

DTU



Kenneth Karlsson

Head of Energy System Analysis, Sustainability,

DTU Management

Technical University of Denmark

Long Term Energy Planning in Denmark

Danish energy history

First energy plan – diversify and use surplus heat from power plants

First heat plan – where to have DH and gas (incl. grid)

From 1980 to 2003 number of buildings connected to DH more than doubled (60% of buildings)

Test station for small wind turbines started Risø

CHP units produces more than condensing plants

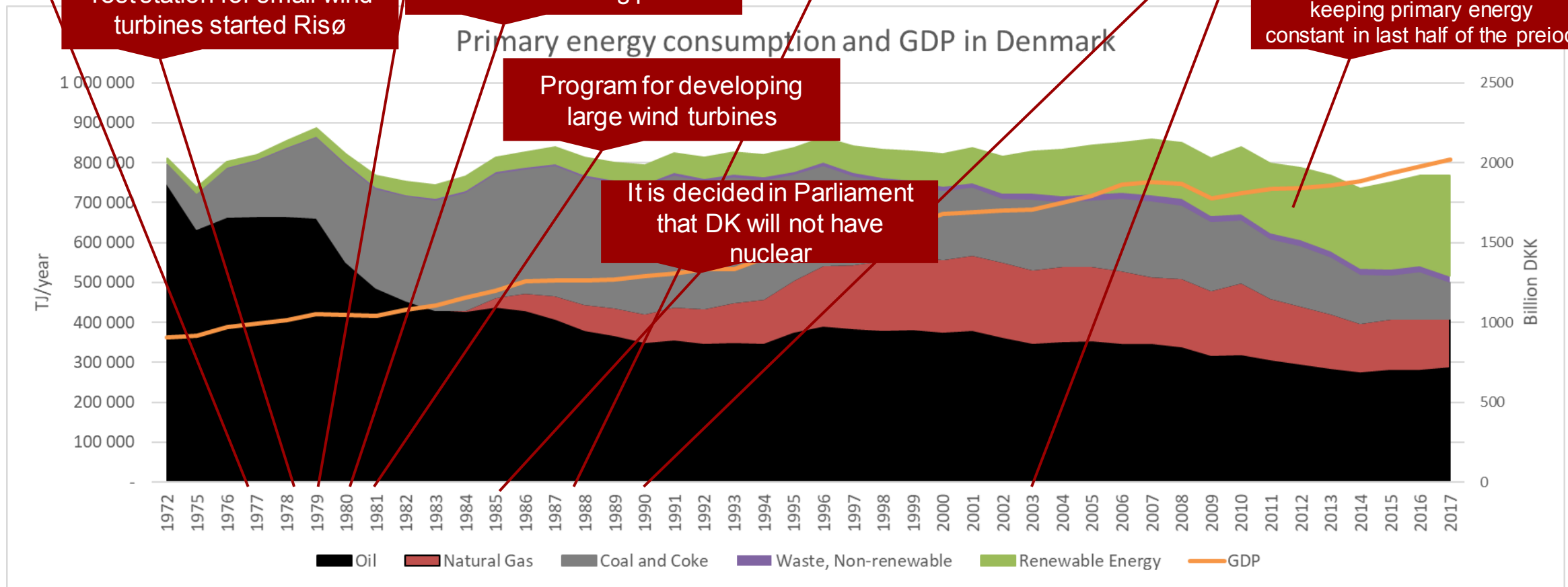
Almost phased out oil for power and heat production

Continues energy plans. After the Brundtland report with more focus on RE

Wind is the main reason for keeping primary energy constant in last half of the period

