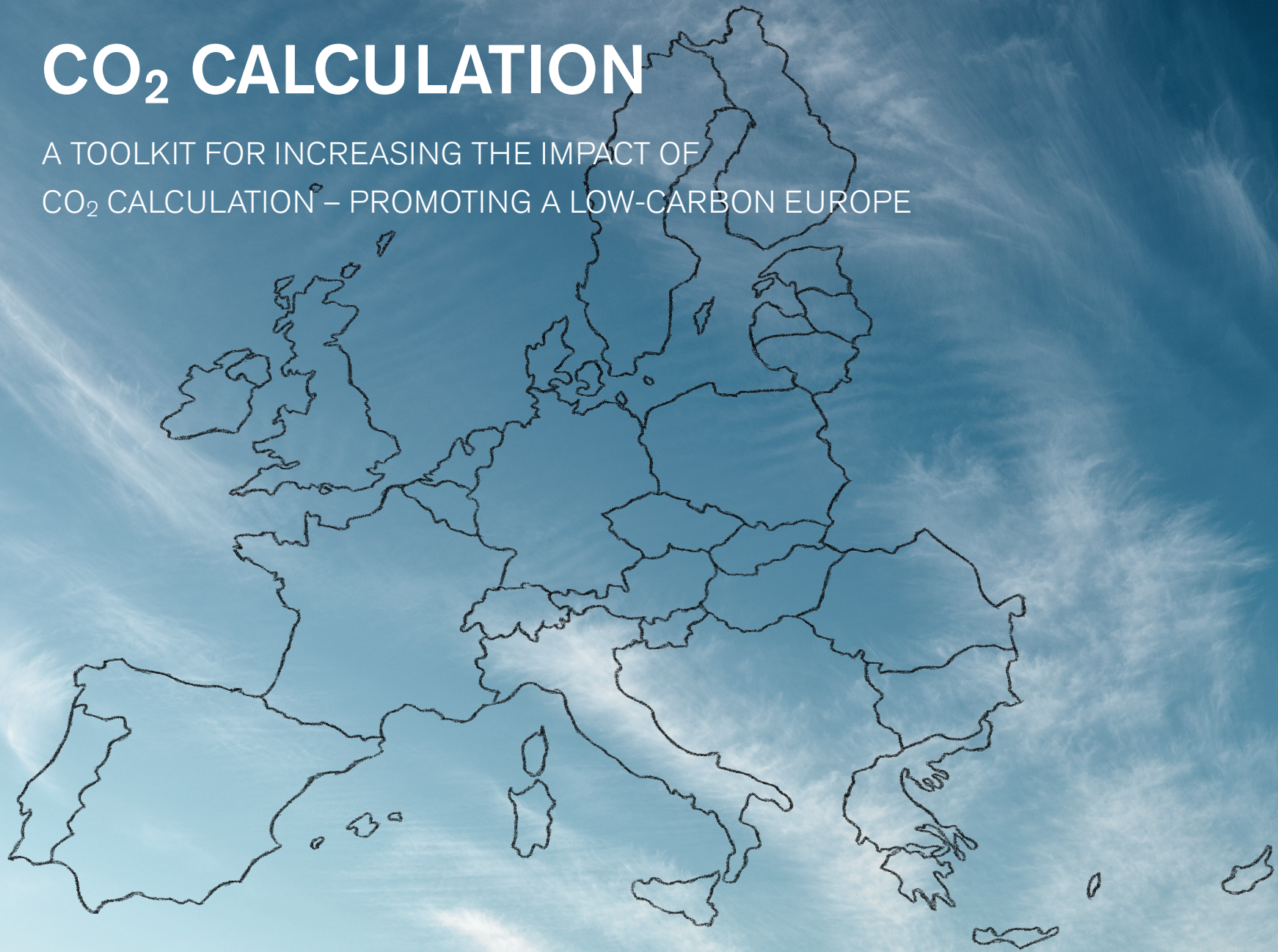
CO_2 CALCULATION

A TOOLKIT FOR INCREASING THE IMPACT OF
CO_2 CALCULATION – PROMOTING A LOW-CARBON EUROPE



NORTH SEA SUSTAINABLE ENERGY PLANNING PLUS

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PHOTO: Mikael Göthage Photographs, www.gothage.com

PRODUCTION AND LAYOUT: The Alexanderson Institute.

PRINTED BY: Sandstens tryckeri, Gothenburg, 2015.

PAPER: This book has been printed on Scandia 2000, a paper manufactured from timber harvested from environmentally certified Swedish forests. Scandia 2000 is made at Lessebo Bruk in Småland, in Sweden – an integrated mill that produces pulp and paper on the same site. The woodchips that are used come from local forests. Waste heat from the production process is used to supply district heating to local homes – a scheme that is unique in Europe.

PUBLISHER: The Alexanderson Institute.

ISBN: 978-91-979940-4-0

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CO_2 CALCULATION – PROMOTING A LOW-CARBON EUROPE

The Interreg IVB North Sea Region Programme

NORTH SEA SUSTAINABLE ENERGY PLANNING PLUS

Investing in your future

EUROPEAN UNION
European Regional Development Fund

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INTRODUCTION

AUTHORS: NICK LYTH & MANFRED WEISENSEE

This toolkit is a product of an international cooperation project named North Sea Sustainable Energy Planning PLUS. With the aim of promoting a low-carbon Europe and increasing the impact of CO_2 calculation, partners from six countries has worked together to create this source of inspiration. The project was part funded by the European Union programme Interreg IV North Sea Region.

Where does this Toolkit come from?

The document you are reading is a product of the NSSEP PLUS North Sea Region Programme project. NSSEP PLUS stands for North Sea Sustainable Energy Planning, and PLUS signifies that it is an additional project which capitalises on an original project which was called NSSEP.

NSSEP dealt with a variety of different aspects of sustainable energy and its planning, but NSSEP PLUS concentrates on one aspect of particular importance, which is carbon calculators. This theme was dealt with in the original project at some length, and so this project is designed to enhance and capitalise on the achievements of the first project. As part of this process, the production of this toolkit is a priority, intended to bring the benefits of the work to as wide an audience as possible so that they can learn from the knowledge gained, and can put into practice much of the theory of what will work best for doing the job of carbon calculating.

Who is responsible for this Toolkit?

The project is part funded by the North Sea Region programme, which asks that the needs of the North Sea Region be brought into sharp focus in all its funded projects. So, although the need for carbon calculators in a European context has been brought about principally by the agreements on targets for all EU member states, this toolkit has special application for the North Sea regions, encompassing areas of the UK, Belgium, The Netherlands, Germany, Denmark, Sweden and Norway. These regions have a common socioeconomic character, and share many of the same challenges, as well as sharing the nature and impact of the North Sea itself. It therefore has similar needs in addressing the requirements of the EU as far as the targets required for carbon emissions are concerned.

The project includes partners from all these regions. The partners involved are:

- Jade Hochschule, Germany.
- Vejle Kommune, Denmark.
- Intercommunale Leiedal, Belgium.
- Alexanderson Institute, Sweden.
- Green Angel Syndicate, United Kingdom.
- SNN, The Netherlands.

Who is this Toolkit for?

We have produced this toolkit for those of you who are concerned with, and affected by, the need to monitor carbon emissions, especially in the North Sea Region. We are a region characterised by a cold climate, and the relationship with the sea. This means there is a high heat requirement and also an industrial and leisure dependence on sea and air transport. Added to this, there are areas of low population density where journey distances are high, and the reliance on automotive transport is consequently also high. The sectors this is therefore aimed at are the variety of commercial and industrial sectors with an obligation to monitor carbon emissions, which include:

- fishing,
- the transport sector itself,
- leisure and tourism,
- food and drink manufacturing,
- the energy sector,
- the water sector,
- IT and call centres,
- all other commercial and industrial sectors relevant to the region.

The academic sector, covering:

- schools,
- colleges,
- universities in the region.

The public sector, including:

- local and regional government,
- hospitals and surgeries,
- waste management and recycling operators,
- libraries.

And finally, the community sector is also a natural audience for this toolkit.

If you are working in any of these sectors, and have responsibility for ensuring the good practice in your organisation for purposes of controlling carbon emissions and hitting targets for reduction in the coming years, this toolkit is for you.

What is the toolkit for?

The toolkit is designed to provide you with a realistic and practical guide for engagement with the challenge of monitoring your organisation's carbon emissions. It will explain how carbon calculators are developed, how they work, and what they can provide. It will steer you towards the best methodology for your organisation. You should use it as a reference document, to help you make your own decisions, and define the terms for debate and discussion with others as to how best to mitigate the problem of carbon emissions in your organisation. It is not a definitive guide, it will not tell you what to do. Use it as an advisory source, helping you to find the way in an otherwise controversial and difficult subject.

How does it relate to European and National Policy?

In our approach to carbon calculators, it is important to understand the context with regard to European and national policy. The European Commission has set the target to reduce the emission of greenhouse gas until 2020 by 20% compared to 1990 and with the 2030 Framework for Climate and Energy Policies the domestic greenhouse gas reduction target of at least 40% has been agreed on for 2030. In order to meet these targets local authorities engage themselves undertaking a set of actions to reduce their carbon emissions. These actions are summarised in a Sustainable Energy Action Plan SEAP. The Covenant of Mayors that has already been signed by more than 6.000 municipalities has become the benchmark for developing local climate and sustainable energy policies. Here, a standardised methodology for CO_2-reduction policies is used. Firstly, CO_2 emissions are calculated. Secondly, a carbon reduction target is set. Thirdly, a set of actions with high impact is agreed. The progress on carbon reduction needs to be monitored and reported. For this a carbon calculator has to be applied.

What are "carbon calculators"?

We also need to understand what we mean by "carbon calculators". Essentially, we refer to methodologies of monitoring carbon emissions, and quantifying them along a standard volume scale. Although the scale is largely agreed, the methodology for calculation is not. There are many different carbon calculators available, as a simple Internet search will reveal. Their output is generally designed to be consistent with the accepted standard of measurement, but the means by which they reach this is widely different. This is hardly surprising, as the purpose of each differs, sometimes quite widely. There are so many different causes of carbon emission, that deal with so many different aspects of our daily lives. Each requires a different form of calculation. Without central guidance from the source of the policy in Europe, there is very little standardisation.

What does this Toolkit include?

This Toolkit is therefore divided into the following sections:

Firstly, we will deal with the question con-

cerning the source of the emissions. The need for carbon calculators is divided by the activities and motivations that lead to the emissions in the first place. This section attempts to define what these categories are, and how they differ for purposes of monitoring their carbon emissions to help you identify your own needs and place them in context.

The second section deals with the range of different carbon calculators available for you to consider, and provide you with the means of discriminating, so you can judge which will be best for you. Their quality, ease of use, accuracy and methodological base will all be considered, so you will be able to understand what each one does and does not do.

The third section deals with the challenge of developing the calculator tools themselves into viable and sustainable methods for use not just in the North Sea Region, but around Europe and even further afield. The challenge for carbon calculation is as much consistency and standardisation as the calculation process itself. Until there is a recognised standard methodology for each sector, the process will be flawed, as the measurement will be inconsistent.

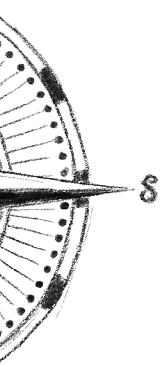
Finally, the fourth section presents an overview of progress around the EU on the study of carbon calculators, and offers suggestions as to where it should go next.

WHERE TO START?

DEFINING THE TARGET GROUP

AUTHORS: NICK LYTH, TONY CHRISTENSEN & BORIS SCHØNFELDT

This Toolkit is designed to help you to achieve a practical objective: reducing carbon emissions within your sphere of influence. However, before you start work, it is necessary to be completely clear about the practical application of your work. Who are you aiming to speak to about carbon calculators? What are you expecting them to do with the calculators? What are you expecting them to do as a result of the calculations? This section will help you to understand how a strategy can be constructed to define what you are attempting to achieve, and – critically – with which target group you should engage. It will encourage you to define the issue of carbon emissions in the following terms, in order to define the targets for your work.



What is the Problem? In other words, where does the focus of the problem concerning carbon emissions lie? What is the context in the region's environment for the most serious problems of carbon emissions? What are the circumstances in which they are created? What efforts are already being made to address the problem? Has the problem already been identified, and if so, with what results? What is the consequence of the problem, and what are the likely outcomes if the present situation is continued without action?

Is remediation possible? Is it practicable? Is it achievable? If the answer is "no" to any of these questions, then it is mistaken to waste effort on introducing a carbon calculator, as no action can take place as a result. But if improvements are possible with knowledge and judgement, then there is every reason to prioritise this problem area.

What actions characterise the problem, what are the actions causing the problem, how are they characterised? In other words, who is doing what to create the problem of the carbon emissions? The actions must be specified and defined with precision in order to gain the maximum benefit from the introduction of the carbon calculators.

Who are the actors causing the problem? As a result of the above analysis, it becomes possible to define and priorities the target markets for the carbon calculators and the work you will undertake in introducing them to your region. You can specify the actors who are responsible for the carbon emissions, and introduce them to the benefits of carbon calculators.

This section will discuss the nature of the different targets in four broad categories, each of which will sub-divide into further categories of usage and behaviour. These are:

- citizens,
- business.
- government,
- projects.

In each case, we will define how the behaviours of each category are liable to create

problems, and how carbon emissions need to be addressed. These vary widely, and of course, vary within the categories, hence the need to create further sub-categories. In terms of impact, the most important category will be government, since it has the capability of influence over all the other categories within your region. But this is not to suggest it is their exclusive responsibility to guide and decide how carbon calculators should be used. It is the responsibility of all of us, as private citizens, or as economically active members of society, to take precautions that ensure that our treatment of the environment is not contributing to the longterm damage being done by global warming as a result of careless behaviour. So this section will consider every member of society before showing how these can be prioritised by the scale of their influence over emissions. These are the targets for us all to concentrate on in the use of carbon calculators in future

CO_2 CALCULATION FOR CITIZENS

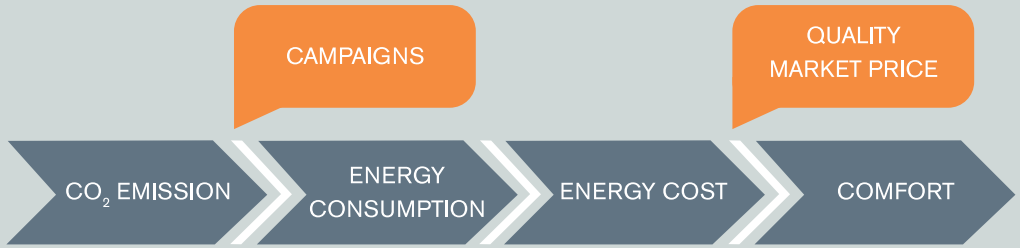
Few citizens think they are responsible for lowering CO_2 emissions. CO_2 is very abstract and distant to citizens' everyday life. So the question is what will make the citizens take part in lowering CO_2 emissions? Do they need to know and understand the CO_2 monitoring system? Do we educate and inform them to do the right things? Do we add taxes to encourage the right actions? Or is nudging a better way to make the right actions happen? It seems that energy prices and comfort does play a vital role, and that CO_2 emissions are irrelevant when changing behaviour in everyday matters. Not to say that citizens do not care for the future and do not understand the importance of CO_2 levels on climate change, but it does not connect to everyday behaviour.

The challenge is, when shopping in the supermarket, when driving the kids for social activities and sports, when cooking and when doing the laundry, we probably have all heard the campaigns telling us that we are doing it all wrong, and that we should act differently. And we may even be able to recite or even understand and repeat the message, but it doesn't make us see the connection to the CO_2 monitoring and the strategy goal of lowering the CO_2 emissions.

Since 2000 general energy costs have been rising. For example the cost of electricity went up by 27% from 2006 to 2011 in Denmark. This may encourage actions when refurbishing homes. But then again lowering the energy cost is just one parameter among a lot of others like colour, function, comfort and many others we have to take into consideration when refurbishing our homes.

What drives the right measures? For a long time campaigns have been the answer to many questions like reducing smoking and now also to inform and drive the right climate actions. For example there have been massive campaigns for the last decade or two, encouraging us to replace light bulbs for the newer energy saving type and now

CO_2 is not relevant to the household, but the further right in the figure, the more relevant it becomes, and still it will have a direct connection back to the CO_2 emission.



Campaigns deploy where the decision makers identify the challenge, but citizens change behaviour further to the right.

again for the LED type, encouraging us to switch off power consumption connected with standby of many products, encouraging us to consider the energy consumption when buying a new fridge, freezer or car. But actually the process of replacing light bulbs only speeded up, when the EU banned the incandescent lamp when the new types reached market price and a quality that is similar to the original type.

The consumers did not react to the campaigns and the information that was communicated to make sure they understand the why and how. Only when the "wrong" or "irrational" action is hindered or even banned, when the quality and price of the alternative or the "right" is accepted, will the consumer change behaviour or take the right measures. It seems that the wish for CO_2 reduction and the communication of the carbon emission calculations does not combine to make sense directly to the majority of the consumers. The correlation between the citizens' energy consumption and the experienced flooding is not realized or non-existing to the consumer. Only the few percent following ideological thinking will struggle to find alternatives and be ready to pay the additional cost of behaving right.

