

The Interreg IVB  
North Sea Region  
Programme



*CO<sub>2</sub>-calculator in Danish municipalities.*

# CO<sub>2</sub>-calculator in Danish municipalities.

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## Background

The North Sea Sustainable Energy Planning Project conference I Middelfart February 2010 contained a session about “Co2 – calculator in Danish Municipality’s”. The session was held by Mr. Morten M. Westergaard (Municipality of Middelfart) and Mrs. Merete Valbak (Municipality of Kolding).

At the conference there was a great interest in the subject. It was agreed that the Danish partners made a short paper to “wrap” the session up. To fulfill this agreement a paper was made (Denmark CO2 Calculator.doc). The paper was accompanied by a PowerPoint Presentation regarding the co2-calculator.

Due to further interest the Danish partners have elaborated on the subject and explained the calculator-model into some depth. It is important to stress that there are several institutional requirements before calculations can be made without large margins of error. This will be dealt with in the chapter on data.

Please feel free to contact the Danish partners if further information is wanted



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## **Introduction; The often used CO<sub>2</sub>-calculator in Danish municipalities.**

Many countries are in the process of mapping their national CO<sub>2</sub> emissions. And development is proceeding fast at municipal level.

Danish municipalities have succeeded in such a project. Using a new national IT-based calculation model, municipalities can calculate the extent of their CO<sub>2</sub> emissions and identify ways to reduce them.

This allows them to compare their CO<sub>2</sub> emissions between themselves, as well as with other municipalities in the EU.

The Danish CO<sub>2</sub> calculation methodology for municipalities is based on EU and UN requirements for national emission reporting. The Danish CO<sub>2</sub> calculation methodology may serve as the missing benchmarking tool for municipalities within the EU and the UN.

In autumn 2007, the Danish Ministry of the Environment, the Ministry of Climate and Energy and Local Government Denmark (LGDK) decided to develop a nationally recognized methodology that would allow Danish municipalities to map CO<sub>2</sub> emissions on a uniform basis. The model take into account all municipal operations with a Green House Gas emission or which serve as a carbon sink i.e. heat and power production, transport, agricultural, forestry, land use, commercial energy use and citizens' use of energy and heating



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Supplies, waste production and industrial processes with CO<sub>2</sub> emission (production of cement, glass and ceramic products) or emission of solvents.

The CO<sub>2</sub> calculator has also included a catalogue of tools and methods to reduce CO<sub>2</sub> emissions within areas such as waste, traffic, agriculture and nature and the program can calculate CO<sub>2</sub> reduction potentials for these mitigation measures.

The CO<sub>2</sub>-calculator has been developed in a co-operation between the National Environmental Research Institute (NERI) and COWI.

## Where to get the calculator and how?

The calculator is free to use and is available to download at the website <http://www.miljoportal.dk/CO2-beregner/>



Figur 1 Screenshot from the webpage, where the calculator is available



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On the homepage it is possible to read

**News about the calculator.** For instance a new version is released 21. of march 2011.

**Guidance.** Several guides are available. The guides include:

- Installation of program
- Starting with the calculator
- How to gather data
- Recommendations how to cut back CO<sub>2</sub> emissions
- Users guide on installing the program
- The used method for computing and calculation in the program ( background)
- Examples on use of calculator in Copenhagen (Municipality Level)
- Examples on use of calculator in Aarhus (Municipality Level)

**Further examples of using the program**

- Examples on use of calculator in Copenhagen (Municipality level)
- Examples on use of calculator in Aarhus (Municipality Level)
- Examples on use I municipality of Herning.
  - Climate mapping of emissions with calculator
  - Climate Scenarios
  - Action Plan for the municipality

**Support.** Several possibilities to receive help and support are described

All above mentioned features are available for the users of the calculator.



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## **But it's in Danish – How about an English version – can I test it as a North Sea Sustainable Energy Planning partner?**

The version is being used by several Danish Municipalities and developed for a Danish context. The developer of the program is COWI. COWI is an international consulting company and of course interested in converting the calculator into English, and applying it to other contexts.

A test, to apply the calculator, to partner municipalities (None Danish) can be done, prescribed that partners deliver data and help fill in the calculator.

The process means Danish partners translate requirements and partners insert data.

Work-time will be approximately 2 weeks. Simpler models of testing can also be made upon agreement.

### **Data in the calculator**

Data can be implemented with at different levels, according to precision and available data. The chosen level is called "Tier" and is divided into 3.

Tier 1 is the most detailed and precise level.

Tier 2 is the level that has details and some precision.

Tier 3 is average data, and does not require very much local knowledge.



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This means that if you do not have all data, you can insert average data for your country (Tier 3). Of course you get an average result if you only use average data.