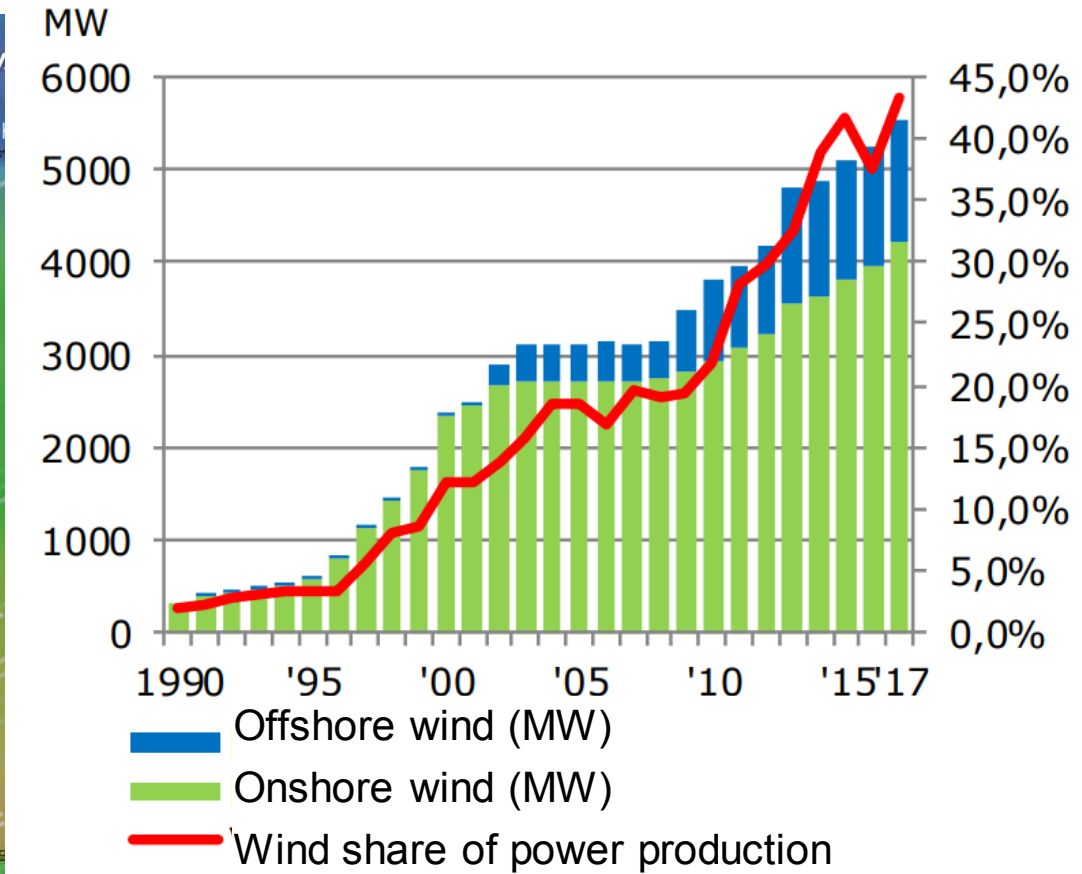
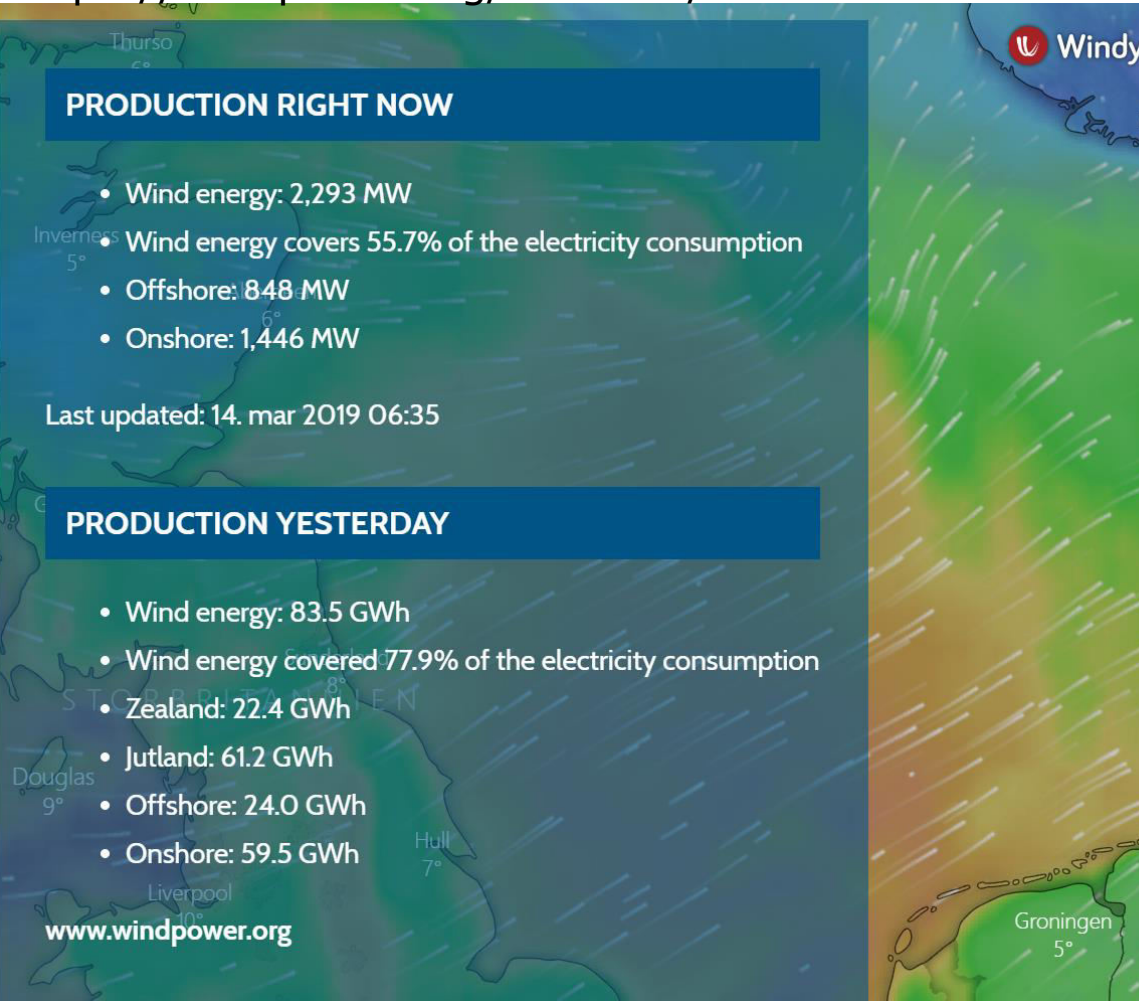
Program for developing large wind turbines

It is decided in Parliament that DK will not have nuclear



Share of variable renewables in Denmark

<https://windpower.org/tal-fakta/vindkort>

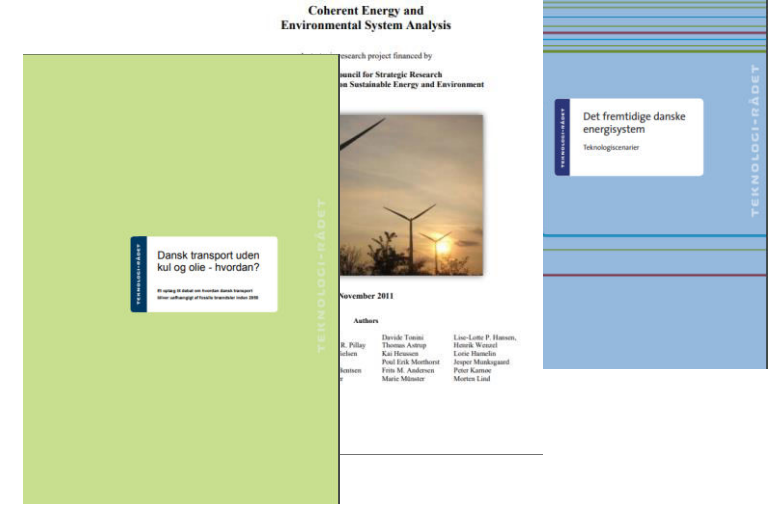
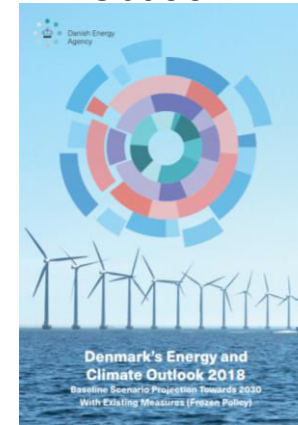