In other words there is a big challenge to connect the political goal of CO_2 reduction with the change of citizens' behaviour. And we believe that communication of the CO_2 monitoring system is not quite one of them. On the other hand, whatever effort the citizen makes to lower the energy consumption or change fossil fuel for renewable energy, will be possible to recalculate/back-calculate to give a CO_2 reduction.

There are already quite a few models developed with the purpose of getting the citizens to take part in lowering CO_2 emissions, by reducing their consumption of fossil fuels connected with power consumption in households and transportation. The models span: campaigns, contests, education, encouragement of local involvement and commitment, data collecting to analyse and show consumption, models calculating payback time of energy renovations, and finally energy coaching.

We have tried a concept of engaging with four small local communities in rural areas where there is no public energy supply but they all are depending upon their own stove (biomass or oil). By identifying areas without public energy supply we secured the incentive to take action as the energy costs in these areas are higher than in areas with district heating or public supply of natural gas, CNG. Also the houses in these areas are typically built before the mid 1970's and hence have the potential of optimizing the insulation.

We held an educational half day, to raise awareness and find out what the situation and perception of the situation and the future is in the local community. In every place, two families opened up their homes as an example to the other participants. The homes were given a thorough check, to visualize and explain the possibilities of adjusting and optimizing the existing system with the purpose of saving energy and raising comfort, to broaden the knowledge of taking into account the perspective of energy savings when planning refurbishing the home and to raise awareness of new technologies that are based on renewable energy instead of fossil dependant.

All participants have expressed their satisfaction with the arrangements and that they expect or will consider engaging in actions to lower their energy consumption. Unfortunately we have not had the possibility to interview the participants to check if, after events, they have taken any measures to lower their energy consumption.

The CO_2 monitoring kit merely aims at identifying the challenges and where to deploy the effort, and is not to be used in directly advancing actions among citizens.

CO_2 CALCULATION FOR BUSINESSES

Climate change is alarming, human influence on the climate is clear and the recent climate changes have had widespread impacts on human and natural systems.[1] To combat this challenge we are all a part of the problem, and most important a part of the solution. Private businesses have a great responsibility, and also a great opportunity, to ensure that their future business operations are oper-

ated sustainably and become a part of the solution to stop climate change.

Why CO_2 calculators in enterprises?

The issue of the greenhouse effect and contemporary climate changes are today well known. An increasing number of enterprises act accordingly upon this knowledge by seeking to become more climate friendly in their operations. The first step to head in this direction is to adopt a climate calculation tool to measure the company's impact on the climate. A common point of departure is a CO_2 calculator, a carbon accounting tool that measures and documents the company's carbon footprint. The adoption of a CO_2 calculator gives a well-documented analysis of the current status on CO_2 emissions and provides the background that is needed to draw up suitable strategies and effective efforts to be a part of the solution to combat climate challenge.

A barrier to adoption of a CO_2 calculator in a company is the lack of motivation and perceived incentives, a valid question is indeed; why is the CO_2 calculator a good thing to my company? The answer to that question is multifaceted and comprises carrots and sticks as well as opportunities and risks.

The most immediate incentive is undoubtedly the risk of climate change itself and its effects on society. To businesses operating in the particularly vulnerable coastal area that makes up the North Sea region this risk is imminent. Nevertheless, this risk is often perceived vague and complex and hard to link with a single company's operations. In lieu there are other impelling factors such as compliance with government regulations, public procurement requirements, increased taxes on CO_2 emissions and increased energy costs that are often seen as the most valid incentives and motivations for companies to adopt a CO_2 calculator.

Incentives are however not only risks and sticks. Carrots and opportunities are at least as important. The use of a CO_2 calculator can help build up a good reputation among the company's stakeholders and it counts as part of the company's CSR (Corporate Social Responsibility) undertakings. Furthermore, it helps to situate the organisation well to tackle future government legislation and increased costs for CO_2 emissions. However, a more immediate driving force for many companies is the financial incentive; a CO_2 calculator is a basis for cost-efficiency and savings in energy and climate accounts.[2] With the right climate management a CO_2 calculator is not only climate friendly, but also a source of increased profits. Furthermore, when the company proceeds to reduce its emissions as a result of the CO_2 calculation it will also drive innovation and development in the company since a reduction of CO_2 requires new processes and perhaps even new products to be successful. This is a seldom calculated incentive but nevertheless important to include in the cost-benefit analysis of ap plying a CO_2 calculation in the company.

What are the inputs?

The initial input from a company management to start use a CO_2 calculator is relatively small. To reach the decision to start to measure CO_2 emissions is the big thing. The inputs could than vary depending on the level of ambition, from low ambitions with low inputs to higher ambitions which also require a higher input. The input should match the ambitions and goals of the company.

It is crucial that the company management sets off resources and mandates to take subsequent improvement actions based on the result from the CO_2 calculation. The minimum measure taken should be to follow the standard management procedure of plan, do, check, act. However, to really benefit from the engagement with CO_2 calculators it should be a part of a wider climate and environment management strategy embedded in the organisation and management structures and with a yearly plan for follow up and revise results.

What are the values?

The use of CO_2 calculator alone brings some clear values to the company; good reputation, ease of compliance with legislations and regulations as well as increased cost-efficiency. However, the real value lies in the CO_2 calculator as a first step towards a wider climate and environment management strategy in the company. When the CO_2 calculator goes from being an external measurement tool to become an integrated part of the company's business strategy great value can follow.

Recommendations

- Use external consultants in the first phase, embed in organisation in second phase.
- The CO_2 calculation is just the first step, make sure to follow up the results from the CO_2 calculation.
- Plan for a wider climate- and environment management structure.
- Embed in the organisation.
- Integrate in the business strategy.

Read more

- www.ghgprotocol.org
- www.cdp.net/cdpresults/cdp-global-500-climate-change-report-2013.pdf
- www.cdp.net/en-US/Pages/HomePage.aspx
- www.wbcsd.org
- www.wri.org
- www.ipcc.c h/pdf/assessment-report/ar5/syr/SYR_AR5_SPMcorr1.pdf

Footnotes

1. http://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_SPMcorr1.pdf
2. https://www.cdp.net/cdpresults/cdp-global-500-climate-change-report-2013.pdf

CO_2 CALCULATION FOR REGIONAL GOVERNMENTS

When analysing the sources of greenhouse gas production as well as the means to reduce and avoid their emission it can be stated that local and regional governments play a crucial role in mitigating the effects of climate change.

Besides greenhouse gas emissions originating from own activities and consumption counties, towns and cities account for more than half of the greenhouse gas emissions stemming from energy use related to human activity through products and services used by their residents. Furthermore, many of the actions which are necessary for climate protection – either on the energy demand side or on the renewable energy sources side – fall within the scope of competence of local and regional governments, or cannot be achieved without their political support.

Thus, local and regional governments throughout Europe are reducing greenhouse gas emissions through energy efficiency programs, including sustainable urban mobility, and the promotion of renewable energy sources. As the closest administration to the citizen regional governments also lead action and show examples.

The EU Member States benefit from effective decentralised action at local level in order to meet their commitment from the climate and energy package, which is a set of binding legislation that aims to ensure the European Union meets its ambitious climate and energy targets for 2020. These targets, known as the "20-20-20" targets, set the gauge for the success of all measures of greenhouse gas emission abatement

An outstanding movement mobilising local and regional actors around the fulfilment of the "20-20-20" targets is the Covenant of Mayors. It plays an important role in the context of North Sea Sustainable Energy Planning PLUS and will also be considered in detail in the following chapters of this toolkit.

Covenant signatories notably undertake to prepare a Baseline Emission Inventory (BEI) and set up a Sustainable Energy Action Plan (SEAP) outlining the key actions they plan to undertake in order to implement political commitments into concrete measures and projects.

The Covenant of Mayors applies a straightforward methodology for CO_2-reduction policies:

- measuring or calculating yearly CO_2 emissions,
- setting a carbon reduction target by 2020,
- defining a set of local actions for reduction of CO_2 emissions,

- monitoring and reporting the reduction of CO_2 emissions.

Within this methodology, carbon emission monitoring is a very central instrument. The methodology is highly standardised throughout EU, well described in technical and methodological material such as a SEAP guidebook, guidelines on reporting and SEAP templates.

Beyond energy savings and emission reduction, the results of actions are manifold:

- creation of skilled and stable jobs, not subject to delocalisation,
- healthier environment and quality of life,
- enhanced economic competitiveness,
- greater energy independence.

These actions serve as examples for others to follow, notably through referring to the "Benchmarks of Excellence", a database of best practices submitted by Covenant signatories. The Catalogue of Sustainable Energy Action Plans is another such unique source of inspiration, as it shows at a glance the ambitious objectives set by other signatories and the key measures they have identified to reach them.

Read more

- www.eumayors.eu
- www.covenantofmayors.eu/about/covenant-of-mayors_en.html
- ec.europa.eu/clima/policies/package/index_en.htm
- www.ghgprotocol.org

CO_2 CALCULATION FOR PROJECTS

CO_2 calculations are often done with a systemic and holistic approach. Many models and calculators aim at national levels, and as such a lot of assumptions have to be made to simplify the situation and make possible and practicable the calculations.

Local politicians are elected for a short period of time, in Denmark a four year period for example. This influences their choices of actions as the effect of longer term actions can be hard to use as an argument for reelection. To overcome this inherent challenge, politicians often decide to have CO_2 calculations made more often, like every year or every second year. But due to the assumptions and simplicity of the CO_2 monitoring models, this is really not possible. Or at least, it is not possible to conclude anything with certainty on the results.

In some cases it therefore will be advisable to argue for the effect of a given measure on a project level instead of the effect of a single measure on a holistic calculation. Doing so, it is straight forward to include other effects as well that will enhance the grant for the project.

Let's give a few examples of the idea: At your home you like to know the effect of changing an incandescent lamp with the new type of LED bulb. The incandescent lamp changed is a 60 Watt bulb for a new 4 Watt LED bulb. If the lamp stays on for five hours a day every day the whole year, the power consumption is 109,5 kWh versus 7,3 kWh. The difference is a saved energy consumption of 100 kWh, which equals 30 kg CO_2 (1 kWh emitting 300 g CO_2, 2012 level national Danish power supply). So if the production and transportation of the bulbs are not included, but we only look at the power consumption, it is fairly easy to calculate the saved emission of CO_2 by using the measure of changing a light bulb. But if we look at the home with the holistic approach, trying to see the effect of changing the light bulb in the calculation of the total emission of CO_2 from the home, the effect will soon be drowned in uncertainty of other factors like the heat consumption for example, that will vary due to the outside weather and the changing degree days from period to period.

Another example could be the refurbishing of a primary school building. If the building is more than 30 or 40 years old, it probably needs an update on the climate shield (insulation, windows and so on), readjusting

the ventilation system and probably a new boiler among other things. For each of these measures it will be possible to calculate the saved energy consumption as well as the future expected cost of energy needed. Hence it will also be possible to calculate the expected payback time for the measure introduced. Even though the calculation is a bit more complex than the above example with the light bulb, it is possible to perform it, and still it will be more precise than the holistic approach. The holistic approach will be influenced by factors like the outside weather, the use of the building like changing number of pupils and also the use of the building at night for public purposes. Thereby it will be very difficult to estimate the experienced CO_2 reduction of a specific measure, as it will be hindered by assumptions and uncertainties and factors not measureable.

But other important side effects may enhance the grant for the measure. Focusing on insulating the building or readjusting the ventilation system it becomes obvious that it will also improve the indoor climate for the pupils or people using the building, and this may even led to reduced health cost and reduced absence. It may be difficult to evaluate the economic consequences of these two things, but nevertheless they may have full political attention.

We may therefore argue that calculating expected reduction of CO_2 emissions on a project level may be more relevant and accurate than doing a Baseline Emission Inventory periodically and comparing consecutively BEIs to evaluate the effect of implemented measures.

HOW TO DO IT?

A SELECTION OF METHODOLOGIES

AUTHORS: NICK LYTH, TONY CHRISTENSEN, BORIS SCHØNFELDT, CHRISTIAAN HEUTINK, STEFAN NICOLAUS, DOMINIEK VANDEWIELE, HANS-PETER RATZKE & MANFRED WEISENSEE

This section of the Toolkit deals with the range of carbon calculators that are available and will help you to find the right approach for the problems you wish to address. There are many different calculators available, and many of them are free. So we present these to you, at the same time as considering their application in the contexts you will need to consider. Their sources are dominated by the large policyforming bodies in the EU, but they all perform in a different manner and against different measurement standards. This creates a complexity that is difficult to unravel.

It becomes even more complex when the calculators which require payment are taken into account. These are presented by specialists and consultancies working in the field, which are competing to create the standard definitions and methodologies by which carbon emissions will be measured. These cannot be discounted as they tend to reflect developments in the technology of monitoring.

This is a very large subject, and is still in a state of flux. Monitoring technology in the energy sector is changing rapidly. Already the move towards smart metering initiated within the last decade has been overtaken by the "Internet of Things" which is pioneering the capability of machine to talk to machine. The work begun on smart meters is being set aside, as the next generation of monitoring technology is coming through. The most noticeable introduction in the energy sector in recent months has been the "Nest metre" (The world's first learning thermostat), which was brought by Google, and launched online to the residential market in North America and Western Europe. This is a sign of things to come.

Carbon calculators are a subset of the monitoring market. They are a means of monitoring carbon emissions. Although Nest, and its rivals, are not currently monitoring carbon emissions, they have the capability of doing so, if required, and the embedded technology will achieve a measurement which is far more sophisticated and consistent than any of the existing methods of measuring.

Whilst the current carbon calculators cannot hope to rival this degree of technical sophistication, they do still have one advantage. The monitoring technology embedded in Nest and its rivals is location specific, because the technology is monitoring machines, not people. Hence it cannot monitor group activity, unless it can be attached to every machine in the group. At the moment, this is not feasible, and it is not likely to be feasible for some years.

For our purposes, we must use the carbon calculator techniques that have been developed in order to achieve a collective measurement of the carbon emissions produced by the different constituent groups within our regions.

So this section discusses how these work, what the relative benefits are of each ap-

proach, how they might be applied to your circumstances, and where you can source them. It presents an overview of data collection as it presently can be conducted for groups of people and organisations, and also considers how the techniques for carbon monitoring on this scale might be improved.

METHODOLOGIES FOR CO_2 CALCULATION

This chapter gives a short introduction into methodologies of CO_2 or carbon calculation. Basic information on popular approaches and important terms is given and concepts are presented in a comprehensible way. When discussing concrete carbon calculators later on as tools to be used in order to improve our working habits and practices to help minimise the harmful effects of greenhouse gas emissions we need to know the background and constraints of these instances.

The proceeding passage already contains several terms that should be explained in more detail. First of all it has to be pointed out that the expression CO_2 or carbon calculation may easily be misinterpreted under two different aspects at least.

The first is that in the context of climate change and sustainable development CO_2 calculation does not necessarily mean the calculation of an amount of CO_2 by using reaction equations as in chemistry. There, one carbon atom and two oxygen atoms react to one carbon dioxide molecule e.g. when burning fossil fuels and biomass or producing material like cement. A more complete approach to CO_2 calculation also includes the amount of CO_2 that is emitted during the production process of oil or gas that we are using, by storage and transportation of fuels or material and goods to the consumers and any other secondary processes that are a prerequisite to any actual chemical reaction.

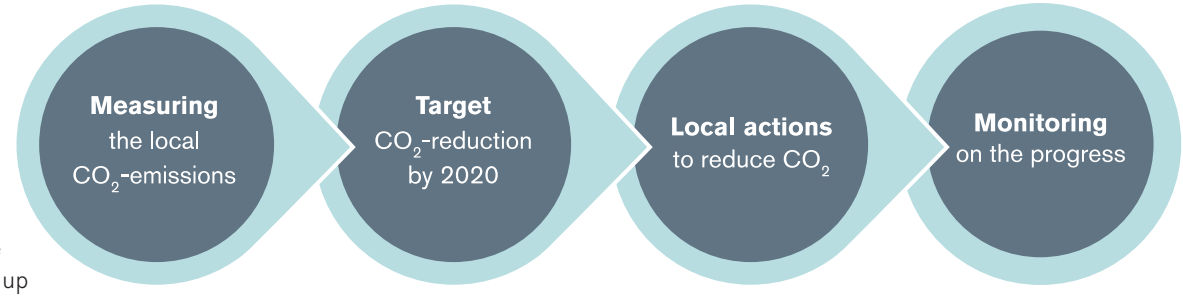
The second aspect is that other greenhouse gases like methane or laughing gas originating from energy production or consumption etc. are usually converted to equivalent amounts of carbon dioxide with factors depending on the respective global warming potential and the relative climate change effect of the greenhouse gases over a fixed time period. Thus, the amount of CO_2 equivalent (CO_2e) given for a product or a service can be much higher than the theoretical maximum of CO_2.

What has been said about secondary processes concerning CO_2 applies to other greenhouse gases as well. So, the local or regional aspect of carbon calculation has already been introduced. Especially when calculating emissions of a municipality or any other region emissions caused by imported elec-tricity and other energy sources but also by imported goods from industrial processes or agriculture and other emissions have to be considered. Thus, strategies have to be distinguished for inventories of CO_2 emissions within a region or caused by a region.

