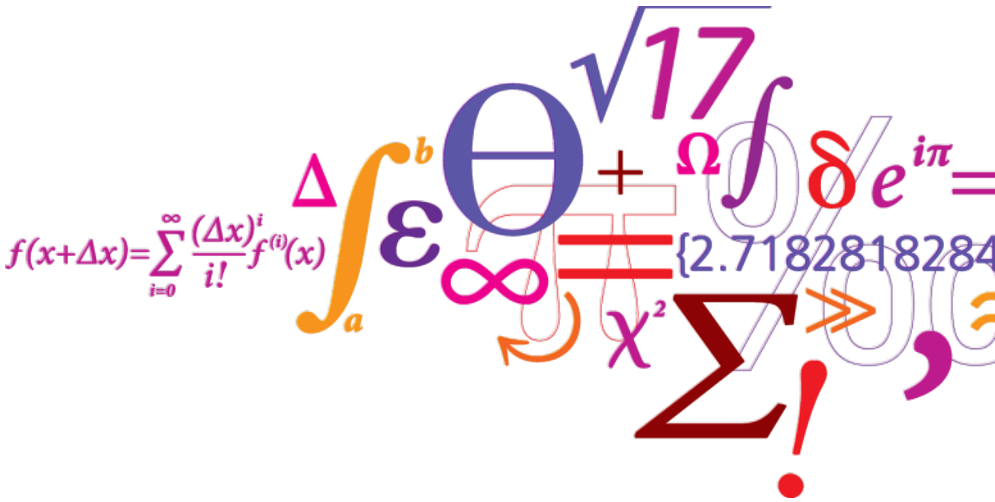
Participatory perspective on scenario development: Introducing the TIMES-DK scenario interface

Mini-Modelling Series
12th June, 2018



Giada Venturini
PhD Student
Energy System Analysis
Technical University of Denmark
give@dtu.dk

DTU Management Engineering
Department of Management Engineering

Inclusive - Exclusive

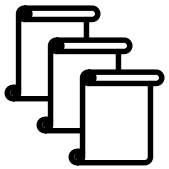
Model-based - **PARTICIPATORY**

Qualitative - Quantitative

Descriptive - Normative

Qualitative scenarios

Explore and capture causal relations and interdependencies



Quantitative scenarios

Model the deterministic structure of the system

PARTICIPATORY SCENARIOS

Encourage discussion and common visions
Support inclusive policy making
Stimulate mutual learning and knowledge creation