Energy scenarios in Denmark

Governmental plans



DK Outlook



Organisations, TSO and commissions



Input to a Danish Energy Policy

1976



NGO plans

International references are important



Credible assumption about technology development, future fuel prices and climate impact

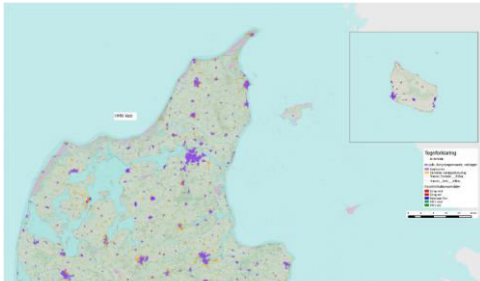
Danish Energy Policy

Targets agreed by Parliament

- Danish energy system CO2 neutral by 2050
- 40% CO2 reduction by 2030 compared to 2005
- Phase out of fossil fuels for power and heat by 2035



DH grid

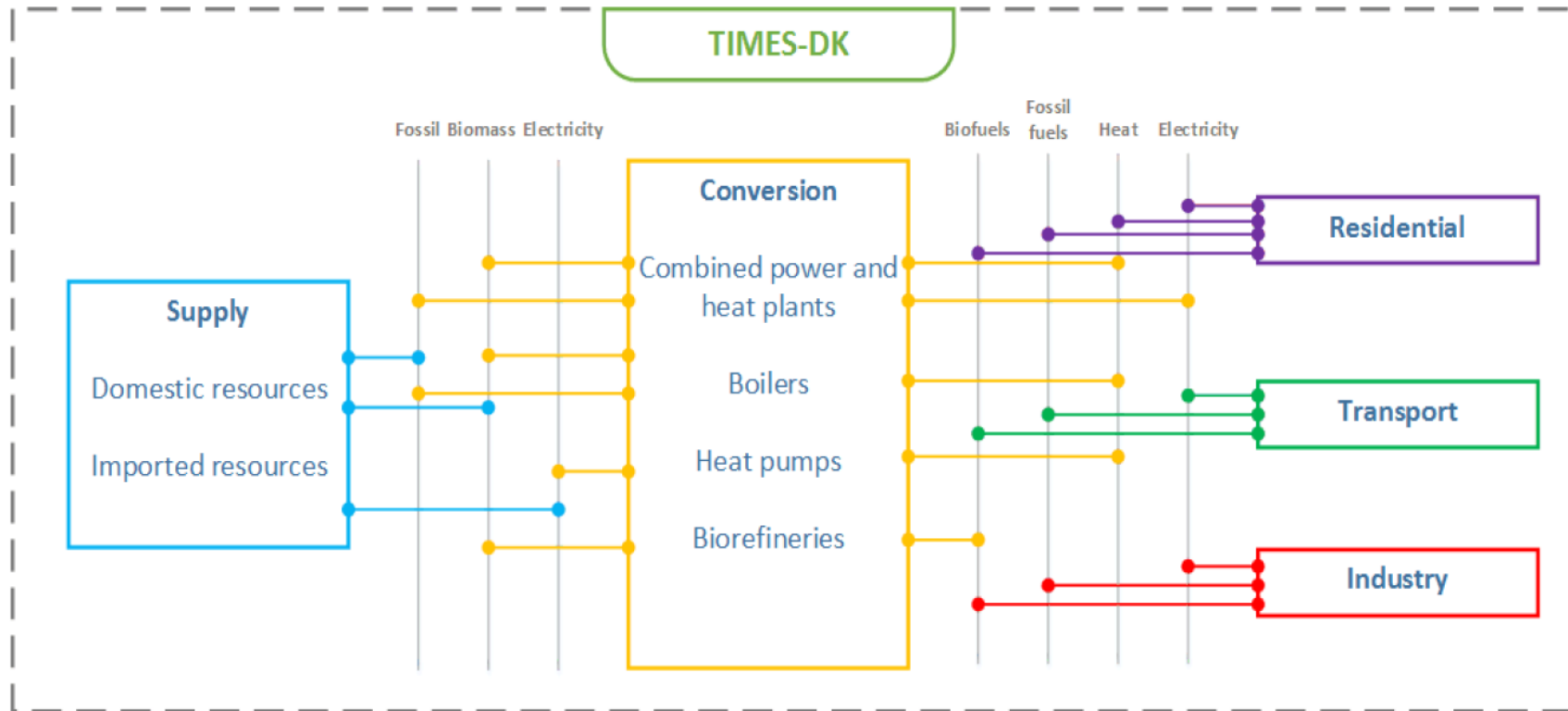


Gas grid



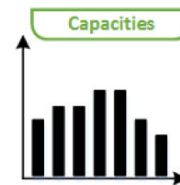
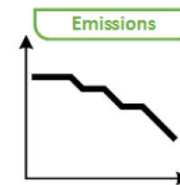
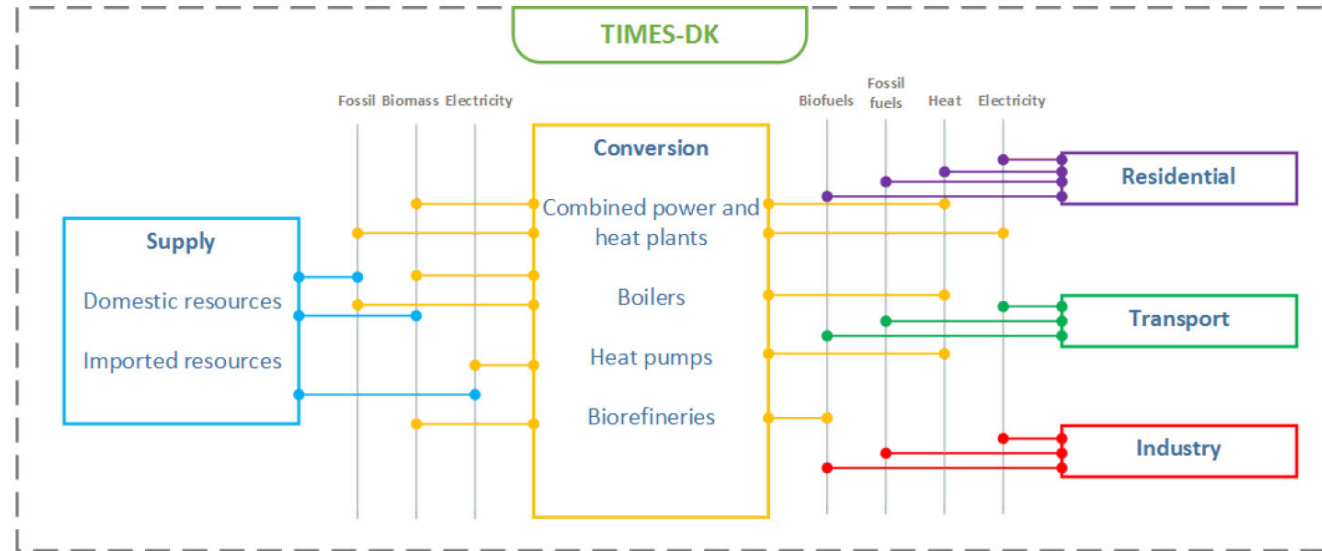
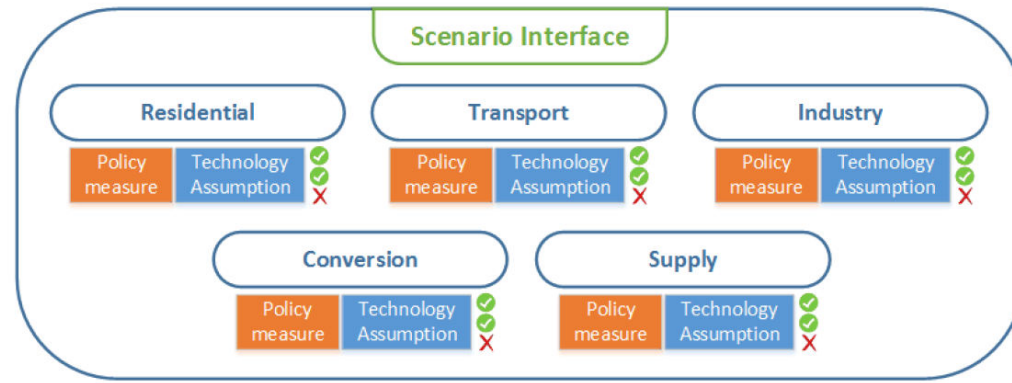
Punish	Motivate
High taxes on fuels to end-user	Support to electricity produced from wind and solar
High tax on electricity to households	No tax on biomass
High tax on cars	Subsidy to biogas production
Strict building regulation	Lower tax on efficient cars
Forced connection to district heating	Support to energy efficiency

Energy Scenarios as a Democratic Process



State of the art TIMES model covering all sectors in the Danish energy system – developed as a collaboration between DTU and DEA

What we really do – the model is only a part of the process



Stakeholder Interface