In both cases, a comprehensive consideration of emissions requires the complete and thorough calculation of the energetic and material history of a product which can be performed by an ecologic life cycle assessment (LCA). Here, all greenhouse gas emissions associated with the total usage of energy and material of products is included starting from acquisition and processing of material and parts over manufacturing, transport and distribution to use and reuse or recycling and disposal or in case of energy consumption the construction of power plants, mining of coal etc. is considered. In fact a complete life cycle assessment includes environmental burdens of any kind so that the limitation to greenhouse gas emissions is only a small part of a complete LCA. Still, this is a very costly procedure.

In the first instance, such an ecologic life cycle assessment calculates the status quo of all greenhouse gas emissions of a region, a household or a person, a company, a plant or a product. Terms used for this result are either the Carbon Footprint (CF) or the Baseline Emission Inventory (BEI) which represent the total emissions of CO_2 equivalents from arbitrary sources within defined boundaries and within a given period of time.

Either way, the calculations are most useful to identify locations, processes or activities with high environmental impact and thus are predestinated to identify the best fields of action for climate protection projects aiming at the reduction of carbon emissions. So in a



second instance measures can be defined and their beneficial environmental effect can again be calculated by life cycle assessment resulting in the carbon saving of these measures.

An example for a package of measures of activities set up to achieve carbon reduction targets together with time frames and assigned responsibilities is the Sustainable Energy Action Plan (SEAP) that has been defined by the Covenant of Mayors for municipalities of arbitrary size.

In this chapter five methodologies will be examined in more detail. In addition to the above mentioned methodology of the Covenant of Mayors the Greenhouse Gas GhG Protocol with tools for a wide range of sectors of companies based on worksheets with associated step-by-step guides will be focused. The GhG Protocol is divided into three levels (scopes) of emission calculation accounting for the company's direct emissions, the company's indirect upstream and downstream emissions, and third party emissions. The Climate Alliance CO_2 Inventory has been developed to extend the survey of greenhouse gases conducted on the EU and national levels to the local level and thus create refer-ence values on the municipal level for future CO_2 reduction programs. The "Klimaatmonitor" (Climate Monitor) offers a toolbox for local governments to decide which the best solutions for their particular area of responsibility to accomplish the Dutch objectives are. Finally the "Vejle CO_2 Beregner" uses the inventories of greenhouse gases at the municipality level divided into sectors used for the official Danish emission inventories.

Read more

- www.bifne.de/fileadmin/bifne/user-data/Bilder_und_Grafik/DIN-EN-ISO_14040_-_2006.pdf
- www.envirocentre.ie/includes/documents/Carbon_Footprint-what_it_is_and_how_to_measure_it-JRC_IES-Feb09-b%5B1%5D.pdf
- ec.europa.eu/clima/policies/g-gas/monitoring/docs/swd_2013_308_en.pdf
- www.covenantofmayors.eu/about/covenant-step-by-step-developments_en.html

COVENANT OF MAYORS

"The Covenant of Mayors is the mainstream European movement involving local and regional authorities, voluntarily committing to increasing energy efficiency and use of renewable energy sources on their territories. By their commitment, Covenant signatories aim to meet and exceed the European Union 20% CO_2 reduction objective by 2020." (Covenant of Mayors website).

The European Commission has the ambition to involve all policy levels in the ambition to create an "Energy Union" the EU 20/20/20 targets (minus 20% CO_2, 20% renewables, and 20% more energy efficiency by 2020), and the CO_2 reduction goal of -40% by 2030 ("2030 Framework for Climate and Energy Policies").

Through signing the Covenant of Mayors of the European Commission, the local authorities engage themselves to reduce their carbon emissions with at least 20% by 2020 (as 2020 is approaching, most likely the target for 2030 will be -40%). Local authorities engage themselves to undertake a

Key Actions	Area of intervention	Policy instrument	Origin of the action	Respoinsible body	Implementation timeframe		Estimates in 2020		
					Start time	End time	Energy savings (MWh/a)	Renewable energy production (MWh/a)	CO_2 Reduction (t CO_2/a)
Municipal buildings, Equipment/Facilities									
High energy performant new public buildings	Integrated action	Building standards	Local authority	ANZ, DEE, HAR, KOR, WER, WEV, ZWE	2013	2018	4.000		800
Master planning for energy refurbishment of public buildings and optimization of use	Integrated action	Building standards	Local authority	ANZ, DEE, HAR, KOR, KUU, WER	2013	2018	8.000		1.600
Renewable energy on public buildings (photovoltaic, solar, thermal solar, heat pumps, wood pellets…)	Renewable energy for space heating and hot water	Public procurement	Local authority	ANZ, AVE, DEE, HAR, KOR, KUU, LEN, MEN, SPH, WAR, WER, WEV, ZWE	2013	2018		13.500	3.000
New district heating scheme: connect public buildings	Renewable energy for space heating and hot water	Energy management	Local authority	HAR, KUU, MEN	2014	2016			
Purchase of 100% renewable electricity	Renewable energy for space heating and hot water	Public procurement	Covenant Territorial Coordinator	ANZ, AVE, DEE, HAR, KOR, KUU, LEN, MEN, SPH, WAR, WER, WEV, ZWE	2010	2020			18.000
Carbon emission monitoring of public buildings	Behavioural changes	Energy management	Covenant Territorial Coordinator	Leidal, ANZ, AVE, DEE, HAR, KOR, KUU, LEN, MEN, SPH, WAR, WER, WEV, ZWE	2011	2018			800

Extract from the SEAP-table, prepared by Leiedal (2014) and approved by the CoM secretariat (2015)

set of actions to reduce their carbon emissions. These actions are summarised in a "Sustainable Energy Action Plan" or SEAP.

Already more than 6.000 mayors –as representatives of local authorities have signed the Covenant of Mayors. In some countries of regions this initiative has triggered many dynamics (e.g. Belgium, Spain, Italy…). The Covenant of Mayors has become the benchmark for developing local climate and sustainable energy policies.

The Covenant of Mayors offers a simple but EU-standardised methodology for CO_2–reduction policies: first measuring yearly CO_2 emissions, setting a carbon reduction target by 2020, and defining a set of local actions with high impact. The progress on carbon reduction needs to be monitored and reported.

Within this methodology, carbon emission monitoring is a very central instrument.

The methodology is highly standardised throughout EU, well described in technical and methodological material such as a SEAP guidebook, guidelines on reporting and SEAP templates.

The monitoring template includes all energy consumption and CO_2 emissions on the territory in different categories:

- Buildings, facilities and industries:
  - *Municipal buildings, equipment/facilities;*
  - *tertiary (non-municipal) buildings, equipment/facilities;*
  - *residential buildings;*
  - *municipal public lighting;*
  - *industries (ETS and non ETS).*

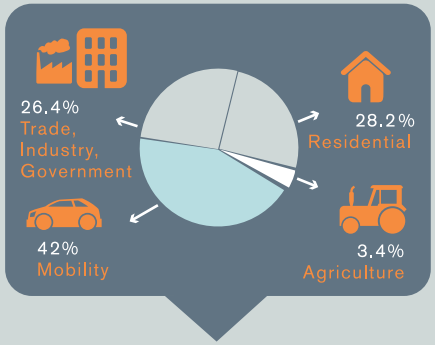
- Transport:
  - *municipal fleet;*
  - *public transport;*
  - *private and commercial transport.*

- Other: agriculture, forestry, fisheries.

- Other non-energy related:
  - *waste management;*
  - *waste water management;*
  - *other non-energy related.*

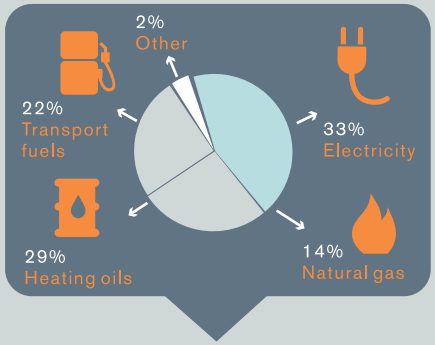
All energy consumption and CO_2-emissions from different sources in the different categories:

- electricity;
- heat/cold;
- fossil fuels (natural gas, liquid gas, heating oil…);
- renewable energies (biofuels, plant oil, solar, geothermal…).



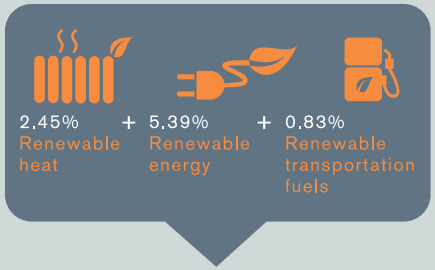
CO_2 EMISSIONS IN 2011 IN ZUID WEST VLAANDEREN

Carbon emissions per sector in the Leiedal territory (B): residential, agriculture, mobility, industries



CO_2 EMISSIONS PER ENERGY SOURCE IN 2011 IN MUNICIPALITY OF AVELGEM

Mix of renewable energies in the city of Harelbeke (B): heat, electricity and transport fuels



8,67 % OF THE TOTAL ENERGY CONSUMPTION IN 2014 IN THE CITY OF HARELBEKE IS RENEWABLE ENERGY

Mix of energy carriers in carbon emissions in the municipality of Avelgem (B): electricity, natural gas, heating oils, transport fuels and others

- Local electricity production (energy carrier input/output).
- Local heat/cold production (energy carrier input/output).
- The adopted CO_2-emission factors: the ratio between CO_2 emissions and net energy consumption, per energy carrier.

From this rich amount of data, a number of interesting indicators and info graphics can be designed, see above.

The detailed inventory of CO_2 emissions allows to link with the action plan: how much CO_2 reduction, renewable energy production and energy efficiency is targeted by each action? The obligatory SEAP template.

The NSSEP PLUS-partner Leiedal supported 13 local authorities to join the Covenant of Mayors, and facilitated the process to develop the carbon emission monitoring and setting up the SEAP. The SEAP (with report on CO_2 monitoring included) can be downloaded on the NSSEP website.

Linked outputs of NSSEP PLUS:

- SEAP Leiedal territory with included CO_2 monitoring.
- Excel-tool for CO_2-inventory according to NSSEP PLUS methodology.

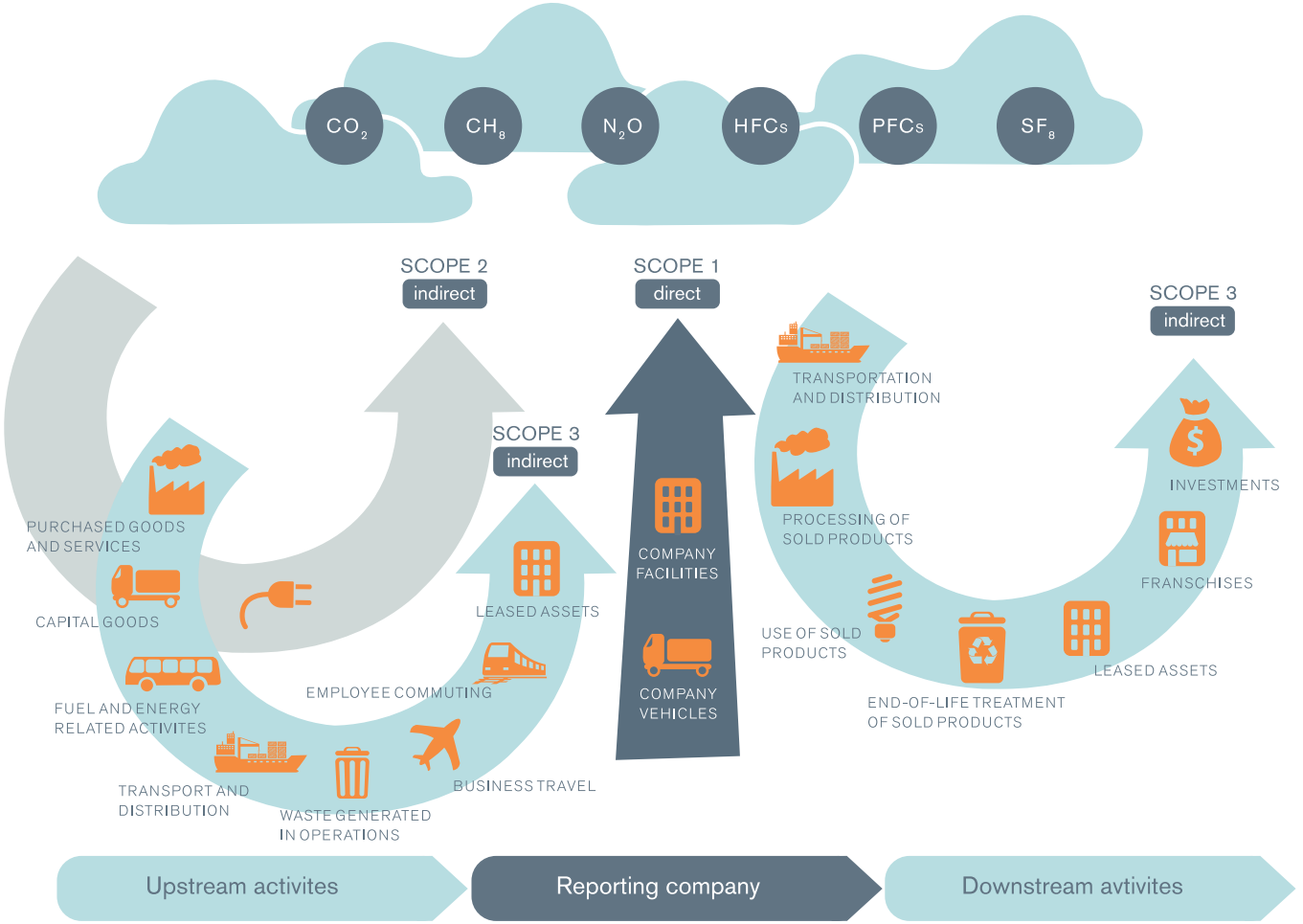
More information
www.eumayors.eu

GREEN HOUSE GAS PROTOCOL

The Greenhouse Gas Protocol (GHG protocol) is an internationally widely accepted accounting tool to calculate, quantify and manage greenhouse gas emissions in general and CO_2 emissions in particular. The GHG protocol provides hands on tools that enable companies to improve their climate perfor-mance and thereby increase their global competiveness. The tools provided by the GHG protocol are free to use and easy to use thanks to freely available step-by-step guides and workbooks.[1]

What is the GHG protocol?

The GHG protocol was initiated in the late 1990s as a partnership between the World Business Council for Sustainable Development (WBCSD) and the World Resource In-



Picture from http://www.carbontrust.com/resources/faqs/services/scope-3-indirect-carbon-emissions

stitute (WRI). The initiative was a response to alarming climate change reports and the lack of a common standard for businesses to report on CO_2- and GHG emission. In the early 2000s the GHG protocol launched the first climate accounting standard with a set of comprehensive tools for climate reporting, called Greenhouse Gas Protocol – A Corporate Accounting and Reporting Standard. This standard is constantly being revised and extended to comply with up to date expectations and regulations.

Why use the GHG protocol corporate standard?

There are numerous reasons to use this standard when reporting CO_2- and GHG-emissions in a company. First of all, and most important, the standard is available free of charge and is refined to be user-friendly with step-by-step guidance and available for electronic worksheets that help businesses calculate their emissions to a low cost. Second, the standard is systematic and structured but remains flexible and by combining various

tools of the standard it is tailored to fit every company's needs. Third, the standard is widely internationally accepted and brings a high level of recognition among investors, customers and stakeholders at a global market.

How to use the GHG protocol tools?

The use of the GHG protocol tools is based on the worksheets with associated step-by-step guides that are available at www.ghgprotcol.org. Different tools are available to a wide range of sectors. The sector specific tools are combined with activity specific tools divided into indirect- and direct emissions tools. These tools are combined and altogether make up the company's emission inventory.

In order to provide a standardised definition of how companies should categorise emissions and draw boundaries the GHG protocol is divided into three levels (scopes) of emission calculation. Scope 1 is the reporting company's direct emissions. Scope 2 is the reporting company's indirect upstream and downstream emissions. Scope 3 counts for third party emissions where the reporting company also collects data and report on emissions from the product life cycle and the corporate value chain. These three scopes are visualised in figure 1.1 in this chapter

The recommendation is always to start with scope 1 and calculate the company's direct emissions; this then serves as a good basis to enable an organisation to set up climate goals and a feasible action plan. When the company is mature, the natural next step will then be to succeed with Scope 2 and Scope 3 that requires the reporting company to examine its value chain from a wider perspective.

For companies lacking internal knowledge and staff resources to handle climate affairs it is always recommended to use external consultants. With the GHG protocol being one of the most widely internationally accepted standards for CO_2- and GHG-emission management there are multitudes of climate management consultants specialised in this method.

Communication

Whether you use internal staff resources or external consultants, a key to success for the company to benefit and profit from the climate management is the communication of efforts and results. Actions, results and policies should be visible and well known to society and all potential stakeholders. However, do not forget that there are rules and standards on how to communicate climate management. Please refer to the ISO14021 standard on Environment and Climate Communication for more information on the do's and don'ts in the company's climate and environment communication.

Recommendations

- Use existing reporting frameworks as far as possible.
- Make sure that the methodology suits the company's purposes.
- Use external expertise if needed – saves time and effort.
- Be coherent in what is measured and what is communicated.
- Start with scope 1 and the company's direct emissions.
- Expand with scope 2 and scope 3 and wider value chain when the company is mature.