Model-based scenarios

Manage the complexity and uncertainty of the system under analysis

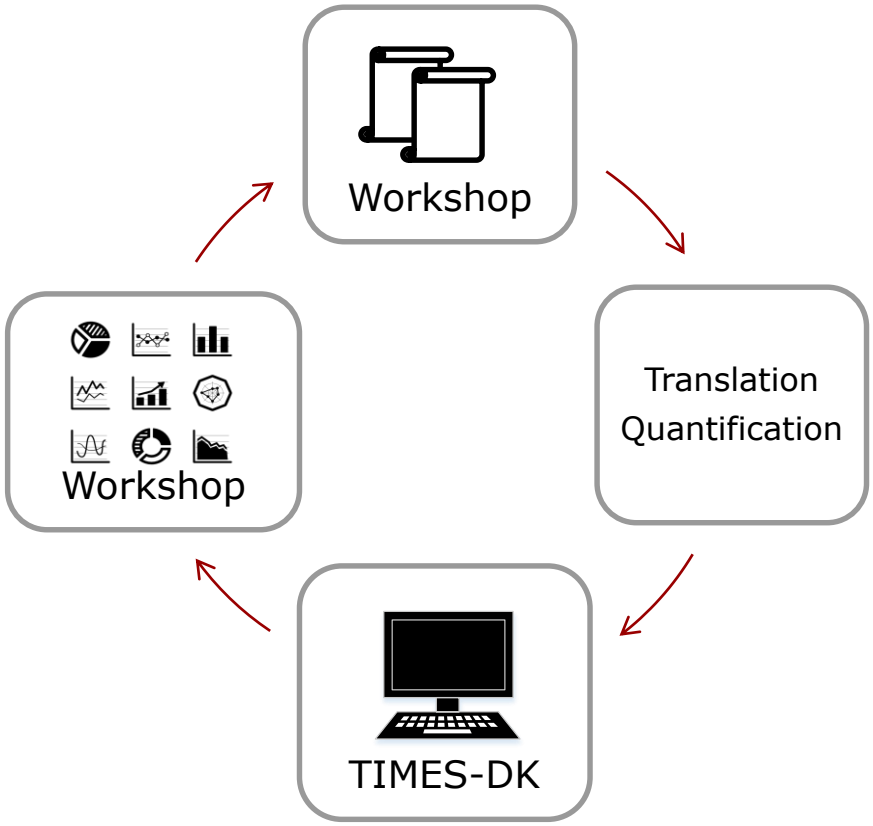
Research questions

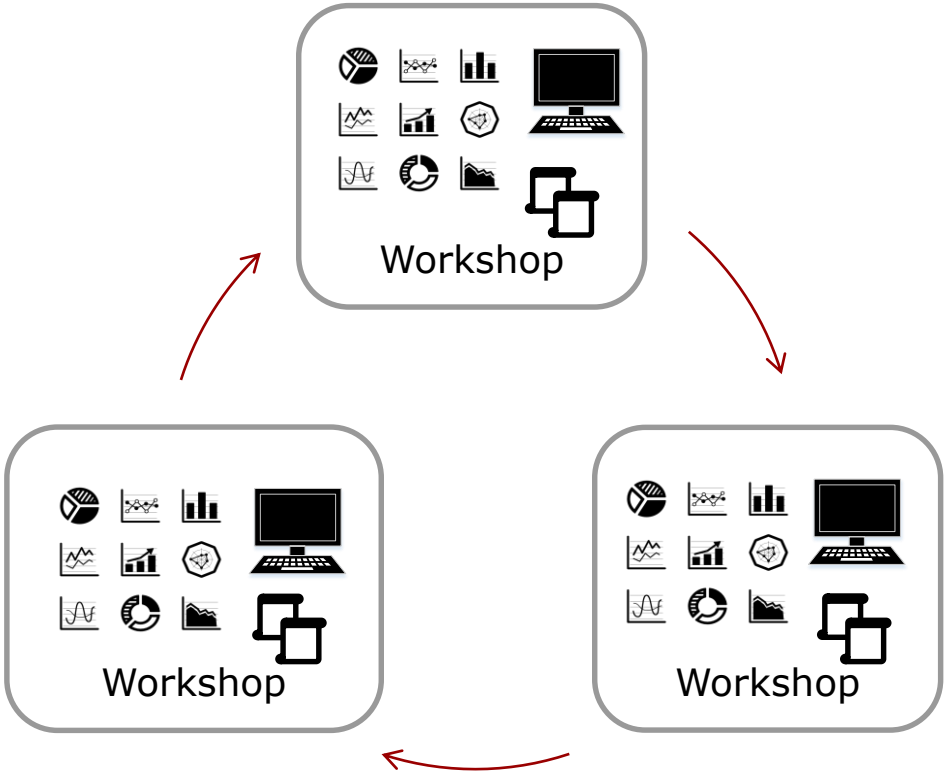
Methodology