Menu

- Policy Targets
- Resources
- Transport
- Power & Heat
- Residential
- Industry
- References

Scenario name:
My_Scenario

TIMES-DK Scenario Interface

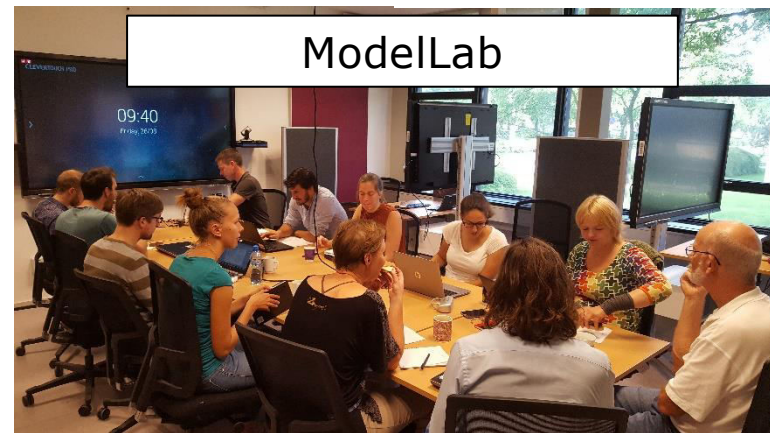
Denmark is committed to achieving... To do this, different technical, economic and policy options need to be put into place.

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:

- 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.
- Once within a section, hover 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.
- You can assign a name to the created scenario.
- Create DD file, Create Run and Solve Model

Global assumptions

Driver	Options	Reference
Phase-out of fossil fuels	Active/inactive	Hten (2017)
CO2 target	Value Choice	
Renewable energy target	Options	
PV production	Unit	
Wind production	Year	



Design policies and implement them in TIMES-DK – run the model

Evaluate policies

Compare results with targets and expectations

Result Interface

Klimaaftalen DTU

- Om værktøjet
- Beskrivelser af scenarier
- DTU's anbefalinger
- Forudsætninger
- Abonner på opdateringer
- Scenarier
- Energiaftalen 2018
- Regeringens klimaudspil
- DTU energispare
- DTU lav vækst
- Carbon budget 2°C
- Carbon budget 2°C, begr.bio
- Carbon budget 1.5°C
- Carbon budget 1.5°C, begr.bio
- Scenarie difference
- Online version fra Tokni