Read more

- www.ghgprotocol.org
- www.wbcsd.org
- www.wri.org
- www.wri.org/our-work/top-outcome/china-moves-toward-mandatory-corporate-greenhouse-gas-reporting
- www.cdp.net
- www.carbontrust.com

Footnotes

1. http://www.ghgprotocol.org/about-ghgp

CLIMATE ALLIANCE CO_2 INVENTORY

Since the foundation of the "Climate Alliance of European Cities with Indigenous Rainforest Peoples"[1] in 1990, more than 1.700 local and regional authorities in 24 European countries have joined the association. All members commit themselves to reducing their greenhouse gas emissions continuously, aiming at a reduction of 10% every 5 years. In 2005, all municipalities commit to a CO_2 in-ventory including emissions from energy consumption and the transport sector. Furthermore, Cli-mate Alliance has developed a set of rules for monitoring local CO_2 emissions. These rules have been implemented in the software tool ECOSPEED Region which has been developed in co-operation with the Swiss company Ecospeed and the European Energy Award.[2]

What is ECOSPEED Region?

ECOSPEED Region is a web-based software tool which enables energy and greenhouse gas calculation on a local or regional level. It fulfills the specifications of the Covenant of Mayors and has references for more than 1.200 government authorities mainly in Germany and Switzerland. In 2010, the European Commission officially recognized ECOSPEED Region as an efficient tool for the development of Baseline Emission Inventories (BEI) in context of the Covenant of Mayors initiative.[3] A core output is to fill in the Sustainable Energy Action Plan template (SEAP). The software is available in three versions (Smart, Pro and Premium). The following text refers to ECOSPEED Region Pro which is also the most widespread version.

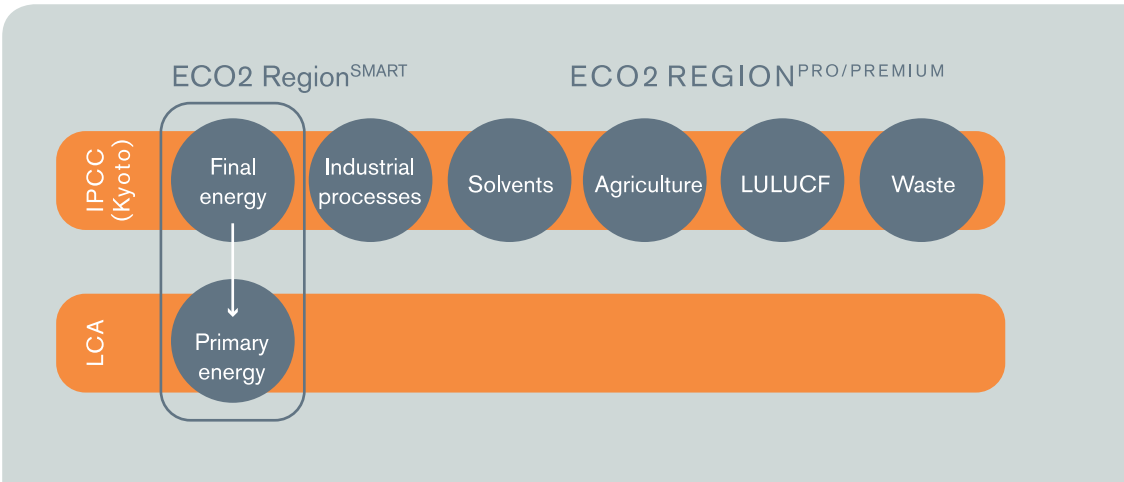
Methodology

"The aim of municipal CO_2 monitoring is to extend the survey of greenhouse gases conducted on the EU and national levels to the local level and thus create reference values on the municipal level for future CO_2 reduction programs." (CLIMATE ALLIANCE, 2011).[4] Therefore, not only the direct CO_2 emissions within the boundaries of a municipality or region are to be calculated, but also the emissions from imported electricity, particularly those from power plants located outside of a municipality whose energy is used by end consumers within the municipality. Referring to the region of inventory, CO_2 monitoring is based on two different approaches:

- *Inventory of CO_2 emissions "within the region"*

  The territorial inventory, alias source inventory, calculates the primary energy consumption of a region. Only those emissions from inside the boundaries are taken into account. Emissions from out-of-region energy production, particularly electricity and district heating, are not taken into account even if the energy is used inside the boundaries of the region. Thus, the consumption of electricity and district heating is calculated as emission-free.

  Similar to this approach, the method used by the Intergovernmental Panel on Climate Change (IPCC) calculates the total final energy consumption of a region. In addition, non-energetic emissions from industrial processes, solvents, agriculture, land use, land use change, forestry and waste are also included. The IPCC method is used by all countries who have signed the Kyoto-protocol.



- *Inventory of CO_2 emissions "caused by the region"*

  The emitter inventory involves energy loss during the generation and distribution of electricity and district heating. In the calculation, the consumption of electricity and district heating by the end consumers in that region is burdened with corresponding emissions. Thus, the out-of-region emissions in the transformation field of energy are taken into account.

  Comprehensive consideration of out-of-region CO_2 emissions is only possible when emis-sions from the complete upstream chain are taken into account. Hence, the Life Cycle Ap-proach (LCA) considers the entire energy input and all CO_2 emissions associated with the total final energy consumption, e.g. energy for the construction of power plants, for mining of coal, exploitation of oil and gas, production of fuel, energetic use of biomass and waste.

In ECOSPEED Region, the final calculation of CO_2 emissions is done according to the Life Cycle Approach. The sectors covered are: households, services, industry, agriculture, transport, municipal buildings and public lighting. The energy demand is calculated according to the formula:

*Energy demand LCA = Energy demand IPCC * LCA-factor*

Crucial to the calculation is the choice of the LCA-factor. ECOSPEED Region refers to the ecoinvent database[5] because it provides LCA-factors for all over Europe. This means a good comparability on a national or international level.

Footnotes

1. http://www.klimabuendnis.org/our_profile0.0.html?&L=0
2. http://www.european-energy-award.de/european-energy-award/
3. https://www.ecospeed.ch/documents/flyer/region/ECORegion_Recognition_letter_en.pdf
4. CLIMATE ALLIANCE (2011): CO2 monitoring within Climate Alliance. Frankfurt/Main. http://www.klimabuendnis.org/fileadmin/inhalte/dokumente/2012/co2-monitoring-methogology_en.pdf)
5. http://www.ecoinvent.org/database/

KLIMAATMONITOR

The Dutch government has formulated climate objectives for the near future:

- a 30% decrease in the emission of greenhouse gasses by 2020 compared to 1990,
- 2% annual energy savings,
- an increase in the share of renewable energy sources to 20% by 2020.

These objectives can only be accomplished by collaboration with business organizations, civilians and local and regional authorities. Local and regional governments are encouraged to contribute to the national objectives. Municipalities, for example, have agreed that 75% of their purchasing will be sustainable. In future, this amount will increase to 100%. Another example is that the national government and municipalities want new housing developments to be climate neutral by 2020. The energy use in residences and buildings must by then have decreased by 50%. The Dutch government has also concluded agreements with other (market) parties, such as housing corporations, power companies, the building industry and provincial authorities.

Municipalities in The Netherlands are very diverse; they vary in size and nature; the country has urban regions as well as rural areas. Business activities are different

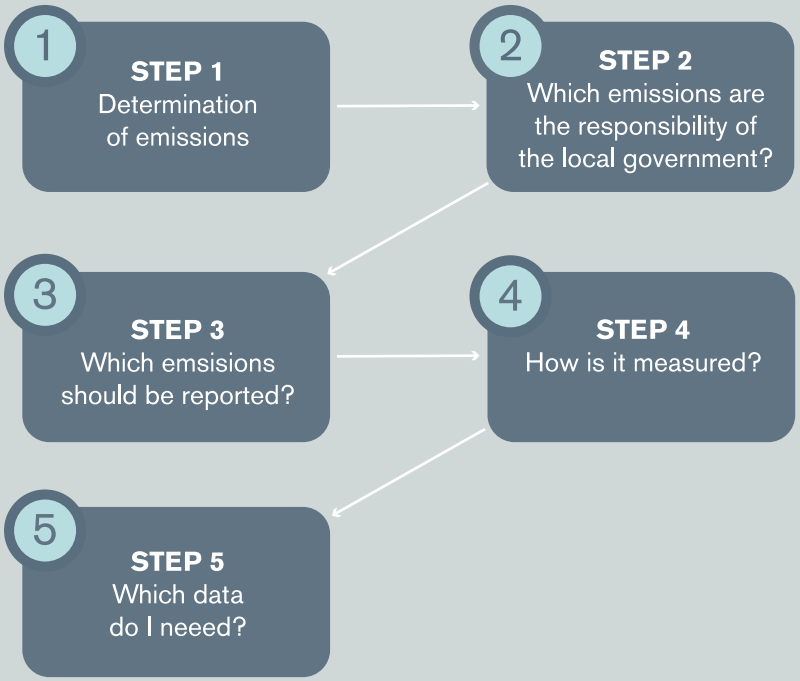
everywhere (agricultural, industrial or commercial services). Considering this diversity, it is very difficult to have one approach on accomplishing the climate objectives. Therefore, municipalities have the freedom and responsibility to develop custom-made solutions for their own local climate policy.

Monitoring

In order to measure and manage local climate policy, it is important to know where all the municipalities stand. Lots of municipalities want to know what their carbon footprint is. Another important issue is to know your responsibility: what are the emissions and savings which municipalities are re-sponsible for? Municipalities or local governments cannot be responsible for everything. To make clear which responsibilities (and possibilities to decrease emission) municipalities have, the Dutch government developed a monitoring system for sustainable energy and emission of greenhouse gasses. The Klimaatmonitor (Climate Monitor) shows a toolbox for local governments to decide which are the best solutions for their particular area of responsibility to accomplish the Dutch objectives.

Using the Climate Monitor

To use the Climate Monitor, the schedule on next page has been used to get a clear view of the carbon footprint for municipalities. Monitoring emissions is done in terms of CO_2 and, for other greenhouse gases, in CO_2 equivalents.

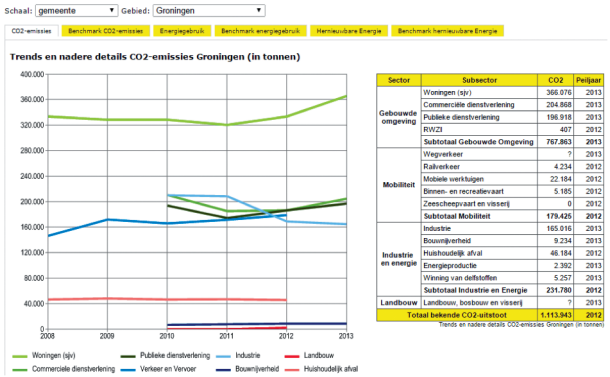


The CO_2 and CO_2 equivalents are measured in five different categories: buildings, industry and energy, agriculture and transport. Each of these categories has levels of sub-categories to narrow the measurements on specific levels. For example, Industry is divided in sectors as chemistry, waste industry, energy sector, and construction industry. Each of these sectors has its own type of emission which should be measured or monitored.

The big question of course is how to measure the emission. You cannot measure in an area and know where the CO_2 exactly comes from. In order to have insight on the emission, most of the elements are calculated, instead of actually measured in the field. To make a proper calculation, the Climate Monitor offers a set of standardized parameters for each type of building, industry or sector. Other data, like the energy use for a city, borough or street, comes from other organizations which already have this kind of information.

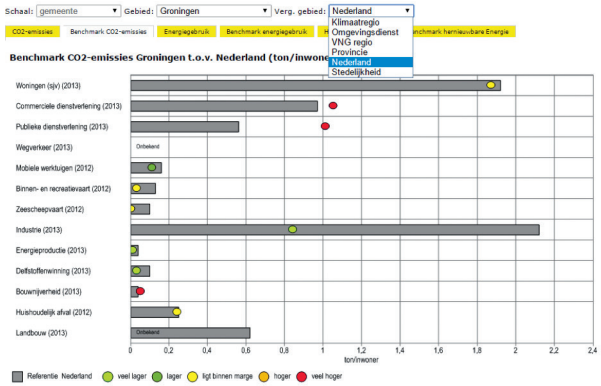
What do you do with the data?

Using the Climate Monitor is a first step. It gives a total amount of used energy and CO_2 emission for each category. It is possible to have an in-depth look at each category.



Sector	Subsector	CO2	Peiljaar
Gebouwde omgeving	Woningen (sjv)	366.076	2013
	Commerciële dienstverlening	204.868	2013
	Publieke dienstverlening	196.918	2013
	RWZI	407	2012
	Subtotaal Gebouwde Omgeving	**767.863**	**2013**
Mobiliteit	Wegverkeer	?	2013
	Railverkeer	4.234	2012
	Mobiele werktuigen	22.184	2012
	Binnen- en recreatievaart	5.185	2012
	Zeescheepvaart en visserij	0	2012
	Subtotaal Mobiliteit	**179.425**	**2012**
Industrie en energie	Industrie	165.016	2013
	Bouwnijverheid	9.234	2013
	Huishoudelijk afval	46.184	2012
	Energieproductie	2.392	2013
	Winning van delfstoffen	5.257	2013
	Subtotaal Industrie en Energie	**231.780**	**2012**
Landbouw	Landbouw, bosbouw en visserij	?	2013
Totaal bekende CO2-uitstoot		**1.113.943**	**2012**

Trends en nadere details CO2-emissies Groningen (in tonnen)



The next step is to know what your position is compared to other municipalities. Therefore, the Climate Monitor offers a benchmark with the region, municipalities of the same size and even on a national level. As is shown in the table below, the benchmark provides an overview of the results of an individual municipality. The colors indicate if the results are better than the average (green) up to a higher amount of emission, which is colored red. In the example below, you can see that the city of Groningen has good results on industry as whole (Industrie (2013)), while there is still much to improve on commercial and public services (Commerciele Dienstverlening and Publieke Dienstver-lening.

What does it say?

The Climate Monitor gives an overview and benchmark for each municipality. However, it is not always easy to see everything in perspective. For example, it looks like Groningen has very green industry, while the public services provide a lot of emission. Another explanation is that there is not much industry in Groningen, while public and commercial services are very common in the city. Even though the Climate Monitor gives a clear view, to define what really makes a city greener with a lighter carbon footprint, policy makers still need to take a very close look at the actual situation in the field.

VEJLE CO_2 BEREGNER

The Local Government Denmark, an association of all the Danish municipalities, and the Danish ministry for Climate and Energy, decided to develop and deliver a standardized model for making baseline emission inventories for each municipality as a geographical unit rather than a business unit. The model or tool was ready in 2008. The model is based upon the international methods of EU and UN for CO_2 baseline emission inventories (BEI). It thereby set a standardized basis for the order of magnitude of the different contributions to the CO_2 emissions within the different municipalities. Hence the municipal CO_2 emission can be compared to other municipalities, as a benchmarking or even with the National CO_2 emission. There is a risk by doing CO_2 calculations that some emissions are counted for twice or some storage of CO_2 may be overseen. But using the same model or tool widely among the municipalities diminishes this risk, and ensures that the National CO_2 outlet is shared the best and most precise way between the municipalities.

The purpose of developing a single model or tool for BEI, was apart from the above mentioned, to be able to prioritize the means that the municipality can use in the effort for lowering the emissions.

Using the tool in the municipalities the local politicians have realized the possibility of defining goals for the wanted reduction of the local CO_2 emissions, other politicians

have asked what can be achieved by using realistic means, and thereafter setting goals for the CO_2 reduction. And some have decided that the achieved reductions has to be measured by doing a new calculation using the mod-el, and comparing it to the original BEI. But the model was not developed for this purpose, and the question remains if the tool is suitable for this purpose.

Another topic to be considered is how to transfer the knowledge gained for the BEI to real actions in for example the many households using a fair amount of the total energy consumption within the municipal boundary.

As touched above there are many challenges to be considered, but here is a short description of the actual tool given for CO_2 calculations by the Local Government Denmark.

CO_2 calculations by the Local Government Denmark

The below is taken from the summary in the report FR 700 from the national environmental research institute, DMU.

This report includes a description of methodologies, data and algorithms behind the inventories of greenhouse gases at the municipality level divided into sectors. The starting point for the sectors in this report is the sectors used for the official Danish emission inventories. A simplified generalization of the equations used in emission calculations is based on the assumption that emissions of a given activity is estimated using data descriptive for the size of the activity multiplied by an emission factor pr unit of activity. Emissions of CH4 and N_2O are converted to CO_2 equivalents. In this project this generalization and these conversions are also the basis for all methodologies. The sectors included in this report are: the collective power and heating, individual heating, mobile sources, transportation and machinery, industrial processes, solvents, agriculture, land use and waste depositing and wastewater. The methods include calculations of the greenhouse gases that are most important for the sectors. The importance is estimated from the national emission inventory. This report covers methodologies for the greenhouse gases CO_2, CH4 and N_2O. Due to the mentioned importance criteria for some sectors not all greenhouse gases are included. As for the national inventories the calculation is built into several levels (Tiers) with increased requirements for municipalities regarding data. Tier 1 is mainly based on the Danish national greenhouse gas inventory data using appropriate distribution keys for a given activity into municipality level. Tier 2 is more detailed and includes emission factors used in the Danish national greenhouse gas inventories, for some sectors the emission factors are aggregated, while municipalities can enter their own activity data. At Tier 3, which is the most detailed level, there is – for some sectors – the opportunity to enter municipality specific emission factors and activity data. For other sectors Tier 3 is a further disaggregation of emission factors compared to Tier 2. Each municipality may use different tiers for different sectors depending on the data availability. The methodological descriptions in this report explain the data and algorithms behind the CO_2 calculator, while the IT program software user face is described in a separate project report. Eventually, the report outlines potentials for improvements and further develop-ment of the CO_2 calculator.