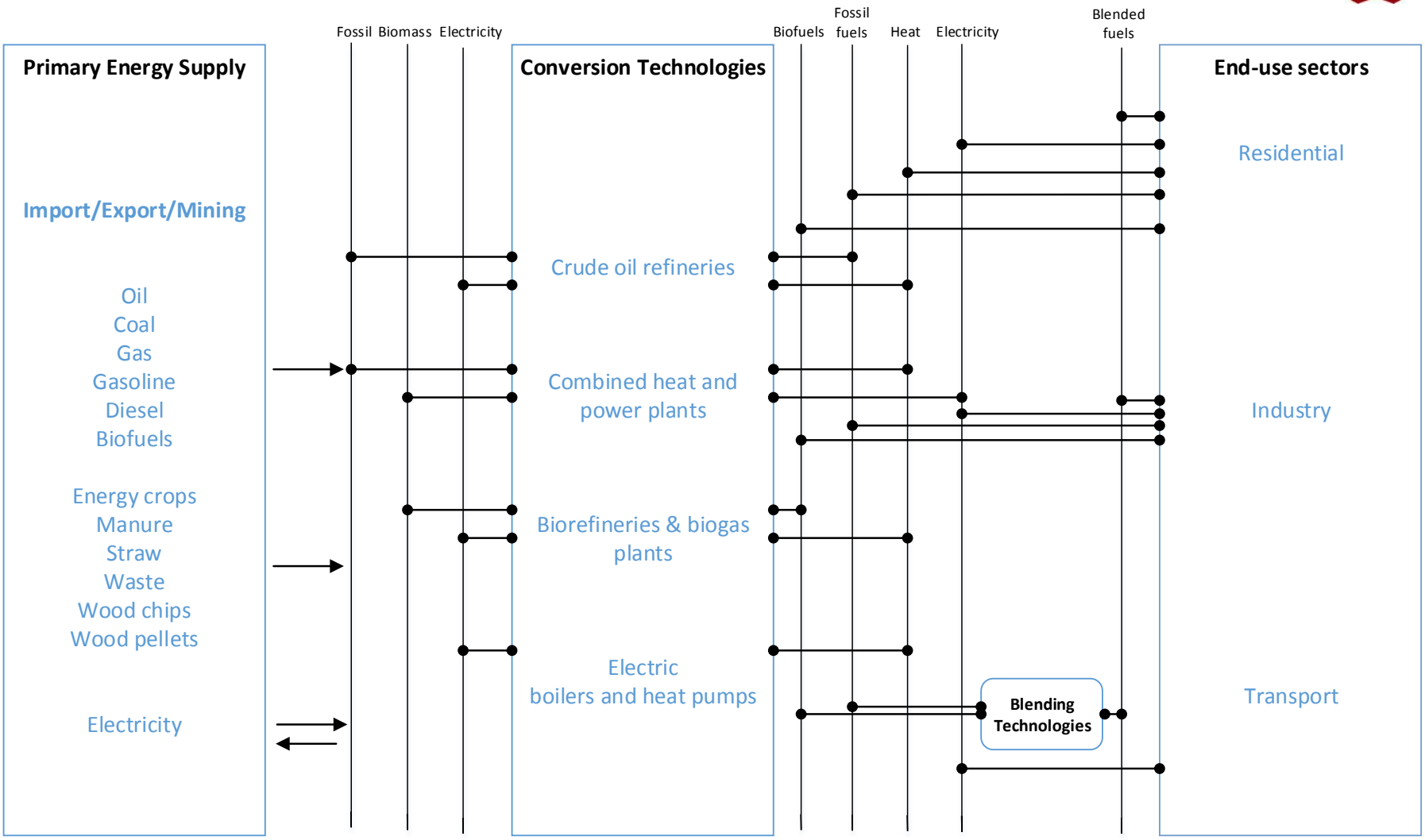
- How can we bridge qualitative and quantitative tools for the creation of scenarios in TIMES-DK?
- What do we gain from this dialogue? How can it be improved?