Hovedresultater Transportsektoren Forsyningssektoren

CO2-emissioner og VE-andel

Biobrændsels-forbrug

El-produktion

El-kapacitet

El-netto-eksport

Fjernvarme-produktion

13 March 2019

DTU Management

Long term energy planning in Denmark

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Energiaftalen



Om værktøjet

Beskrivelser af scenarier

DTU's anbefalinger

Forudsætninger

Abonner på opdateringer

Scenarier

DTU Frozen policy

DTU International skibsfart

Energiaftalen 2018

Regeringen

Radikale Venstre

Alternativet

Socialdemokratiet

Carbon budget Paris

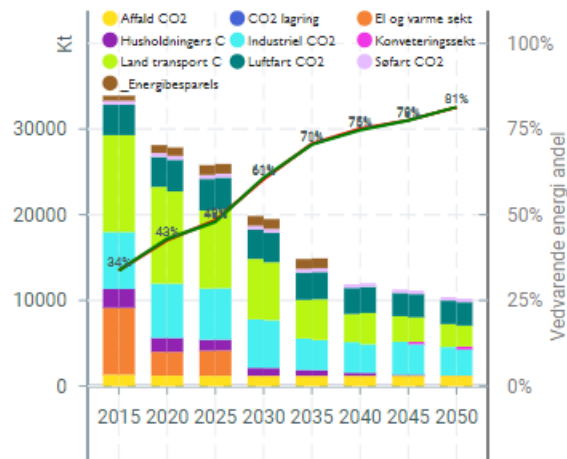
Carbon budget Paris BIO

Klimarådets biomasse

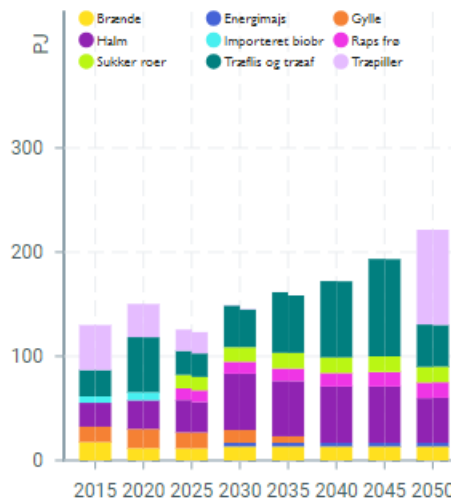
Scenarie difference

Online version fra Tokni

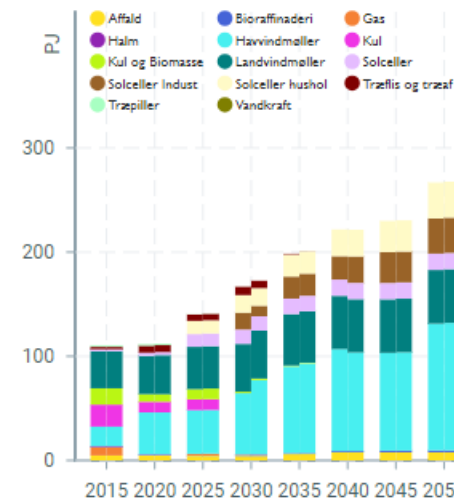
CO₂-emissioner og VE-andel



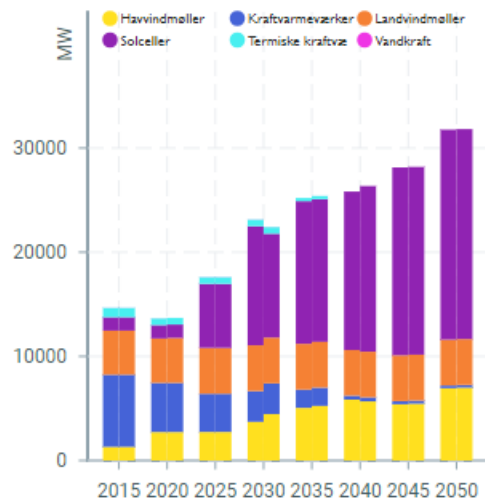
Biobrændsels-forbrug