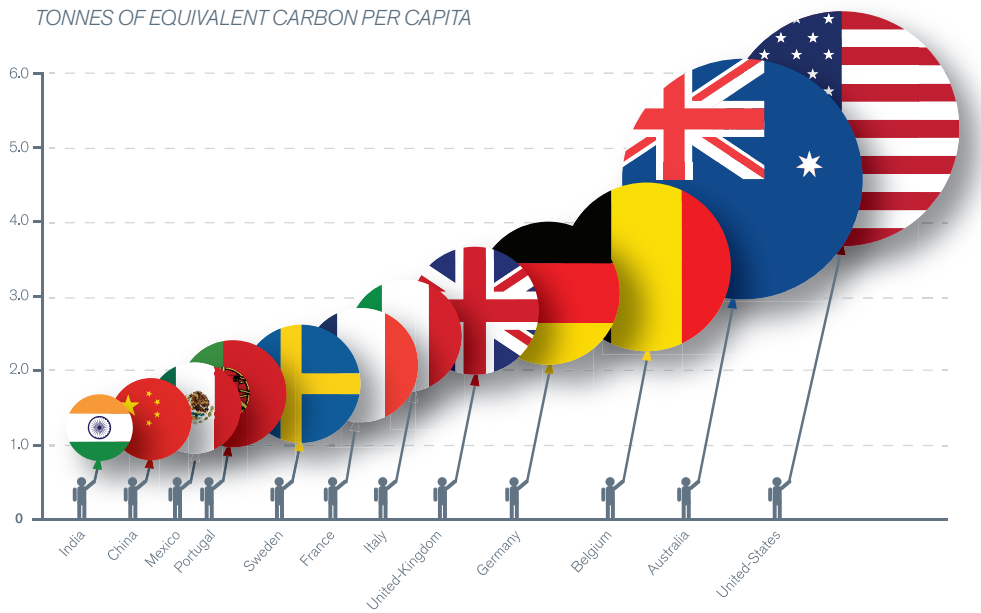
Read more

- www.miljoeportal.dk/CO2-beregner/
- www.northseasep.eu/fileadmin/user_upload/publications/Denmark_CO2_calculator_EXTENDED_VERSION__2_.pdf

DATA COLLECTION

The carbon emission of a house, a neighbourhood, a person, a city, a region or a country is summarized in one single number. E.g. the carbon emission per capita is a very popular indicator. Another common indicator is the total annual emissions of a territory in comparison with the 1990 emissions.

This simple, single number is built on a rich set of data, calculations, sources and assumptions. Off course it is not possible to "capture" and weight all carbon one person or territory emits in one day or one year. Thus, other methods have been developed to estimate the emissions of carbon in an accurate way. Smart factors convert a certain number into corresponding carbon emissions: "emis-



sion factors". E.g. 1 MWh of electricity corresponds with 0,460 tons of CO_2 emissions. Electricity consumption is easy to measure.

In this factsheet, we give a short overview on the major options in the CO_2 monitoring methodologies and data collection.

Scope 1, 2 and 3

What is the scope of emissions to quantify? As most of the carbon emissions derive from burning (fossil) fuels and waste (e.g. heating buildings, electricity production, mobility…) within the territory these emissions are essential. They are called scope 1, the direct emissions. Scope 2 are the indirect emissions related to production of electricity, heat, or cold that are consumed in the territory, but produced outside the territory. E.g. if a city imports electricity, the corresponding emissions are emitted outside the territory but taken into account. Scope 3 are the other indirect emissions, such as the extraction and production of purchased materials and fuels.

Choice of emission factors: IPCC/Kyoto or LCA.

The choice of emission factors will have a major impact on the final carbon emissions. 2 major approaches are dominant when selecting emission factors.

- According to the IPCC-principles, used in the context of the UNFCCC and the Kyoto protocol, the emission factors are based on the carbon content of each fuel. In this approach, CO_2 is the most important greenhouse gas, and other greenhouse gasses not need to be calculated. Consequently the CO_2 emissions from biomass/biofuels and certified green electricity are considered to be zero.

- Life Cycle Analysis (LCA) emission factors. This approach includes the emissions of the final combustion, plus all emissions of the supply chain from exploitation, transport and processing (e.g. refinery).

CO_2 and CO_2 equivalent emissions

CO_2 is the main cause of the greenhouse effect. But other gasses also contribute, but in minor pro-portion, such as CH_4 (methane) and N_2O, originating in e.g. agriculture, landfills and wastewater treatment. Sometimes, these gasses are also taken into account into the carbon monitor. This is done by the introduction of the factor "CO_2-equivalent emissions", a conversion factor using the Global Warming Potential values. For example, one kg of CH_4 has a similar impact on global warming than 21 kg of CO_2.

Buildings

Usually the energy consumption of a building or a building patrimony of an organisation is monitored. Data of gas, electricity and district heating is collected real time (smart metering), sometimes with a longer frequency e.g. one year. Consumption data from surveys or"average national house consumption"-number can be necessary to complete the

picture for energy that do not pas a centralized grid (e.g. fuel oil, wood, natural gas tank…). With national or regional energy balances, evolutions of the numbers of energy consumed can be approximated. The share of energy sources the building stock makes use of is essential information.

Sometimes a temperature correction is made for the energy consumption of heating, e.g. by the heating days degrees (HDD)-technique. This is done to neutralise the effect of a severe or a mild winter on the carbon emission from heating.

TYPE	STANDARD EMISSION FACTOR ($t CO_2$/MWh)	LCA EMISSION FACTOR ($t CO_2$-eq/MWh)
Motor Gasoline	0.249	0.299
Gas oil, diesel	0.267	0.305
Residual Fuel Oil	0.279	0.310
Anthracite	0.354	0.393
Other Bituminous Coal	0.341	0.380
Sub-Bituminous Coal	0.346	0.385
Lignite	0.364	0.375
Natural Gas	0.202	0.237
Municipal Wastes (non-biomass fraction)	0.330	0.330

Emission factors, guidebook Covenant of Mayors

Mobility

If you monitor the carbon emissions of one car or a fleet of an organisation, then the data collection can be done through fuel sales. This method can be used for a territory, but is not preferential. The estimate of the fuel used has to be based on estimates of: (1) mileage driven in the territory of the local authority; (2) vehicle fleet in the territory (cars, buses, two-wheelers, heavy and light-duty vehicles); (3) average fuel consumption of each vehicle type. These figures are based on models on traffic flow, surveys and statistics, often at a national level.

Local energy production

Local electricity production generally is very well monitored and documented. Local heat/cold production usually is well documented in the case of district heating or macro-systems, but not in the case of micro-production e.g. heat pumps and solar thermal. Then, statistics on the number of installations and surveys on the annual average production are essential.

Recommendations

- Align as much as possible with major standards, e.g. Covenant of Mayors guidelines.
- If you compare, be aware. For benchmarking (e.g. comparing emissions of 2 cities), the values should derive from an identical methodology. If not, it's hard to compare.
- Stick to your methodology; be consistent in your data collection if you want to monitor an evolution. If the methodology changes, this may cause changes in the inventory which are not due to any action to reduce its CO_2 emissions.
- The sources of data should be available in future; the collection process and data sources should be well documented and transparent for all stakeholders.

References:

- International Local Government Greenhouse Gas Emissions Analysis Protocol (IEAP), ICLEI, 2009
- The Greenhouse Gas Protocol, http://www.ghgprotocol.org/
- IPCC
- www.eumayors.eu

IMPROVING FOR CO_2 MONITORING

Improving for CO_2 monitoring has to consider two different ways of improvement to meet the tar-gets listed in Chapter 2. These are:

- regional/spatial planning,
- CO_2 Monitoring Systems.

Regional/spatial planning

Regional/spatial planning is described in literature as process to align or to make use of a geographical area or an administrative region.

Areas of interest for regional/spatial planning are:

- continents,
- countries,
- regions/districts,
- cities/municipalities,
- urban districts.

In these areas of interest different aspects like:

- traffic,
- environment,
- population,
- economy.

and their impacts on the areas of interest have to be coordinated. The coordination focusses very much on a sustainable development in the areas of interest with respect to social, economical, legal and ecological demands in the area.

Due to the recent climate change discussion the resilience against impacts resulting from the climate change are moving more and more into the focus of future orientated planning organizations. Parliaments, district and city councils are proclaiming targets to be reached – but there is currently no obligatory reflection on CO_2 Monitoring anchored in regional/spatial planning legislation.

The implementation of CO_2 Monitoring in regional/spatial planning legislation can be one effective strategy to meet the targets for CO_2 reduction, which have been set top-down (first EU targets which have been followed by Country targets). But as cities and districts are identified as outstanding players in the EU in the field of CO_2 reduction it would be most productive to establish bottom-up ap-proaches in regional/spatial planning legislation of the EU member states to meet these targets.

CO_2 Monitoring Systems

In chapter 2 a selection of different monitoring systems is described, which all have in common, that they are operating with background values and emission factors which are generally based on national or international average values. The algorithms behind the systems are not transparent, so that the user is not in the position to understand, how the system is calculating CO_2 values. Users are just receiving results.

The systems should be more flexible, so that local and regional characteristics can be taken into account. Furthermore the systems should open the possibility to adapt the calculations when new data are available or emission factors have changed. Services under the lead of public administration according to the national cadaster systems shall be established for requesting information on CO_2 and other climate relevant parameters to use these data for local/regional CO_2 calculations. Standards for calculating CO_2 at least on national level shall be established, so that it is assured, that results are comparable.

BE STRATEGIC

EXPLOITING THE FULL POTENTIAL

AUTHORS: NICK LYTH, DOMINIEK VANDEWIELE, TONY CHRISTENSEN & MANFRED WEISENSEE

This is the part of the toolkit that deals with the reality of what you do with a carbon calculator tool. We have learned in previous sections about the capability of such tools, their variety and range; and we have discussed who might benefit most from the operation of such tools. Now we will talk about how to exploit them, in other words, what to do with them in order to derive the benefits we need to gain in our communities in the North Sea Region.

Let us remember what these tools will tell us, what information they will provide. All the carbon calculators discussed in the previous section will tell us what carbon emissions are generated as a consequence of our working operations and our behavioural habits in the workplace, and from our domicile. They will be both organisational based, and also personally structured from within the organisation – in other words, collective and individual.

So the data generated from such tools will provide a detailed break-down of the damage generated in carbon emissions by the working processes of organisations within your communities. This section will deal with the issue, how should this be exploited to gain maximum benefit from the information and knowledge?

The first and most obvious point to make is that the information should help the organisations define the harmful activities, and develop tactics to restrict or eliminate them from their working practice. This must be the priority for all concerned. And so let us make this the first statement for this section:

Carbon calculators are tools to be used in order to improve the working habits and practices of our communities in the North Sea Region to help minimise the harmful effects of carbon emissions.

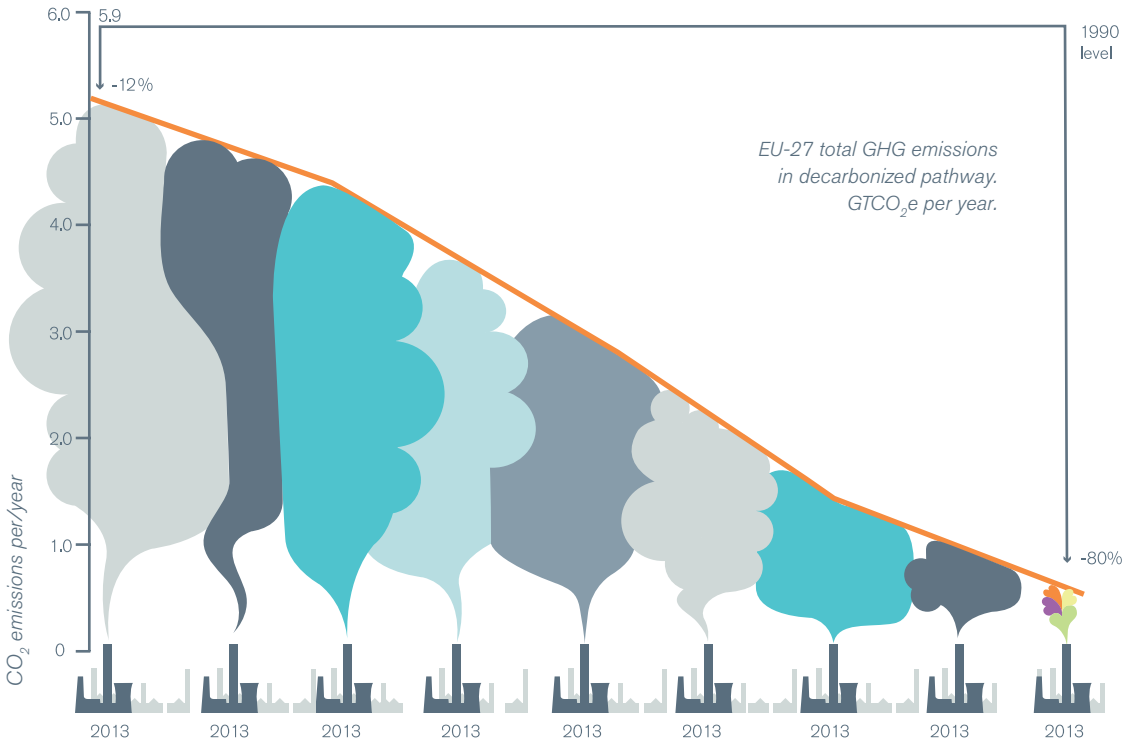
In practice, what does this mean? This section will answer the question in three ways.

1. Behaviours and working practices are regulated by public policies and laws governing the codes of practice required of all organisations in the region. The first requirement of any intervention concerning carbon emissions, using the sort of information generated by a carbon calculator, is that it should be discussed with the policy-makers in the region, shared in detail, and then integrated into the developing policy initiatives relating to these activities. All regions are facing stringent requirements to reduce carbon emissions. The information from a carbon calculator can provide material help in guiding the detail of the policy interventions needed to put these requirements into effect. So the first part of this section will concern itself with policy interventions, and how to integrate the results generated from a carbon calculator into the planning of public policy and strategy.

2. However, policy is meaningless without a practical and achievable context that can allow a realistic application of the objectives of that policy. In reality, the practical context of different organisations and

businesses is the overriding determinant of their working practices. Difficulties are encountered when external regulations create inefficiencies and wasteful rules, which will only cause resentment and hostility. Hence it is essential for the development of effective tactics to deal with carbon emissions that these tactics are compatible with the strategies of the organisations and businesses to which they are addressed. The second part of this section will therefore deal with the issues of integration with business strategy.

3. Operationally, there is a requirement for the carbon calculators to build up a self-sustaining role within the North Sea Region and its communities. It is necessary that they have a function which is valued. Characteristically, free services and products are never treated with the respect they might deserve, precisely because nobody has paid for them. They are more likely to be ignored and eventually forgotten. It is therefore necessary to develop the actual business of carbon monitoring within the North Sea Region in order to maximise the benefit of the activity to the region. This part of the section will therefore deal with the challenge of turning carbon monitoring into a business activity, which is commercially sustainable in the long-term. This might be an activity within a business or organisation, but will also focus on the task of creating new enterprise in the North Sea Region from the products and services of providing carbon calculator tools.