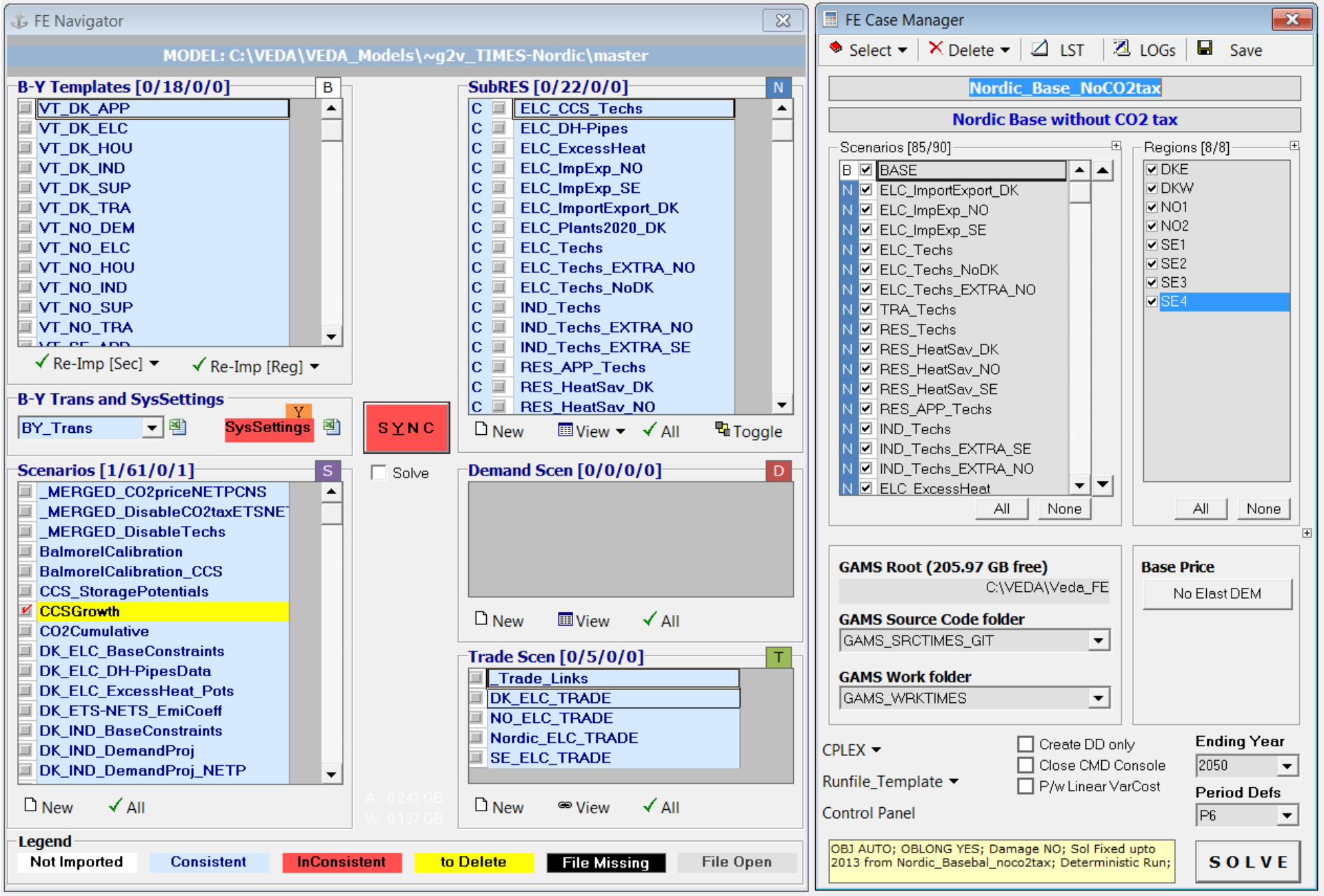
Transport and energy system

- What are robust and sustainable pathways for the future energy and transport system in Denmark?
- Which policy measures can support the recommended pathways?


Workshop
Translation
Quantification
TIMES-DK
Workshop


Workshop
Workshop
Workshop


Primary Energy Supply
Import/Export/Mining
Oil
Coal
Gas
Gasoline
Diesel
Biofuels
Energy crops
Manure
Straw
Waste
Wood chips
Wood pellets
Electricity
Fossil
Biomass
Electricity
Conversion Technologies
Crude oil refineries
Combined heat and power plants
Biorefineries & biogas plants
Electric boilers and heat pumps
Biofuels
Fossil fuels
Heat
Electricity
Blended fuels
Blending Technologies
End-use sectors
Residential
Industry
Transport