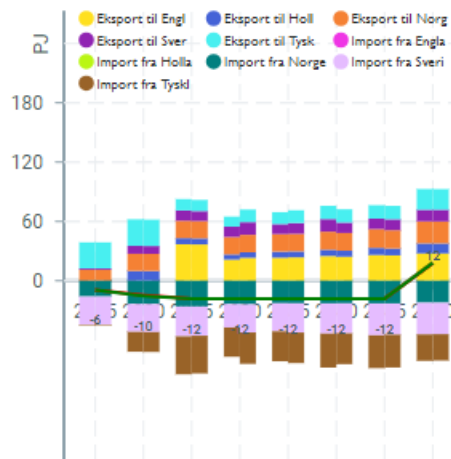
El-produktion



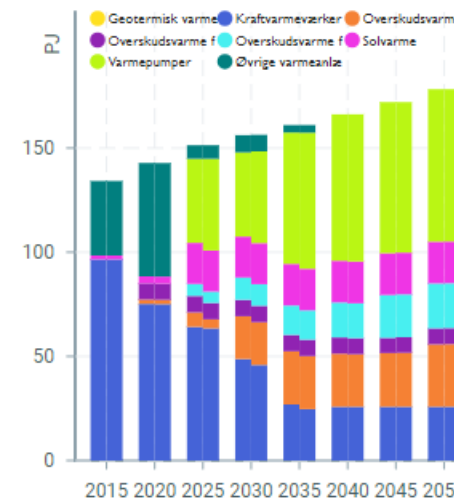
El-kapacitet



El-netto-eksport



Fjernvarme-produktion



Energiaftalen



Om værktøjet

Beskrivelser af scenarier

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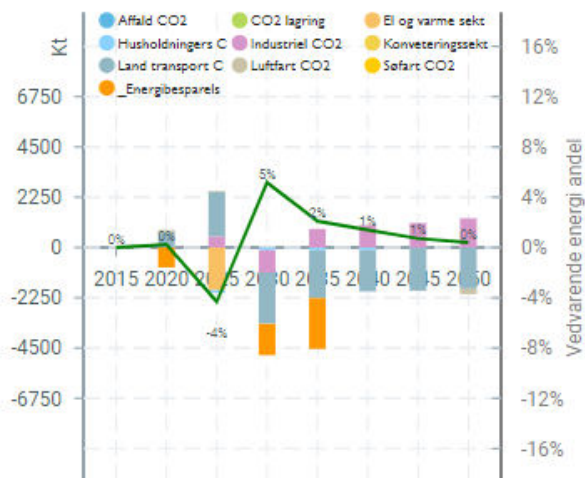
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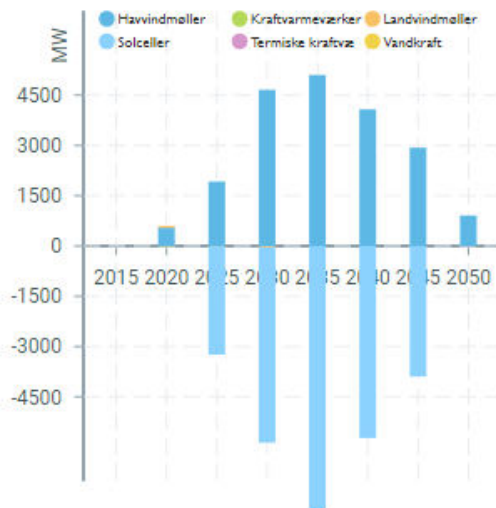
Biobrændsels-forbrug



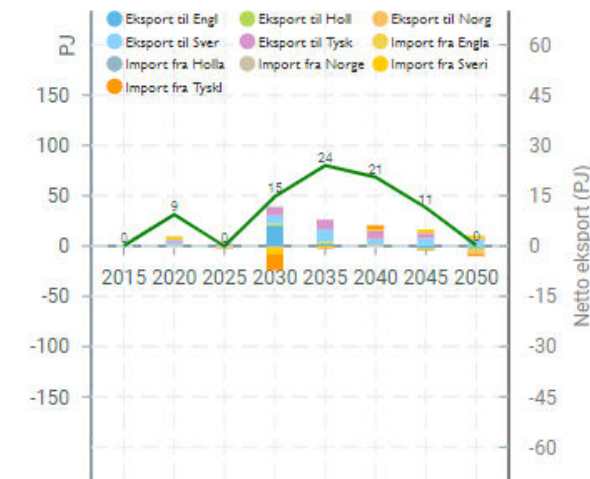
El-produktion



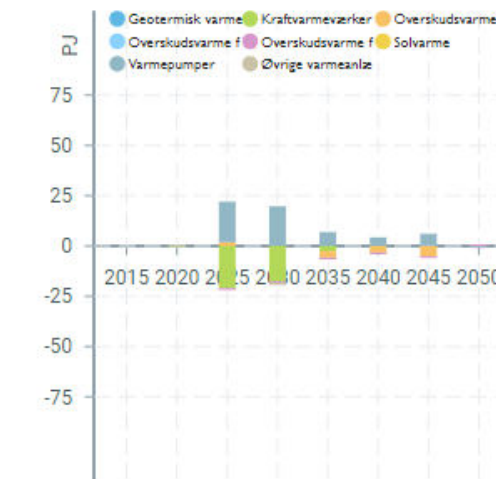
El-kapacitet



El-netto-eksport



Fjernvarme-produktion



Klimaaftalen



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DTU's anbefalinger

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Scenarier

Climate Agreement

Energispare

Frozen policy

Lav vækst

Carbon budget 1.5°C

Carbon budget 1.5°C (bio)

Carbon budget 2°C

Carbon budget 2°C (bio)