Dataindsamling				
Emissionskilde	Tier	Datatype	Enhed	Datakilder
<b>Transport og maskiner</b>				
Vejtrafik	Tier 1	Antal indbygger i kommunen		Kommunens statistiske oplysninger
	Tier 2	Trafikarbejde fordelt på: <ul style="list-style-type: none"> <li>▪ personbiler</li> <li>▪ varebiler</li> <li>▪ lastbiler</li> <li>▪ busser</li> <li>▪ knallerter</li> <li>▪ motorcykler</li> </ul>	årsdøgntrafik i mio km/år	Kommuner med opdateret trafikmodel kan selv foretage/bestille en beregning af trafikarbejdet fra konsulenter. Kommuner med opdateret miljøregneark over talt/skønnet trafik kan selv foretage beregning. For statens veje: Se Vejdirektoratets strømkort ( <a href="http://www.vd.dk">www.vd.dk</a> ) Lokale erfaringstal kan anvendes til opsplitning på transportkategorier For rutebusser: Se køreplaner
	Tier 2 og 3	Hvis muligt angives kommunens (kommunen som virksomhed) forbrug af transportydelse fordelt på hhv. fly, tog, personbiler, varevogne, personbefordring/taxi, kilometerpenge osv. (til brug i virkemiddelberegninger)	GJ/år (alternativt: kr. udgifter/år)	Eventuelle regnskaber/opgørelser i kommunen
	Tier 3	Trafikarbejde opdelt på henholdsvis by, land og motorvej og for hver af disse yderligere fordelt på: <ul style="list-style-type: none"> <li>▪ personbiler</li> <li>▪ varebiler</li> <li>▪ lastbiler</li> <li>▪ busser</li> <li>▪ knallerter</li> <li>▪ motorcykler</li> </ul>	årsdøgntrafik i mio km/år	Kommuner med opdateret trafikmodel kan selv foretage/bestille en beregning af trafikarbejdet fra konsulenter. Kommuner med opdateret miljøregneark over talt/skønnet trafik kan selv foretage beregning. For statens veje: Se Vejdirektoratets strømkort ( <a href="http://www.vd.dk">www.vd.dk</a> ) Lokale erfaringstal kan anvendes til opsplitning på transportkategorier For rutebusser: Se køreplaner

Figur 2 Screenshot from calculator. Data regarding transport

The calculator must be feed with data concerning the activities in the municipality. Amongst activities are:  
 Number of inhabitants in the municipality, Consumption of energy from electricity (divided into different sectors such as municipality buildings, private households, industry, trade-industry, service, agriculture etc), Heating divided in Central Heating, different types of private/individual heating systems, number of driven kilometers in the municipality (distance and vehicle type), number of square meters of land use for forests, wetland, and different kinds of agriculture, Amount of livestock divided into sorts (Cows, pigs, foxes





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etc), amount of used fertilizer and sort of fertilizer, and other sources for CO<sub>2</sub> and equivalent emissions.

The CO<sub>2</sub> emission is calculates as:

$$\text{CO}_2\text{-emission} = \text{Emission-factor} \times \text{Activity}$$

How the emission factors and Activities are defined and transformed to CO<sub>2</sub> emission can be read in the rapport "Drivhusopgørelse på kommuneniveau" by the Danish Environmental Center (DMU). The calculator computes by using the emission-factors, perhaps with a constant, the activity data in sectors measured in CO<sub>2</sub> units. Used data in conversion are, for instance, CH<sub>4</sub>, N<sub>2</sub>O, Organic chemicals such as VOC that is used in industrial processes, Halocarbons, CFC gasses and others.

The data that is requested, concerns municipality data. Much data can be gathered from energy companies and energy suppliers, the transport sector and agriculture sector. None of the data is rocket science, but takes some time to gather.

To "fill in" the calculator with data it roughly takes 2 weeks work.

For this work a number of national data systems are used.

For instance data from the CHR (Central Husdyr Register) is used. This is a system where all data on Danish livestock is kept. This makes it easy to gather information on the number of foxes etc. in a certain municipality.



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Many Danish municipalities have had consultants to do the work, which often charge about 7-10.000 euro for making a report.

### **Other possibilities – strategic opportunities**

The calculator allows you to “play” with data. For instance you can plan a wind farm in the municipality, and insert data from the planned wind farm in the calculator. The result will show you the wind farms impact on the total CO<sub>2</sub> balance. In this way the calculator can be used in the field of strategic energy and climate. These possibilities can also be done in other sectors such as agriculture and transport.

### **The value for North Sea Sustainable Energy Planning**

The method in the calculator, used in several Danish municipalities, has been revealed at the meeting in Middelfart. The knowledge was delivered in oral presentation, accompanied by two papers and one powerpoint. The method has caused interest from partners and given a learning process in different practices. Furthermore it has been a very important basis to make further work and progress in Sustainable Energy Planning. In the North Sea Sustainable Energy Planning project the Danish municipalities; Middelfart, Vejle, Kolding and Fredericia have tested and used the calculator.