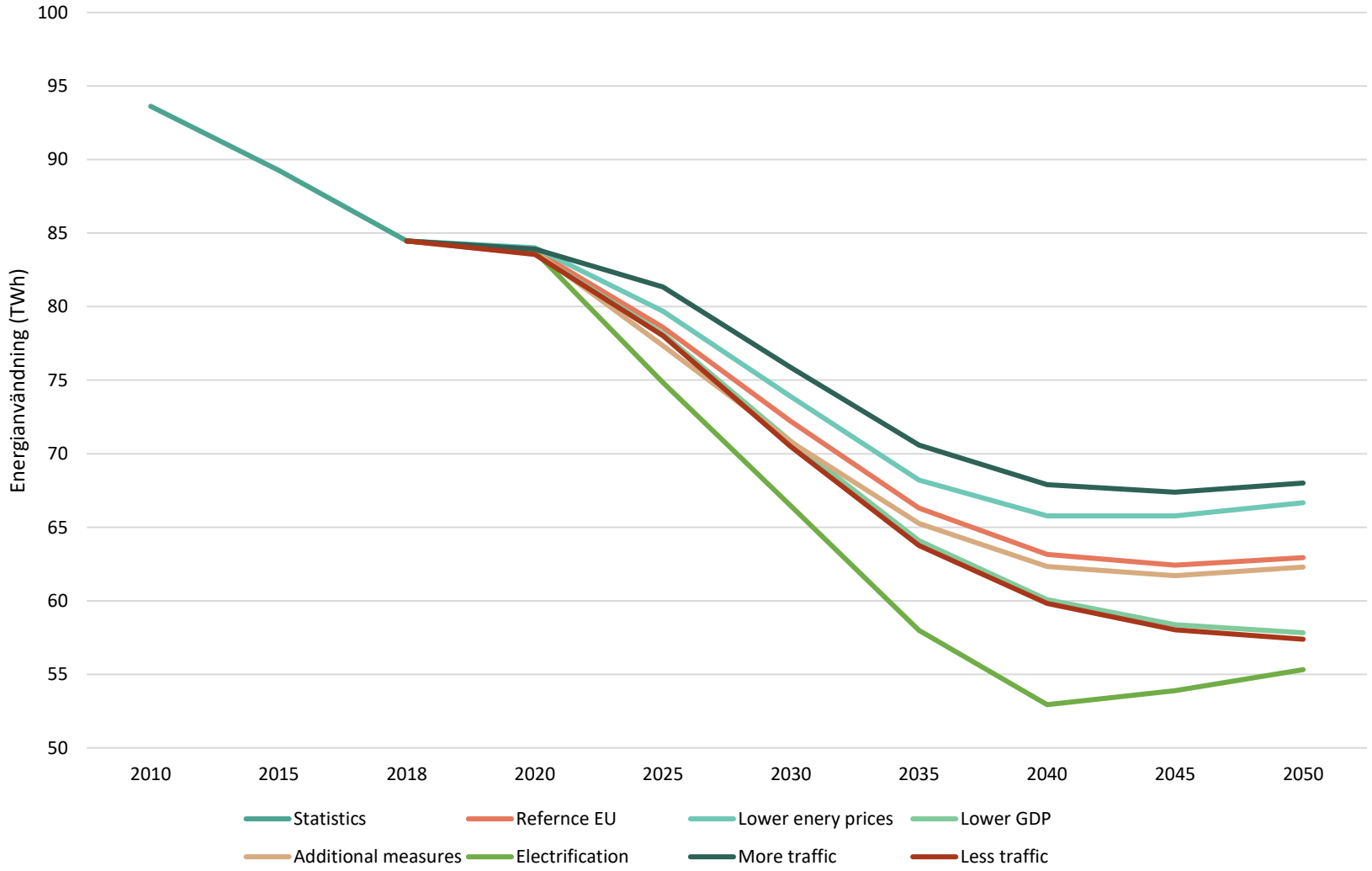
Source: SEA

Energy intensity - all scenarios



Source: SEA

Transport energy use – all scenarios



Source: SEA

Transport energy use

Domestic transport energy use			
Scenarios	2018 [TWh/year]	2050 [TWh/year]	Impact on energy composition
All scenarios	84	55-68	Biofuel use will increase until 2030 then gradually decrease
Electricity	3	28	"
International transport energy use			
Scenarios	2018 [TWh/year]	2050 [TWh/year]	Impact on energy composition
General	31	38	No major shift, apart from biojet (aviation) and LNG (sea)

Source: SEA

So where are we heading Tomas?