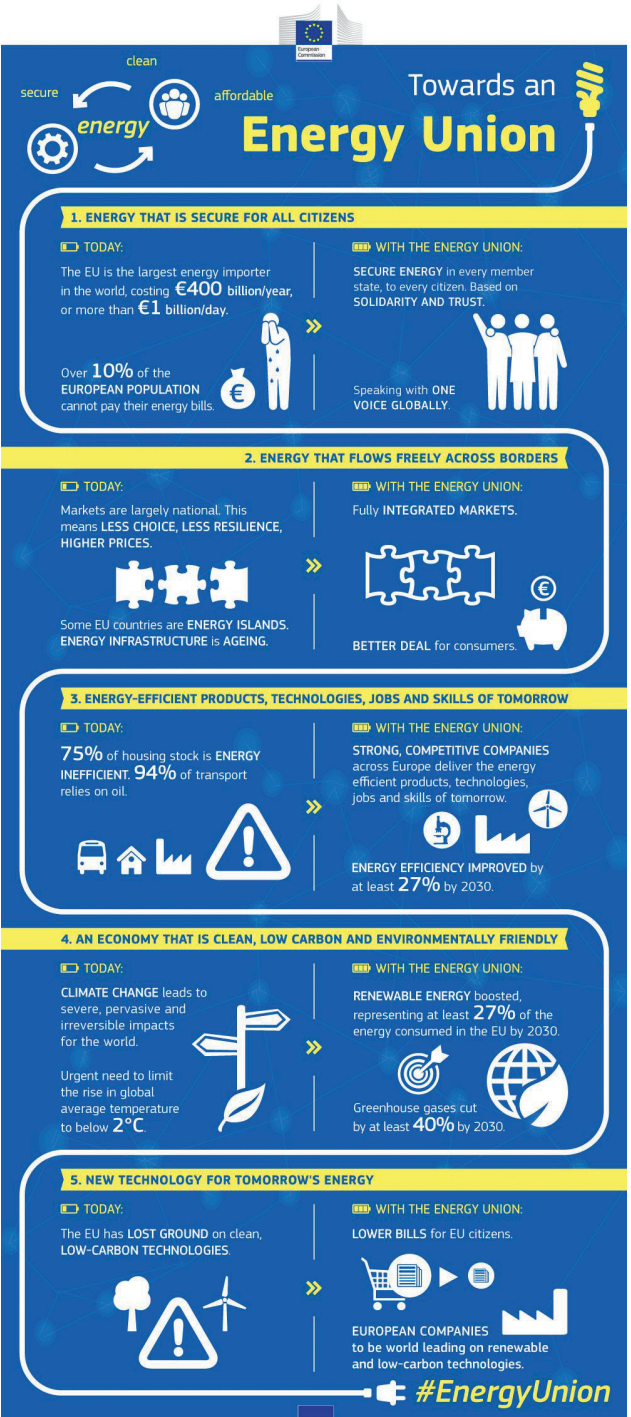


So this section of the Toolkit will give the reader a practical series of considerations for acting and implementing the need for carbon monitoring within his or her region, and possible routes for development of the process.

INTEGRATE IN PUBLIC STRATEGIES AND POLICIES

CO_2 emission reduction is the key indicator in climate mitigation policies last decades. From a global, generic reduction target since the Kyoto protocol, the indicator gets more and more integrated in global to local policies and beyond. As a consequence, methodologies for CO_2 monitoring get more diverse to suit the application.

The Kyoto protocol is an international treaty, adopted in 1997, and initiated by the United Nations. The goal of the treaty was to stop



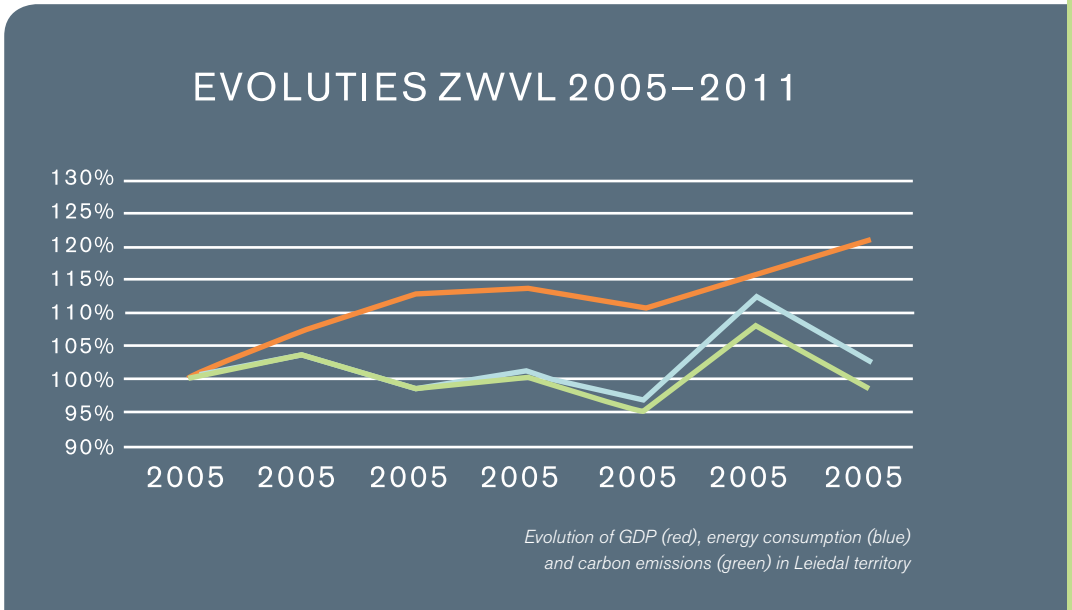
global warming, proved to be caused by the rise of concentration of CO_2 and other greenhouse gasses in the atmosphere and causing a greenhouse effect. As a consequence, all EU-countries adopted binding targets to reduce CO_2-emissions by 2012. Updated global agreements with major CO_2-emitting countries have proved to be very difficult.

The European Union adopted CO_2 as main benchmark for both its ambitious climate policy and energy policy. Whereas the EU 20/20/20 targets by 2020, as part of the EU 2020 strategy, contains three targets (CO_2-reduction, renewable energy and energy efficiency), for 2030 the main focus will be on carbon reduction (-40%). And in a long term, a reduction of 80% of CO_2 by 2050 is envisaged.

The EU initiates a transition to a competitive, secure and sustainable energy system. CO_2 reduction indicates if the EU is on track. As the EU has limited fossil energy resources, high CO_2 emissions indi-cate a high import of fossils thus a higher energy dependency and less secure system. To remain competitive, the EU energy intensity needs to be reduced: economic growth with reduction of energy use and carbon reduction, thus reduction of CO_2. More renewables and energy efficiency are the techniques to achieve these goals. Both will reduce CO_2.

From a global to a local perspective, carbon reduction is highly relevant for policies. An adequate CO_2 baseline and monitoring is adapted to the use and the mission of the policy level.

E.g. for territories a CO_2 monitor need to generate understanding in the sectors that emit CO_2 (typically residential, industries (small vs. large), mobility and agriculture) and



Evolution of GDP (red), energy consumption (blue) and carbon emissions (green) in Leiedal territory

the sources (fuels, electricity, gas…). A yearly inventory is sufficient. Tendencies must show the focus areas to tackle. Key actions, target groups and target sectors and expected impact of policies need to be defined.

E.g. when a household wants to reduce its carbon footprint from 6 tonnes to 1 tonne per year, a different type of CO_2 monitoring is needed, with permanent smart metering of an energy-smart housing, electric cars and clean energy. So people learn what it really take for a family to live carbon neutral.

Recommendations

- Carbon monitoring instruments are not generic, and need to suit the use. Carbon reduction started from a very global perspective, but now is applied on all different scales: from individuals to households, businesses, business parks, neighbourhoods, municipalities, cities, regions, provinces, countries, continents and worldwide. Carbon emission monitoring can serve very different objectives, e.g. international protocols, monitor geopolitical strategies, regional development, awareness rising and interactive learning.

- For different types of applications, standards in Carbon emission monitoring are recommended. E.g. the Covenant of Mayors initiative standardises the CO_2 baseline inventories and monitoring of 6200 EU local authorities.

Nevertheless, CO_2 may not be the sole policy indicator to rely on. Issues like energy cost and energy poverty also need to be envisaged and monitored.

Examples

- Leiedal applied CO_2-monitoring in the regional sustainable energy action plan of 13 local authorities to set up actions and a policy framework for local sustainable energy and climate policies. A set of actions to reduce CO_2, and a set of indicators has been defined. www.leiedal.be

- The "one tonne life"-project, www.onetonnelife.com, creates a climate-smart household. A selected couple with young children will try to meet the low carbon dioxide target yet at the same time live a normal life. They will be helped in a variety of ways, not least with a climate-smart house featuring solar cells on the roof and an electric car.

Source: onetonnelife.se

INTEGRATE IN BUSINESS STRATEGIES

The use of a CO_2 calculator and the monitoring of CO_2 emissions in the company is a useful first step towards more sustainable businesses. However it is only when the company integrates the CO_2 calculator and a climate management system in the ordinary business strategy that the tool becomes truly valuable to the organisation. To move from calculation to strategy and from strategy to action requires determination; in return it is likely to bring a significant competitive advantage to the company.

From calculation to strategy?

The use of a CO_2 calculator in the company is a first tentative step towards a more climate friendly and cost-efficient company. To fully capitalise and profit from the use of a CO_2 calculator, it should be an integral part of the company and a part of a wider climate management system that is integrated in the company's business strategy. To move from CO_2 calculation to climate strategy is also to move from ad hoc initiatives to embedded climate management processes.

Climate management means that climate issues in general and CO_2 issues in particular have become a permanent part of the company's management policy and corporate governance[1]. Climate issues should, when treated seriously, be integrated into everything from business strategy and investment strategy to travel policy and efficiency plans.

Strategic departure and planning

The point of departure for a wider climate strategy is the CO_2 calculator, the monitoring points out the main areas where actions to reduce are needed and as such provides a useful basis. Against this background the company has to define goals and set up a strategy. These goals and strategies can have very different focus depending on type of company, type of emissions identified and the country and context the company is operating in.

Strategies can focus on for example compliance and risk management; cost-efficiency and increased profit; CSR and green profiling; or simply to strive towards the sustainable company. Incentives are multifaceted and to achieve desired and expected results it is vital that every company knows why it is doing it, for whom it is doing it, when it is doing it and certainly what generated values it expects as an outcome from the engagement with CO_2 calculation and climate management.

International standards and management systems

To maximise the advantage of the company's CO_2 calculation and the climate management system it should comply with international standards and reporting guidelines. Such compliance makes the company strategy coherent, reliable and useful in global marketing and communication campaigns. In Box 1.1 some of the most common standards and management systems are listed. Those who are familiar with these listings are likely to improve and simplify the company's climate management system as well as the general business strategy. Furthermore it offers green and profitable synergies that can further profile and position the company.

BOX 1.1 International standards, certifications and management systems.

ISO 14064/ ISO 14065 – Standards for reporting GHG emissions
ISO 14001 – Environment management standard
ISO 14021 – Environment/Climate communication
ISO 50001 – Energy management system
EMAS – Eco management audit system
Carbon disclosure project (CDP)
Greenhouse gas protocol (GHG)
Global Reporting Initiative (GRI)

Communication

Communication is a corner stone in the strategic work of integrating the CO_2 calculator and climate management into business strategies. A successful integration of CO_2 monitoring into the business strategy includes a proactive communication strategy. Actions, results and policies should be visible and known to all possible stakeholders. In the end, how the climate management and improvement efforts are communicated is the bottom line that determines how well the company benefits and profits from the integration of climate management into the business strategy.

Recommendations

- Identify key factors; Why? When? For Whom? Expected values?
- Find a strategy that suits the company.
- Find synergies between different climate and environment management systems and standards.
- Communicate. CO_2 calculation and climate management brings societal values. Stakeholders, partners and customers should know about the engagement and efforts taken by the company.

Read more

- www.ghgprotocol.org
- www.cdp.net
- www.iso.org/iso/ghg_climate-change.pdf
- www.iso.org/iso/home/standards/management-standards/iso14000.htm
- www.iso.org/iso/home/standards/management-standards/iso50001.htm
- www.globalreporting.org
- www.iso.org/iso/climatechange_2008.pdf
- ec.europa.eu/environment/emas/index_en.htm
- www.cdp.net/cdpresults/cdp-global-500-climate-change-report-2013.pdf

Footnotes

1. Tveitdal, Svein (2014) *Green Shift – A handbook for environmentally friendly regions in Europe*. Gothenburg. The Alexanderson Institute. pp. 88.

BUSINESS IN CO_2 MONITORING

Carbon monitoring represents a business opportunity. The degree of interest in carbon emissions, the recognition that they are harmful, the political targets set for carbon reduction, and the regulations developed to help enforce this, have all created a level of interest in carbon emissions that offers potential commercial opportunity. Carbon monitoring is at the heart of this opportunity, as the first requirement of carbon reduction is measurement. This section discusses how the opportunity might be best exploited, how to create a business from the process and practice of carbon monitoring.

Background

It is important to note first that there are a number of businesses already exploiting the opportunity to make money from carbon emissions. These are principally consultancies offering a service, mainly to other businesses. They are generally quite small organisations, small SME's. They offer a range of services

which include training, strategies for carbon emission performance improvement, technologies and courses. In Edinburgh, for example, a private consultancy called Carbon Masters is operating successfully, serving the business community in Scotland. It advertises its service as follows: "Carbon Masters helps organisations to measure, manage, reduce and report their carbon emissions." Measurement comes first, but is only part of a much wider package of activities. The actual process of carbon calculation is taken for granted as a start point to allow Carbon Masters to deliver its service.

Alongside these consultancies, the educational opportunities to make commercial gain from carbon emissions are also important. Many Universities and Colleges now offer carbon management courses. This is creating a supply flow of trained, qualified professional experts in carbon management, which again will start with the process of measurement. This will be taken for granted as part of the skill set.

Carbon monitoring is therefore an activity which has a place and a role in commercial activities which have already started to become embedded in our wider economy, and recognised as providing a service. But it should also be noted that, alongside this opportunity, there are a number of carbon calculator tools available on the internet which are free to use. These are generally restricted to monitoring, or carbon measurement, and often are for the private citizen, not business.

Business Criteria

There are basic criteria which apply to any process of developing and launching a successful business. These could be described as the rules of business creation. They are as follows:

2. Is there a market for the product or service you wish to sell, or will you have to create it?

3. Are other people already offering a product or service comparable to the one you wish to sell?

4. Can you do it in a way that is both different, more efficient, and of greater benefit to the customers compared to others who are already doing it?

5. Is your means of improving the service or product available to your potential customers something that your competitors can copy, or will it be unique to you? (Do you own intellectual property in your product or service?)

6. Will there be a chance to grow and build profitable business by serving your potential customers?

7. Do you have a relevant, qualified and experienced team to build the business?

How these Business Criteria apply to Carbon Monitoring

Testing these criteria against what we know and have found out about carbon monitoring, the results tend to discourage the idea that there is a strong business opportunity.

1. Is there a market? There is no apparent market for carbon monitoring. At present, there seems to be almost no commercial activity exclusive to carbon measurement. No-one is paying for carbon calculators, they are mostly offered free on the internet. This means that any new business offering a carbon calculator product would have to undertake a very difficult task – market creation. There is no apparent demand for such a product, the demand would have to be stimulated. But this is very difficult to do. The sense of need does not really exist. There is a market for carbon management, but it is very small. Consultancies in this sector are also forced to stimulate demand where none before existed, but they have the advantage of offering concrete benefits beyond carbon calculation. Carbon measurement is simply a tool.

2. Are other people already offering a comparable product or service? Carbon management is a sector that includes the means of carbon calculation. These means are absorbed into commercial services by the consultancies, and into edu-

cational courses by the Universities and Colleges. There is nothing new in carbon monitoring and carbon calculation, but it is still not standardised. Hence there are many different ways of doing it.

3. Can you do it in a way that is both different, more efficient, and of greater benefit? In the project work thus far, it is difficult to say whether any of the partners can offer a better means of carbon monitoring, or a better carbon calculator. None of the partners is setting out to be an expert in the field, or to become the manager of a business selling a carbon calculator product. So the question of a robust competitive edge has never been asked of the carbon calculators the partners have dealt with.

4. Can your competitors copy what you do? It is unlikely that there is an unique selling point in any of the carbon calculators seen in this project, and there is unlikely to be any protectable Intellectual Property. Any product of this project is likely to be easy to copy – especially as the outputs of the project itself have to be open source.