FE Navigator
MODEL: C:\VEDA\VEDA_Models\~g2v_TIMES-Nordic\master
B-Y Templates [0/18/0/0]
VT_DK_APP
VT_DK_ELC
VT_DK_HOU
VT_DK_IND
VT_DK_SUP
VT_DK_TRA
VT_NO_DEM
VT_NO_ELC
VT_NO_HOU
VT_NO_IND
VT_NO_SUP
VT_NO_TRA
Re-Imp [Sec]
Re-Imp [Reg]
B-Y Trans and SysSettings
BY_Trans
SysSettings
Scenarios [1/61/0/1]
_MERGED_CO2priceNETPCNS
_MERGED_DisableCO2taxETSNET
_MERGED_DisableTechs
BalmorelCalibration
BalmorelCalibration_CCS
CCS_StoragePotentials
CCSGrowth
CO2Cumulative
DK_ELC_BaseConstraints
DK_ELC_DH-PipesData
DK_ELC_ExcessHeat_Pots
DK_ETS-NETS_EmiCoeff
DK_IND_BaseConstraints
DK_IND_DemandProj
DK_IND_DemandProj_NETP
New
All
SYNC
Solve
SubRES [0/22/0/0]
ELC_CCS_Techs
ELC_DH-Pipes
ELC_ExcessHeat
ELC_ImpExp_NO
ELC_ImpExp_SE
ELC_ImportExport_DK
ELC_Plants2020_DK
ELC_Techs
ELC_Techs_EXTRA_NO
ELC_Techs_NoDK
IND_Techs
IND_Techs_EXTRA_NO
IND_Techs_EXTRA_SE
RES_APP_Techs
RES_HeatSav_DK
RES_HeatSav_NO
New
View
All
Toggle
Demand Scen [0/0/0/0]
New
View
All
Trade Scen [0/5/0/0]
_Trade_Links
DK_ELC_TRADE
NO_ELC_TRADE
Nordic_ELC_TRADE
SE_ELC_TRADE
New
View
All
Legend
Not Imported
Consistent
InConsistent
to Delete
File Missing
File Open
FE Case Manager
Select
Delete
LST
LOGs
Save
Nordic_Base_NoCO2tax
Nordic Base without CO2 tax
Scenarios [85/90]
BASE
ELC_ImportExport_DK
ELC_ImpExp_NO
ELC_ImpExp_SE
ELC_Techs
ELC_Techs_NoDK
ELC_Techs_EXTRA_NO
TRA_Techs
RES_Techs
RES_HeatSav_DK
RES_HeatSav_NO
RES_HeatSav_SE
RES_APP_Techs
IND_Techs
IND_Techs_EXTRA_SE
IND_Techs_EXTRA_NO
ELC_ExcessHeat
All
None
Regions [8/8]
DKE
DKW
NO1
NO2
SE1
SE2
SE3
SE4
All
None
GAMS Root (205.97 GB free)
C:\VEDA\Veda_FE
GAMS Source Code folder
GAMS_SRCTIMES_GIT
GAMS Work folder
GAMS_WRKTIMES
Base Price
No Elast DEM
CPLEX
Runfile_Template
Control Panel
Create DD only
Close CMD Console
P/w Linear VarCost
Ending Year
2050
Period Defs
P6
OBJ AUTO; OBLONG YES; Damage NO; Sol Fixed upto 2013 from Nordic_Basebal_noco2tax; Deterministic Run;
SOLVE

Menu

Policy Targets

Resources

Transport

Power & Heat

Residential

Industry

References

Scenario name:

My_Scenario

TIMES-DK Scenario Interface

Denmark is committed to achieving a fossil-free society by the year 2050. To do this, different technical, economic and political measures can be put into place.

With *TIMES-DK Scenario Interface*, you can create your own energy pathway for Denmark by selecting policy targets and technical constraints for the various sectors:

1. From the tab on the left, you can access the sections where to input your assumptions. Alternatively, you will find the complete tab menu by clicking on the icon ▶ on the top of the Excel bar.
2. Once within a section, hoover on the drivers with the mouse and explanations will guide you in the selection of parameters. According to the driver, you might be able to adjust values, target years, type of constraints or simply activate/deactivate specific features.
3. You can assign a name to the created scenario.
4. Create DD file, Create Run and Solve Model

Create DD file

Create Run

Solve Model

Global assumptions

Driver	Options	Reference
	Value Choice	
Fossil fuels price trajectory	Medium	IEA (2016); Energistyrelsen (2017)
Discount rate	10	
CO2 price (ETS)	High	Energistyrelsen (2017)
CO2 price (NETS)	High	Energistyrelsen (2017)