CCS

Scenarie difference

Online version fra Tokni

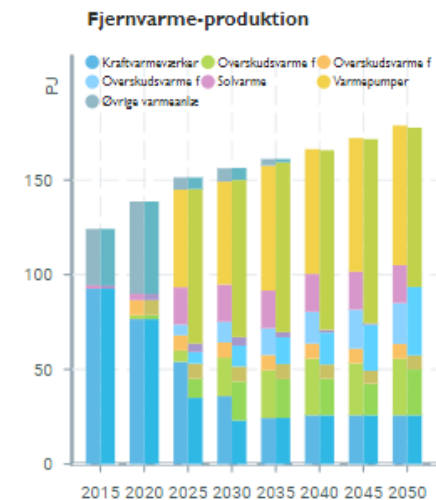
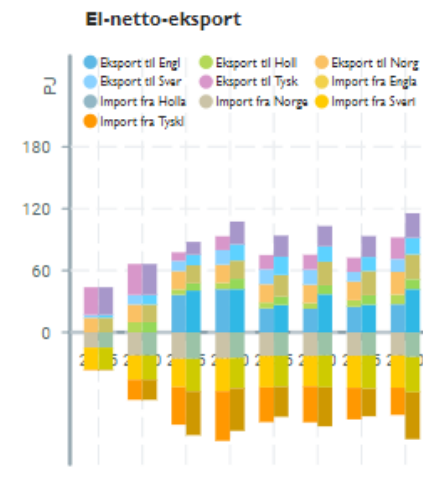
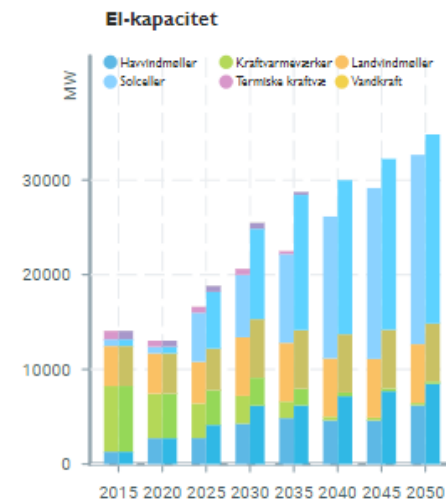
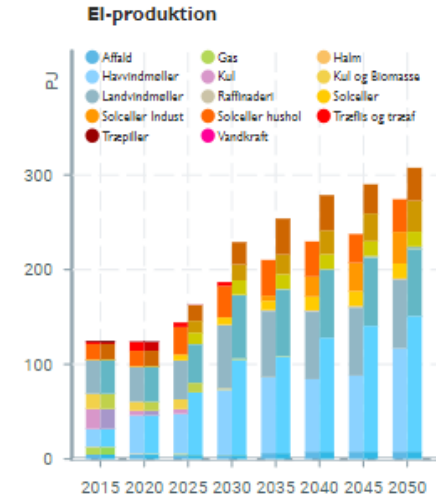
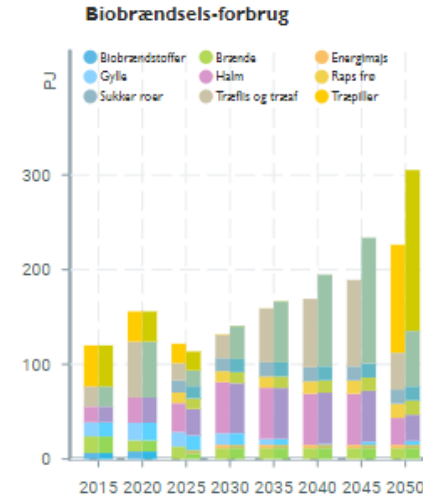
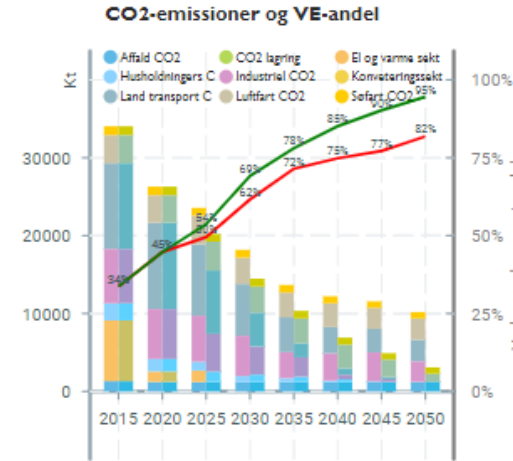
Hovedresultater

Forsyningssektoren

Transportsektoren

Industri

Husholdninger



Klimaaftalen



Om værktøjet

Beskrivelser af scenarier

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Carbon budget 1.5°C

Carbon budget 1.5°C (bio)

Carbon budget 2°C

Carbon budget 2°C (bio)