Conclusion

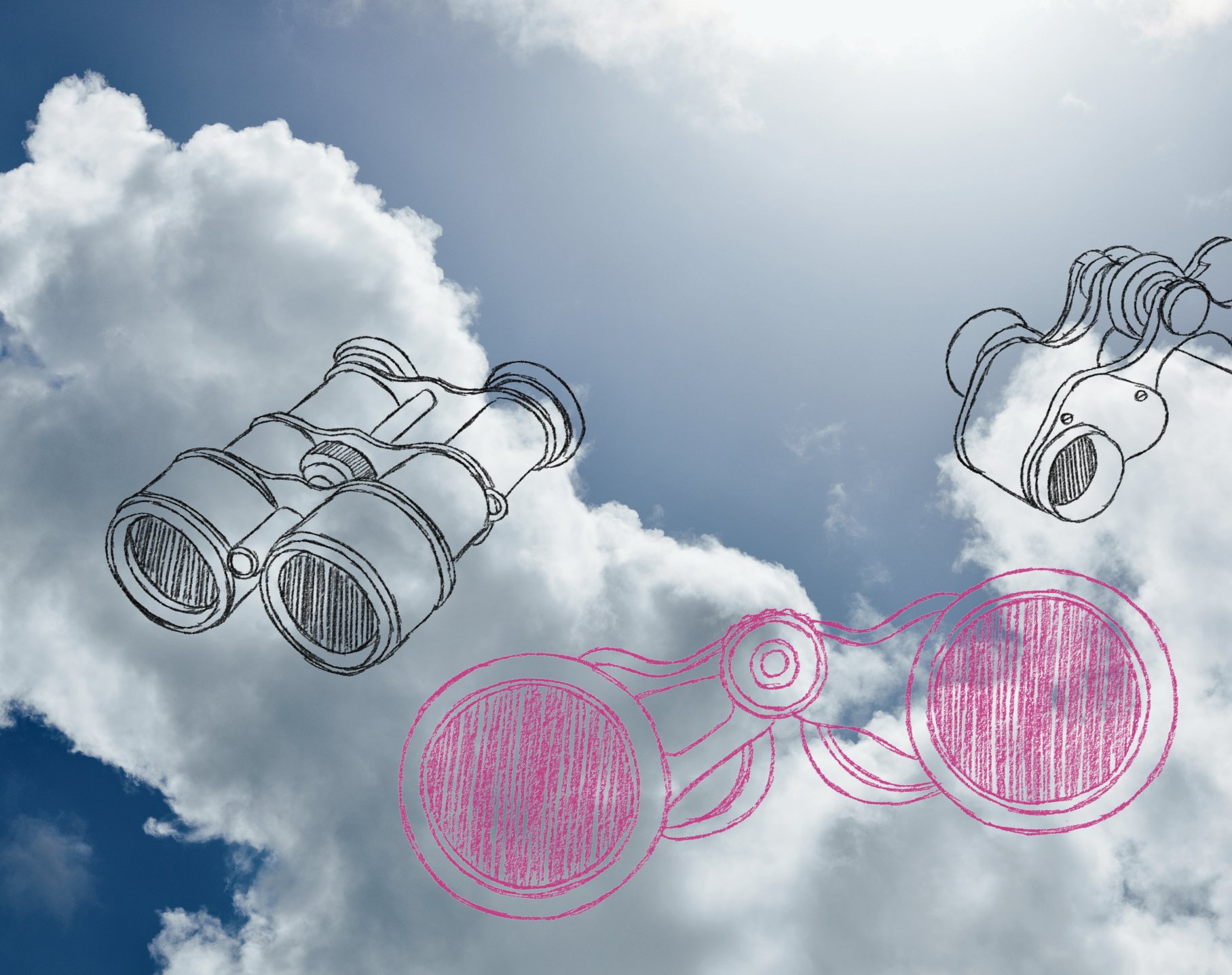
In conclusion, the answers to the first four questions would suggest there is no merit in considering the idea of a business in carbon calculator tools. It would stand very little chance of success, unless the monitoring process were to be radically developed and benefits introduced that are unavailable through any other means. Exciting developments in the Earth Observation sector are providing new capabilities that will be successful, and may well impact on the process of carbon calculation, but do a lot more as well. These technologies are being marketed for purposes of agricultural, timber and soil monitoring that provides "Big Data Analytics" for large commercial and Government interests in these sectors. They are seeking customers from established markets in which the sales value is high. Carbon calculations are a by-product of these new methodologies in Earth Observation, and these may well lead the process of revolutionising carbon calculation, as long as the political and economic leaders can agree a standard with which these measurements should comply.

Read more on business development

- www.businessmodelcommunity.com
- www.businessmodelcommunity.com/fs/Root/8jig8-businessmodelsbusinessstrategy.pdf

Read more on development in Earth Observation

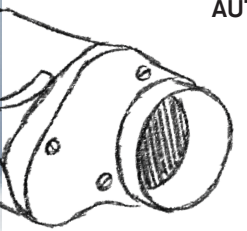
- www.esa.int/Our_Activities/Observing_the_Earth/The_Living_Planet_Programme/Earth_Explorers/Future_missions/About_future_missions
- www.esa.int/Our_Activities/Observing_the_Earth/Two_new_Earth_observation_missions_chosen_for_further_study
- www.esa.int/Our_Activities/Observing_the_Earth/ESA_s_Biomass_satellite_goes_ahead
- www.esa.int/Our_Activities/Observing_the_Earth/SMOS/SMOS_on_acid



A LOOK INTO THE FUTURE

CONSIDERATIONS FOR NEW PROJECTS

AUTHORS: BENJAMIN DAUMILLER, NICK LYTH & MANFRED WEISENSEE



In conclusion, in its final section this Toolkit for Carbon Calculators looks to the future. The issues of carbon calculators all revolve around the means by which we develop and improve our methodologies over the next 5–10 years. The European economy will benefit from success in these efforts.

The single most important issue is standardisation – standardisation in the calculation methodology, standardisation in the reporting systems, standardisation in the analytical context. This is needed in order to create the consistency and accuracy of monitoring and measurement required if the results are to be properly actionable.

Carbon monitoring is only useful if we, as a civil society, do something useful as a result. Consequently this section has a practical application for the future direction of work with regard to carbon calculators. It will help those who require guidance on possible next steps in forming and developing the debate, in contributing to the research and development of the process, and in relating this to European policy and project work.
In order to accomplish this, the section is broken into four sub-sections:

The first reaches out from this project within the North Sea Region to take account of the way in which other projects funded by the EU, in other regions, have also considered carbon monitoring and what conclusions they have reached. In particular, we consider the Interreg projects that might relate, in every strand – A, B and C – and also the Intelligent Energy Programme, which has now been subsumed into Horizon Europe.

The second section takes these projects into account alongside NSSEP PLUS, and suggests how European policy makers in Brussels and elsewhere might develop greater focus in policy terms to help improve the situation. This section offers suggestions, rather than recommendations, ideas that should be considered and reflected in the developing policy landscape. This is an obvious need, given the requirement for standardisation in methodology, measurement, reporting, and so on.

The third section considers the new project funding programmes coming into operation around Europe, with particular reference to the North Sea Region programme, and shows where the best opportunities for new projects relating to carbon calculators might lie. In all the European funding programmes, carbon emissions, and the need to address the problems they create, are reflected. It is an inescapable problem. Hence there are many different programmes with themes inviting project applications that can relate to the work in NSSEP PLUS.

In conclusion, this Toolkit makes recommendations based on the policy development ideas, and the opportunities available in the new programmes, for new project designs concerning carbon monitoring and calculators to build on the work of NSSEP PLUS most effectively. These are ideas that the partners in NSSEP PLUS all feel comfortable in recommending and also feel qualified to support. But they are not exclusive to the partners. Readers of this Toolkit who wish to develop the work are at liberty to do so with or without

any of the NSSEP PLUS partners, although it would be appreciated if they can be notified so as to avoid any direct competition.

HOW DID OTHER EU-FUNDED PROJECTS DEAL WITH CO_2 MONITORING

The following part elaborates on "How did other EU-funded projects deal with CO_2 monitoring", referring to the IVB period and with focus on INTERREG projects, e.g. the clusters LOW-CAP, as well as further key European projects.

OVERVIEW

A carbon footprint is defined as: The total amount of greenhouse gases produced to directly and indirectly support human activities, usually expressed in equivalent tons of carbon dioxide (CO_2).

In other words; when you drive a car, the engine burns fuel which creates a certain amount of CO_2, depending on its fuel consumption and the driving distance. While heating your house with oil, gas or coal, then you also generate CO_2. Even if you heat your house with electricity, the generation of the electrical power may also have emitted a certain amount of CO_2. When you buy food and goods, the production of the food and goods also emitted some quantities of CO_2. A carbon footprint is the sum of all emissions of CO_2, which were induced by activities in a given time frame. The carbon footprint is a very powerful tool to understand the impact of personal behaviour and the need for climate change. Many people are shocked when they see the amount of CO_2 their activities create. If organisations and people want to contribute to stop global warming, the calculation and constant monitor-ing of their organisational and personal carbon footprint is essential. The difficulty of CO_2 calculators are system boundaries.

According to the UN, CO_2 emission sources include emissions from energy industry, transport, fuel combustion in industry, services, households, etc. However, burning of biomass such as wood and straw also emits CO_2; however, unless there has been a change in land use, it is considered that CO_2 emitted from biomass is removed from the air by new growth, and therefore it should not be included in the total for CO_2. Nevertheless, as there is not yet an agreed method for estimating the overall CO_2-footprint, it appears to be that almost every CO_2 calculator possesses more or less the same functions. In the lead-up to the UN climate negotiations in Lima, the latest information on the level and growth of CO_2 emissions, their source and geographic distribution will be essential to lay the foundation for a global agreement. In order to provide input to and support for the UN process, the International Energy Agency provided a document on CO_2 Emissions from Fuel Combustion.

Most of the INTERREG projects based on a carbon footprint policy include a carbon footprint calcula-tion for pilot businesses and/or the creation of a pilot version of an environmental handbook for regional and local authorities. The handbook includes mainly measures for decreasing the carbon footprint and presents the financial benefits of being environmentally friendly. The following shows an outline of INTERREG projects and other initiatives, which deal with carbon dioxide monitoring:

CALCULATION

Most of the carbon footprint calculations are typically based on annual emissions from the previous 12 months. The CO_2 emissions are mostly calculated by the United Nation Standard. CO_2 emissions are displayed in CO_2 emissions per capita and/or CO_2 emissions per km^2. The calculation of CO_2 emissions can either be carried out for the total emissions in a year (your private household, your company, your organization…) or for the emissions of a single occasion (e.g. for air or car journey, cultural or touristic event). The calculation of CO_2 emissions can be achieved through various approaches. The following will outline a variety of calculation methods:

Buildings

Most of the common carbon footprint calculations are based on the same parameters. Despite tested and available technologies and pricing, energy use in buildings is still higher than necessary. Thus, the effort to

reduce human impact on climate change is strongly prioritised by the EU. Although most of the European countries try their best to optimise energy efficiency of buildings, almost 40% of the EU's energy consumption accounts to building structures. Hence, success in energy efficient building is the key to achieve the EU objectives. In the following the main parameters for carbon footprint calculation of buildings are given:

- home type and further information about the layout,
- the year of construction,
- square footage of the house,
- air leaks and insulation,
- window and glass,
- heating and cooling,
- water heating,
- heavy household machines such as refrigerators, freezer, dish washer etc.,
- light household devices,
- outside appliances and extras such as hot tubs or pools.

Further relevant parameters for the calculation of regional or local carbon dioxide calculations are:

Mobility

Low carbon mobility needs more than a change in fuels and propulsion technologies, especially in the transport sector as its carbon emissions remain significant. The European White Paper on Transport sets ambitious objectives including an interim target of 50% clean fuels by 2030, looking at the car-bon emission levels of the transport sector still being above the level of the 1990's. Thus, modern mobility services will play a crucial role in delivering alternatives to the private car.

Electrical and thermal power production

Electricity Reductions (kilowatt-hours)

Most greenhouse gas equivalencies calculators use the emissions & generation resource given by the electricity providers' annual non-baseload CO_2 output emission rate to convert reductions of kilo-watt-hours into avoided units of carbon dioxide emissions. Most users of the equivalencies calculator who seek equivalencies for electricity-related emissions would like to know equivalencies for emis-sions reductions from energy efficiency or renewable energy programs. These programs are not gen-erally assumed to affect baseload emissions (the emissions from power plants that run all the time), but rather non-baseload generation (power plants that are brought online as necessary to meet demand). For that reason, most equivalencies calculators use a non-baseload emission rate.

Therms of natural gas

Carbon dioxide emissions per therm are determined by multiplying heat content times the carbon coefficient times the fraction oxidised times the ratio of the molecular weight ratio of carbon dioxide to carbon. The average heat content of natural gas is 0.1 mmbtu per therm. The average carbon co-efficient of natural gas is 14.46 kg carbon per mmbtu. The fraction oxidized to CO_2 is 100 percent. The British thermal unit (BTU or Btu) is a traditional unit of energy equal to about 1055 joules. It is the amount of energy needed to cool or heat one pound of water by one degree Fahrenheit. In science, the joule, the SI unit of energy, has largely replaced the BTU. To avoid confusion, many compa-nies and engineers use the notation MMBtu or mmBtu to represent one million BTU and in many contexts this form of notation is deprecated and discouraged in favour of the more modern SI prefix-es. Alternatively, the term therm may be used to represent 100,000 (or 105) BTU and quad for 1015 BTU. However, when using this equivalency, it only represents the CO_2 equivalency for natural gas burned as a fuel, not natural gas released to the atmosphere. Direct methane emissions released to the atmosphere (without burning) are about 21 times more powerful than CO_2 in terms of their warming effect on the atmosphere.

Lifestyle, consumption and behaviour

Although behaviour and lifestyle are difficult to measure, it is still important to keep them noted. However, behaviour is not always rational or instrumental. Behaviour Change could rather be seen as the common denominator of carbon footprint calculation. As described above, in reducing CO_2, experience tells us that many organisations & individual households can make comparatively small, and readily achievable, changes that result in a large cumulative impact on carbon reduction and hence costs.

Behaviour should be seen as a low-cost, high-impact way of reducing the carbon footprint. Many organisations find it difficult to engage staff effectively in order to deliver long term energy and carbon savings. This is true for many of the INTERREG projects as there has not been a programme that brings together the technical expertise with sound behavioural psychology, marketing expertise, and a deep understanding of organisational change. What is known is that there is no one-size-fits-all solution, so what works well in one organisation may not work at all in another, the same can be said for individual households. But there are a few design principles that should be integrated into the framework for developing regional and individual calculators.

EU PROJECTS AND INITIATIVES

LOWCAP

Partners from the UK, Germany, Belgium and Norway worked together to deliver a common approach towards carbon reduction and energy efficiency within the North Sea Region. The Low Carbon Regions in the North Sea (LOWCAP) cluster project reviews and exchanges knowledge and experiences from four carbon reduction and energy efficiency projects (Build with Care, Care North, North Sea Sustainable Energy Planning and Carbon Capture & Storage) in the North Sea Region. The European Union's 2020 targets for carbon reduction and energy efficiency require innovative and practical initiatives to deliver change. LOWCAP aims at producing and disseminating policy advice helping to meet these targets within the North Sea Region as a key output of the project.

The project's objective is to create a North Sea Region Programme perspective on carbon reductions and energy efficiency by:

- Compiling key results from the four partner projects and other related North Sea Region projects.
- Identifying innovative high impact initiatives that contribute to EU targets.
- Raising awareness through the creation and expansion of stakeholder networks in North Sea Region.
- Influencing decision makers at a local, national, regional and EU level.

Care-lands

Main aim of the project is to analyse carbon reduction, the use of renewable energies in protected areas, to share understanding and develop approaches for the best options to make steps forward in these issues in the next programme period. The project is divided in the following two parts:

Objectives in phase 1:

- Evaluate results and best practices of INTERREG 2 Seas projects.
- Identifying options to carbon reduction and the generation of renewable energy in partners' areas.
- Identifying businesses who want to be engaged in carbon reduction.
- Disseminate the results of the two Seas projects and of this cluster by an event.
- To make an attractive publication about all results of this cluster project.

Phase 2 focuses on the future by gaining more insight into the possible options of carbon reduction and renewable energy generation in all partner areas and to explore the appropriate scale of different renewable energy applications in precious natural landscape areas.

Also the role of local (tourism) businesses is taken into consideration and joint and lo-

cal approaches will be developed regarding carbon reduction and the strategic deployment of renewable energies.

Mitigation in Urban areas: Solutions for Innovative Cities

The project's ultimate objective is to stimulate actions to reduce CO_2 emissions in urban areas and create solutions for innovative cities. The five MUSIC cities have all now implemented the transition management process for CO_2 reduction and have developed a vision for their city. The cities have started implementing the actions and ideas of the action plan. The Dutch Research Institute for Transitions (DRIFT) has started to collect the lessons learnt, has published the draft Urban Transition Management (UTM) Manual and has presented the MUSIC UTM approach at various international conferences and seminars with a very positive response. The projects' further objectives are the following:

- Mobilising stakeholders to take action towards CO_2 reduction.
- Integrating "Energy" in urban planning and enable monitoring of effects.
- More effective energy reduction measures in cities: testing and improving method-ologies as well as the development of tools.

The EU Covenant of Mayors

Regular monitoring followed by adequate adaptations of the plan allows initiating a continuous improvement of monitoring and reporting processes. A specific monitoring and reporting guidebook was published by the European Commission in 2010. Such implementation report includes an updated CO_2 emission inventory (MEI, monitoring emission inventory). Thus, local authorities are encour-aged to compile CO_2 emission inventories on an annual basis.

The analysis of other INTERREG projects regarding CO_2 monitoring has shown that the collaboration with third-parties such as a municipality, district heating companies, housing associations, or schools are highly recommended, because these collaborations give access to data and households. However, whenever there is a mutual financial interest between the household and the third-party, the energy agency can initialise energy saving actions by means of tools and public meetings.

THE NSR PROGRAMME 2014–2020

The following chapter elaborates on "The NSR Programme 2014-2020" with in specific the role of CO_2 monitoring as regards indicators, targets and priorities, including a graph "Funding Scheme" on (further) possible co-funding.

In recent funding periods e.g. INTERREG IVB, CO_2 reduction was generally promoted across the territory and over all possible sectors. Thus the new scheme has a more specific, small-scale as well as possible experimental reductions or preventions to increase focus of attention. Since the last pro-gramme period was clearly derived that (with the given in these programs means) such a comprehensive objective would not be productive enough to track, the new program becomes more and more important in every plausibly and achievable change. This speaks for a paradigm shift, due to the fact that it is still about the indicators of the estimators. However the fructification approach allows the creative identification of previously untreated or inadequately publicized potential and raises its extreme importance.

PROJECT AIMS AND IMPLEMENTATIONS

In the past the main achievement of the CO_2 projects were the development of a permanent management structure as well as a high quality product to oversee the integration of each member state in the North Sea Region (NSR). This was supported by knowledge transfer and promotion across the NSR including website, newsletters, conferences, forums and exchanges. In addition, CO_2 meetings and activities stimulated active learning and created cross-sectorial networks and innovative actions among groups of people who did not work together in the normal run of their working life.