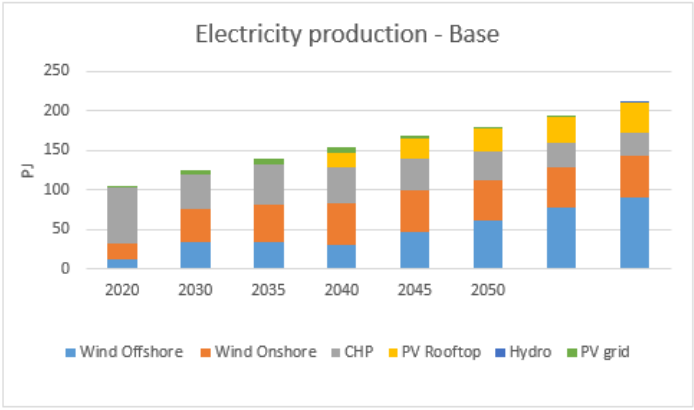
Policy targets

Driver	Options					Reference
	Active/Inactive	Value Choice	Unit	Year	Sector	
Phase-out of fossil fuels	☐			2040	Apply to all sectors	Energistyrelsen (2015)
				2035	Heat & Power	
				2030	Residential	
				2050	Transport (excl. sea)	
				2040	Industry	
CO2 target	☐	55	%	2030	Do not apply to all sectors	EEA (2015)
		50	%	2025	Residential	
		100	%	2050	Residential	
		30	%	2030	Heat & Power	
		70	%	2050	Heat & Power	
		20	%	2030	Industry	
		40	%	2050	Industry	
		20	%	2030	Transport (land)	
		80	%	2050	Transport (land)	
		20	%	2030	Transport (aviation)	
		80	%	2050	Transport (aviation)	
Renewable energy target	☐	50	%	2030	Apply to all sectors	EC (2016)
		80	%	2040	Apply to all sectors	
		50	%	2035	Residential	
		60	%	2035	Industry	
		80	%	2050	Transport	
PV production	☐	40	%	2035	Heat & Power	
Wind production	☑	50	%	2020	Heat & Power	IRENA (2013)

Phase-out of fossil fuels in Denmark:
- In all sectors for a target year
- In each sector in specific years

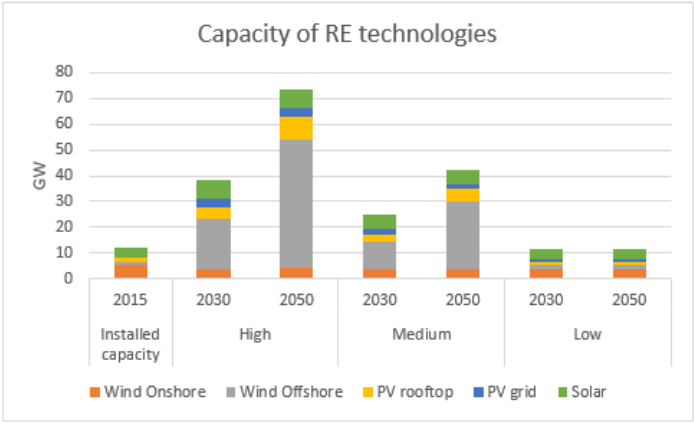
Power & Heat Technology assumptions

Driver	Options				Reference
	Active/Inactive	Value Choice	Unit	Limit	
PV growth	☐	15	%	Max	Own assumption
Offshore wind growth	☐	6.5	%	Max	Own assumption
Wind onshore capacity		High	GW	Max	IEA (2016); Energinet (2015)
Wind offshore capacity		High	GW	Max	IEA (2016); Energinet (2015)
Solar thermal capacity		High	GW	Max	IEA (2016); Energinet (2015)
PV roof capacity		High	GW	Max	IEA (2016); Energinet (2015)
PV grid capacity		High	GW	Max	IEA (2016); Energinet (2015)



Power & Heat Policies

Driver	Options				Reference
	Active/Inactive	Value Choice	Unit	Year	
Subsidies biomass for power	☑				SKAT (2017b)
Reduced tax power-to-heat	☑				SKAT (2017b)
Offshore wind tenders		2	GW	2020	
		4	GW	2030	
Onshore wind tenders		1	GW	2020	
		1.5	GW	2030	
Subsidy for biogas	☑				SKAT (2017b)
Subsidy for large solar heating	☑				SKAT (2017b)