CCS

Scenarie difference

Hovedresultater

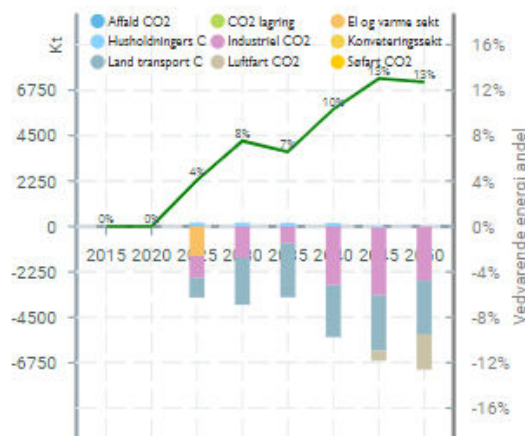
Forsyningssektoren

Transportsektoren

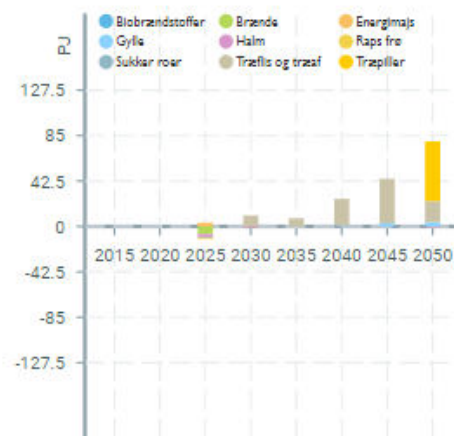
Industri

Husholdninger

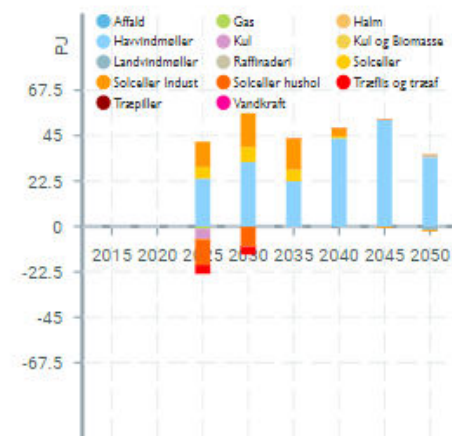
CO₂-emissioner og VE-andel



Biobrændsels-forbrug



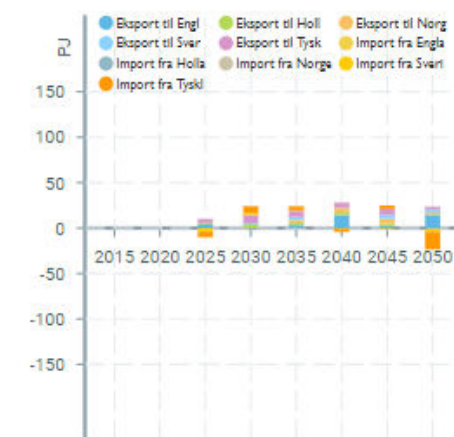
El-produktion



El-kapacitet



El-netto-eksport



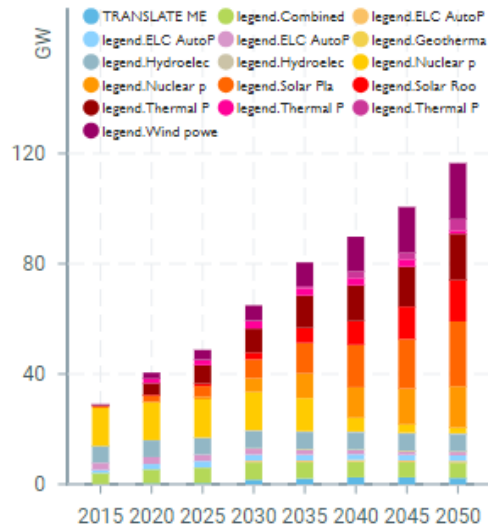
Fjernvarme-produktion



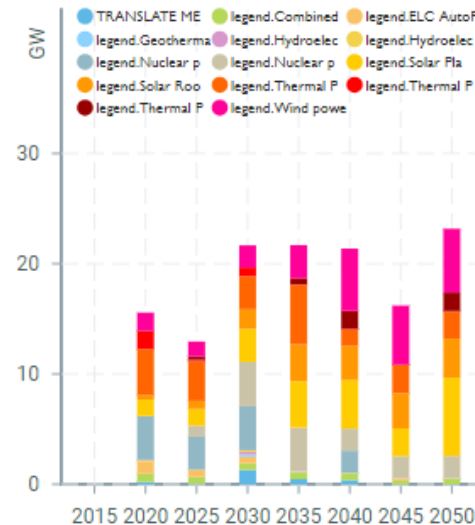
За допомогою цього інструменту ви можете ознайомитися з попередніми результатами сценаріїв розрахованих за допомогою енергетичної моделі TIMES-Україна. Виберіть сценарій у меню ліворуч та перегляньте результати на діаграмах, наведених нижче.

Інформація та результати моделювання, наведені тут, – попередні результати спільного проекту МЕВІТУ, УДЕЦ та ДЕА: “Long-Term Energy Modelling and Forecasting in Ukraine: Scenarios for the Action Plan of Energy Strategy of Ukraine until 2035”. Дані та результати є попередніми, тому на них не слід посперитися або розповсюджувати.

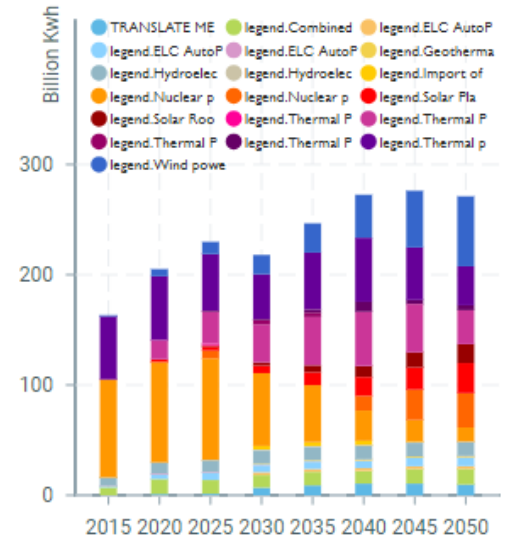
All Electric Capacity



New Capacity



Electric Production (incl. import)





Thank you for attending.

Kenneth Karlsson, keka@dtu.dk, +4521328733
Head of Energy System Analysis

Sustainability

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Contact



Kenneth Bernard Karlsson
Head of Energy Systems Analysis Group
DTU Management
+45 46 77 51 17
keka@dtu.dk

Energy Systems Analysis

Energy Systems Analysis (ESY) comprises competences within systems analyses, operation management and energy technology knowledge. ESY provides tools and expertise, supporting national and international energy policy making by advancing the national and international development of energy systems models, especially TIMES and Balmorel.

<http://www.sustainability.man.dtu.dk/english/Research/Energy-Systems-Analysis>

Affiliations:

Kenneth Karlsson, keka@etsap.org, +4521328733
Operating Agent ETSAP

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Second book available! **New book available!** **EEG – CROSSTEM Results**

A second book was published by IEA-ETSAP members which collates a range of concrete analyses at different scales from around the globe, revisiting the roles of countries, cities and local communities in pathways to significantly reduce greenhouse gas emissions and make a well-below-2°C world a reality.

Informing Energy and Climate Policies Using Energy Systems Models

Written by IEA-ETSAP members, it collates together a range of methodological approaches and case studies of good modeling practice at national and international scale based on IEA-ETSAP tools and expertise.

Available at: www.etsap.org/Doc/Book/272813311651384

Energy Economics Group – CROSSTEM Results

2 | Portugal | 3 | Netherlands | 4 | China | 5 | Italy | 6 | Germany | 7 | France | 8 | Austria

About IEA-ETSAP

The Energy Technology Systems Analysis Program (ETSAP) is one of the longest running Technology Collaboration Programme of the International Energy Agency (IEA). ETSAP currently has as contracting parties 20 countries, the European Commission and two private sector sponsors.


Why choose TIMES

The IEA-ETSAP methodology (the TIMES energy system model) offers elegant solutions for compilation of long term energy scenarios and in-depth national, multi-country, and global energy and

IEA-ETSAP Community

The IEA-ETSAP community leads a major initiative for open source solutions for energy scenario modeling needs.

Contracting Parties



IEA-ETSAP Tool Users (63 countries)

News [ARCHIVES]

ETSAP is hosting a session on "Going beyond energy systems analysis: How can we make long-term energy scenarios more relevant to climate policy making?" in the Long-term Energy Scenario 2019 International Forum organised by IRENA in Berlin during 10 - 12 April 2019. For more details see [here](#).

A new position at E4SMA S.r.l. in Turin (Italy) for an Energy System Modeler with VEDA-TIMES experience. For more details see [here](#).

IEA-ETSAP workshop

Back to back with IEW 2019, the IEA-ETSAP workshop will be held in Paris as follows:

- Times Training Course on
- Monday, June 3rd to Wednesday,

<https://iea-etsap.org/>