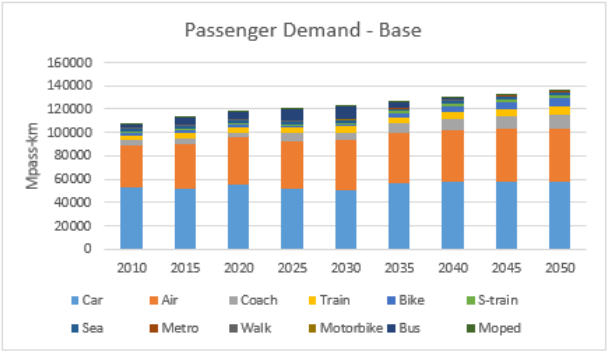


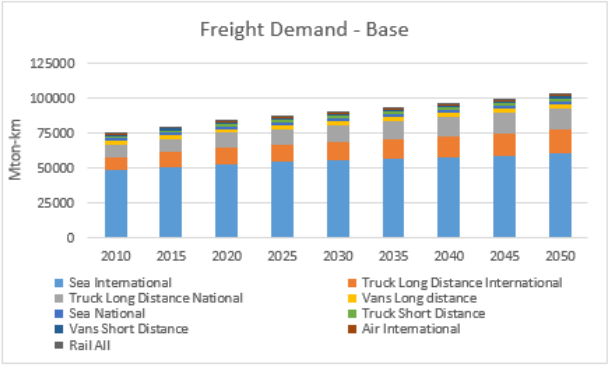
Transport Technology assumptions

Driver	Options					Reference
	Active/Inactive	Value Choice	Unit	Year	Limit	
Vehicles efficiency	☐	0	%	2020		AlternativDrivmiddel Model (Energistyrelsen)
Bike infrastructure	☐			2035		Own assumption
Railways infrastructure		90	km/h	2025		Christiansen & Skougaard (2015)
Public transport planning		0	%	2025		Christiansen & Skougaard (2015)
Car occupancy		1.5	person/vehicle	2020		EEA (2010)
Car occupancy		1.5	person/vehicle	2030		EEA (2010)
Teleworking	☐					Christiansen & Skougaard (2015)
Share of e-bikes	☐	5	%	2030	Min	Own assumption

Transport Policies

Driver	Options					Reference
	Active/Inactive	Value Choice	Unit	Year	Limit	
Biofuel blending limits		Medium				Various sources
Autonomous cars	☑	0	%	2030	Max	Own assumption
ICE ban						
On all ICE cars	☐			2030		Own assumption
Only on fossil ICE cars	☐			2030		Own assumption
Increase tax on fossil fuels		0	%	2025		Own assumption
Decrease tax on electricity		0	%	2030		SKAT (2017a)
Vehicle Registration Tax	☐			2025		SKAT (2017a)
Share 1G biofuels	☑	7	%	2020	Max	EC (2016)
	☑	3.8	%	2030	Max	EC (2016)
Subsidy public transport	☐	10	%			





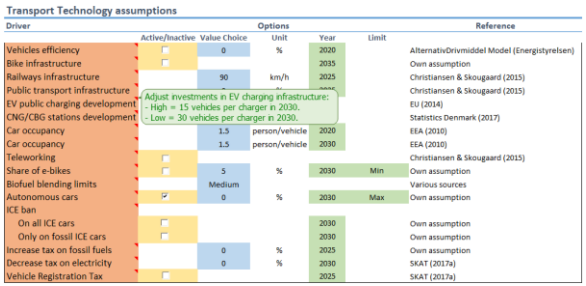
Scenario workshops

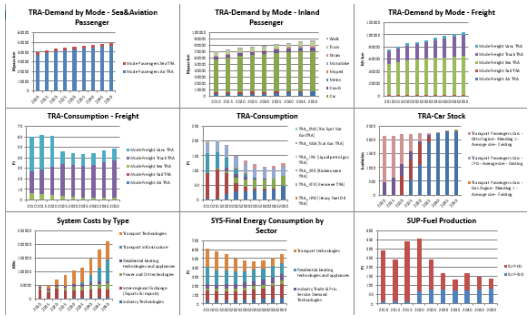
Citizens, stakeholders and researchers involved in the creation of transport-focused scenarios for Denmark

Discussion of driving forces and uncertain parameters

Design of scenarios through TIMES-DK interface

Assessment and comparison of scenario results





Learning opportunities

Discussion and debate over relevant drivers

Shared evaluation of pathways

Understanding of cause-effect relationships

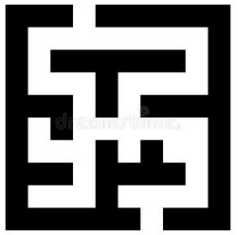
Validation of assumptions

Challenges

Generalizability: link with a dynamic TIMES-DK model

Simplification and adaptability: adjust tool to group needs

Time: lengthy exercise for scenario building and analysis



Further work

Usability: guidance on drivers' impacts

Time: cover all options to run the tool without VEDA

New development: generating alternative scenarios

Thank you for your attention!
Questions, doubts, suggestions?

Giada Venturini
PhD Student
Energy System Analysis
DTU Management Engineering
give@dtu.dk