A collection of existing calculators

Appliance Calculator	http://www.coned.com/customercentral/calculators/EC_res_Appliance_Calculator.html
Assess Your Home	https://www.energystar.gov/index.cfm?fuseaction=home_energy_yardstick.showgetstarted
CFL Lighting	http://www.coned.com/customercentral/calculators/EC_res_CFL.html
Energy Efficiency Calculator	http://www.originenergy.com.au/calculator#calc_intro
Energy Efficient Home Designer	http://www.synergy.net.au/at_home/energy_efficient_designer.xhtml
Energy Efficient Home Renovator	http://www.synergy.net.au/at_home/energy_efficient_renovator.xhtml
Heat Loss Calculator	http://www.resurgence.org/education/heac.html
Heat Pump Calculator	http://c03.apogee.net/contentplayer/?utilityid=cpsenergy&coursetype=misc&id=18395
Home Appliance Energy Calculator	http://renewpenfield.org/resappcalc.html
Home Energy Calculator	http://c03.apogee.net/calcs/rescalc5x/Question.aspx?utilityid=demo52&hostheader=demo52
Home Energy Calculator	http://c03.apogee.net/calcs/rescalc5x/Question.aspx?hostheader=cpsenergy&utilityid=cpsenergy
Home Energy Calculator	http://hes.lbl.gov/consumer/
Home Energy Saver Pro	http://hespro.lbl.gov/pro/
Home Energy Saver™	http://homeenergysaver.lbl.gov/consumer/
Home Energy Savings Calculator	http://ecoliving.scotiabank.com/calculator
HomeEnergyCalculator	http://www.coned.com/customercentral/calculators/EC_res_HomeEnergy_Calculator.html?utilityid=coned&hostheader=coned
Lighting Calculator	http://c03.apogee.net/contentplayer/?utilityid=cpsenergy&coursetype=misc&id=18393
Online Carbon Calculator	http://www.resurgen¤ce.org/education/carbon-calculator.html
Online Usage Calculator	http://www.consumerspower.org/home_energy/billestimator.php
Programmable Thermostat Cooling	http://www.coned.com/customercentral/calculators/EC_res_Programmable_Cooling.html
Programmable Thermostat Heating	http://www.coned.com/customercentral/calculators/EC_res_Programmable_Heating.html
Your Home Energy Costs	http://www.nspower.ca/en/home/energysavings/Energy_Calculator.aspx

Nevertheless, while the NSR deals with the effects of climate change, transport-related CO_2 emissions continue to increase. The new programme period faces an urgent need to develop and implement carbon reduction strategies and to secure an ongoing energy supply for e.g. transport and industry. The NSR has a huge potential for innovative transport strategies which could improve the economic performance of its regions and cities in a post-fossil economy (see Lisbon Agenda).

Most of the recent INTERREG CO_2 projects addressed a sustainable approach taking environmental aspects into account. The increased use of sustainable transport throughout the regions along the route contributes to the reduction of CO_2. Moreover physical improvement of the route as well as the information transferred over the website stimulated a greater environmental awareness and understanding of the cultural and natural heritage of the North Sea Region. Further, the project helped to consolidate the rural economic base in farming areas and hence contributed to the preservation of valuable cultural landscapes around the NSR.

However, it becomes clear that the new programme period has the following two main objectives:

- The increase use of renewable energies in percentages of total use.
- Decrease in unsustainable energy consumption.

Additionally, the new programme period tries to implement a better climate control in the green-houses, an improved use of novel greenhouse techniques and the use of climate tolerant plant types with ICT tools. Supported by intensive information strategies at the business level (SME's) the new period focuses on delivering cost savings and ensure sustainable production. Hence it will create transnational networks linking SME's, grower organizations and political bodies to transfer innovation and deliver a lasting impact. Accompanying this, there is an existing North Sea Commission that publishes in higher level strategically context.

NORTH SEA REGION 2020

The North Sea Region 2020 strategy paper regards the North Sea region as a territorial co-operation area. Its strategic focus is on the major challenges and common characteristics where there is added value in transnational action and collaboration. The five strategic priorities address the challenges and opportunities facing the North Sea Region. They are at the same time closely linked to the EU2020 objectives and contribute to the implementation of several – if not all – of the EU2020 flagship initiatives.

Vision

The North Sea Region has the potential to act as an engine for growth in Europe and as a centre of excellence for wider EU issues through developing existing cooperation efforts, improving policy efficiency and value for public money.

Objectives

The aim of the North Sea Region 2020 is to:

- Help the North Sea Region remain and improve the performance as a competitive, attractive and sustainable area of Europe.
- More efficiently address common transnational challenges and exploit opportunities related to sustainable economic growth, climate, energy, accessibility and management of the maritime space.
- Ensure a better governed region through cross-sectorial coordination and multi-level governance.
- Provide a potential pilot for at different kind of macro-regional strategy than the EU strategies for the Baltic Sea and Danube areas.

Implementation

The strategy is implemented through an action plan and a number of work plans. The action plan is a first step towards implementing the strategy. It is a rolling plan with a set time-frame of one year and contains a limited number of measures related to each of the four strategic priorities. The second step to-


North Sea Region 2020 Strategy
1
MANAGING MARITIME SPACE
Priority Focus
Maritime spatial planning
Exploration of marine resources
North Sea maritime stakeholder forum
2
INCREASING ACCESSIBILITY AND CLEAN TRANSPORT
Priority Focus
Development of multimodal corridors
Facilitate modal shift from road to sea
Clean transport
Clean shipping
3
TACKLING CLIMATE CHANGE
Priority Focus
Climate change adaption
Renewable energy and NS energy grid
Low-carbon technologies
4
ATTRACTIVE AND SUSTAINABLE COMMUNITIES
Priority Focus
Competiveness of sectors and enterprises
Demographic change
Development of skills and employability
PROMOTING INNOVATION, EXCELLENCE AND
5
SUSTAINABILITY – A HORIZONTAL PRIORITY
MEASURES
MEASURES
MEASURES
MEASURES
ACTION PLAN – WHAT WILL WE DO?
WORK PLANS – HOW WILL WE DO IT?

wards implementation is five work plans describing how the action plan will be achieved.

North Sea Region strategy house

The NSR2020 strategy house illustrates the focus of the strategy and how the North Sea Commission as an organization works with its implementation.

Territorial Cooperation

Overcoming borders reinforces the added value of territorial cooperation and helps better address similar threats as well as promote more balanced development. In this respect, it is strongly recognised that joining forces also contributes to fostering integration and inclusion as well as avoiding duplication of efforts and resources. The modern day challenges are not contained by borders and solutions to those require working across borders. In this respect, territorial cooperation stands out as a key tool in efficiently addressing common challenges. In particular, territorial cooperation in the European Union is about reducing disparities between regions, reinforcing cohesion and encouraging optimal economic development.

For more than 20 years the European Union has supported cooperation efforts of regions and cities to address issues that affect our daily life, such as transport, education, energy, health care and environmental protection. Three policy instruments of the European Union support territorial cooperation:

- European Territorial Cooperation (ETC) objective of the EU's cohesion policy supports cooperation on internal borders of the EU.
- Instrument for Pre-accession Assistance (IPA) supports cooperation between EU regions and regions in pre-accession countries.
- European Neighbourhood and Partnership Instrument (ENPI) supports cooperation between EU regions and regions of EU external neighbours.
- Currently there are 93 cooperation programmes which provide the framework and funding for local and regional institutions, universities, companies and research institutes to carry out cooperation projects. By pooling together resources, exchanging knowledge and sharing good practices, cooperation projects improve the day to day lives of people throughout Europe and beyond.

FURTHER INTERREG PROGRAMMES 2014–2020

The following part elaborates further INTERREG programmes 2014–2020. Although, the EU has many different programme areas, each of them shows a similar approach. Most of the programmes have cohesive priority axes as well as related project selection criteria and expected project contribution. Additionally, indications on the contribution of each programme to the EU2020 strategy for smart, sustainable and inclusive growth have been recognised.

ALPINE SPACE PROGRAMME

Objectives

The Alpine Space Programme 2014–2020 is an EU transnational cooperation programme to support sustainable regional development in the Alpine region. However the overall goal is, to contribute to the EU2020 strategy for smart, sustainable and inclusive growth. In its role as a driver of development and change, the programme combines three functions:

- trigger and fund result-oriented projects contributing to the programme objectives,
- nourish debates on cohesion policy and the future of the Alpine Space,
- act as a catalyst of cooperation and common solutions in the programme area.

Budget and Priorities

The total programme budget is almost 140 mio Euro, of which 116.6 mio Euro are contributed by the European Regional Development Fund (ERDF). Projects can be co-funded with up to 85% of ERDF. The priorities

of the Alpine Space Programme are the following (%= share of 116.6 mio. Euro ERDF):

- Innovative Alpine Space (32%).
- Low Carbon Alpine Space (27%).
- Liveable Alpine Space (27%).
- Well-Governed Alpine Space (8%).
- Technical Assistance (6%).

DANUBE TRANSNATIONAL PROGRAMME 2014–2020

Objectives

On 17th December 2013 the EU Cohesion policy package 2014–2020 was finally adopted following two years of negotiation between the European Commission, the Council of the European Union and the European Parliament. Thus six new EU regulations came into live, defining the conditions for investing 325.15 billion Euros to support a smart, sustainable and inclusive growth in Europe. Among these was Regulation (EU) No 1301/2013 relating to the European Regional Development Fund and the European Territorial Cooperation Regulation (EU) No 1299/2013. These are the regulations setting the rules for the three new programmes succeeding South East Europe programme in the next seven years: ADRION, Balkan-Mediterranean, and Danube. Eligible partners will, therefore, come from eight EU countries – Austria, Bulgaria, Croatia, the Czech Republic, Germany (only Baden-Württemberg and Bayern), Hungary, Romania, Slovakia, Slovenia; and five non-EU countries – Bosnia and Herzegovina, the Republic of Moldova, Montenegro, Serbia, and part of Ukraine.

Budget and Priorities

The programme will invest 202.3 mio. Euros from the ERDF and 19.8 mio. Euros from IPA II for trans-national projects in the Danube basin territory. The Danube Transnational Programme (2014–2020) is built around four thematic priority axes:

- innovative and socially responsible Danube region,
- environment and culture responsible Danube region,
- better connected and energy responsible Danube region,
- well-governed Danube region.

CENTRAL EUROPE 2014–2020

Objectives

The INTERREG CENTRAL EUROPE 2014–2020 programme's overall objective is to cooperate beyond borders in central Europe to make our cities and regions better places to live and work. Put more precisely, transnational cooperation should become the catalyst for implementing smart solutions answering to regional challenges in the fields of innovation, low-carbon economy, environment, culture and transport. The programme will build regional capacities following an integrated bottom-up approach involving and coordinating relevant actors from all governance levels. In doing so, it will coordinate with other efforts in the regions including, amongst other, national and regional pro-grammes supported by structural and investment funds, macro-regional strategies, the Horizon 2020 programme or the European Investment Bank. In the programme, capacities are to be understood as the combination of all the strengths, attributes and resources available within a community, society or organisation that can be used to achieve agreed goals. Strengthening capacities is therefore understood as creating an enabling environment through improved:

- Policy frameworks as well as legal and economic frameworks.
- Institutional and human resources development.
- Managerial systems within the four priority axes (see below) specific actions will be support-ed and various outputs obtained.

Budget and Priorities

Co- financing rates are up to:

- 80% for partners from Austria, Germany and Italy.

- 85% for partners from Croatia, the Czech Republic, Hungary, Poland, Slovakia and Slovenia.

The focus will be on policy-learning and implementation-oriented approaches at the transnational level. More concretely, actions will include the development and implementation of strategies and action plans, the development, testing and implementation of tools, the preparation of larger investment, the implementation of pilot actions – including pilot investments – as well as capacity building measures including training. Nevertheless, the following for thematic priorities have been selected:

1. Cooperating on innovation to make CENTRAL EUROPE more competitive.

2. Cooperating on low carbon strategies in CENTRAL EUROPE.

3. Cooperating on natural and cultural resources for sustainable growth in CENTRAL EUROPE.

4. Cooperating on transport to better connect CENTRAL EUROPE.

NORTH-WEST EUROPE 2014–2020

Objectives

The INTERREG North-West Europe (NEW) Programme encourages public, scientific private and civil society organisations to cooperate with a view to improve the economic, environmental, territorial and social development of Europe's regions.

Budget and Priorities

The programme has a budget of 372 mio. Euro ERDF available for projects. The maximum applicable co-financing rate for projects is 60% (ERDF). The following three thematic relevant priorities have been announced:

1. innovation: Enhance innovation performance of enterprises throughout NEW regions.

2. Low Carbon: To facilitate the implementation of low-carbon, energy and climate protection strategies to reduce GHG emissions in NEW. Also, to facilitate the uptake of low carbon technologies, products processes and services in sectors with high energy saving potential, to reduce GHG emissions in NEW as well as to facilitate the implementation of transnational solutions in transport systems to reduce GHG-emissions in NEW.

3. Resource and material efficiency: To optimise (re)use of material and natural resources in NEW.

BALTIC SEA REGION

Objectives

The INTERREG Baltic Sea Region Programme 2014-2020 supports integrated territorial development and cooperation for a more innovative, better accessible and sustainable Baltic Sea region. Partners from countries around the Baltic Sea work together in transnational projects on common key chal-lenges and opportunities. The Programme is funded by the European Union and involves the EU member states Denmark, Estonia, Finland, Latvia, Lithuania, Poland, Sweden and northern parts of Germany, as well as the partner countries Norway, Belarus and the north-west regions of Russia. The Programme is agreed by the participating countries and approved by the European Commission.

Budget and Priorities

The Programme funds come from the European Regional Development Fund (ERDF, EUR 263.8 million), the European Neighbourhood Instrument (ENI) and Norway. Project partners co-finance activi-ties with their own resources. The co-financing from the Programme is between 75% and 85% (for ERDF funds). Additionally, Belarus and Russia plan to join INTERREG Baltic Sea Region. An allocation of EUR 8.8 million was earmarked from the European Neighbourhood Instrument to support partners from Russia and Belarus in joint projects. Before the Programme can grant EU funding to

Russian and Belarusian partners, Financing Agreements between the Governments of each country and the European Commission will have to be negotiated and concluded. At this point it is not clear when this will be done.

In the period 2014–2020, the Baltic Sea Region Programme is offering funding in the following four thematic fields, the so called Priorities:

1. Capacity for innovation – This will offer support for e.g. development of innovation infrastructures, implementation of smart specialisation strategies and development of non-technological innovations.

2. Management of natural resources – This highlights the need to manage natural resources more efficiently. Resource efficient blue growth, renewable energy sources, energy efficiency and clear waters are examples of the areas that will receive support.

3. Sustainable transport – Here themes such as accessibility of remote areas, maritime safety, environmentally friendly shipping and urban mobility will attract project proposals.

4. EU Strategy support – This offers support to the stakeholders of the EU Strategy for the Baltic Sea Region. Assistance to the Priority Area Coordinators and Horizontal Action Leaders, seed money projects of the EU Strategy, organisation of Strategy Forums and other implementation tasks will be co-financed.

The Programme will group thematically linked projects into clusters. Clustering will help to coordinate activities and increase the impact of the projects. Project clusters will run as and in parallel to the "regular" projects.

RECOMMENDATIONS

This part of the study is to elaborate recommendations, to explore potential project topics among the partnership, but also to throw torchlight into plausibility of future aspects of capitalising on the current achievements.

In general, to support knowledge transfer and to be a think tank on new project developments, also regarding CO_2-monitoring, will foster access to INTERREG programmes and co-funding schemes for the period 2014–2020.

Without any doubts Europe is one of the world's main CO_2 emitter. The region is pretty developed and has a long history of fossil fuel consumption. But it's currently undertaking a number of wide-reaching energy policies which could see its carbon footprint reduce over the coming years – renew-ables targets, an emission trading scheme, as well as national plans for decarbonisation. To get an insight into Europe's current emissions, tools like the "Global Carbon Atlas" – an online tool released alongside the new carbon dioxide predictions for 2013 – can be used. The Global Carbon Atlas does not show real time data, but it shows and compares data back to 2012 and 2011. Thus, it provides a good feedback of how the world's emissions break down. However, for a collection of small coun-tries, Europe packs a significant carbon punch. The region contained nine of the world's top 25 emitters in 2012. Germany had the 6th highest emissions. The UK ranked 13th highest, closely followed by Italy in 16th and France 18th. Consumption of fossil fuels in these countries remains high.

In addition, governments measure territorial emissions – the amount of carbon dioxide produced inside the boundaries of a country by activities which consume fossil fuels. But there's another way of looking at it – consumption emissions. That's a measure of how much carbon is produced by the stuff a country actually uses - inside and outside its borders. Across Europe as a whole, consumption emissions were estimated to be about a billion tonnes higher than territorial emissions in 2011. Thus, it is not a very green picture either when you consider that Germany, the UK, Italy and France all ranked in the top 20 biggest emitters in 2012. If it was based on consumption emissions, they'd have all been in the top 12.

The response to the financial crisis and its economic impact, dealing with climate change, rising energy prices and demographic change are just some examples to

mention. The European Union and its Member States are facing the task these challenges while implementing measures agreed in the Treaty of Lisbon – socially, economically and physically, "territorial" grow shall be promoted. Consequently, the strategy of the EU "Europe 2020" has set the timetable. Thus, based on knowledge and innovation, competitive, resource-efficiency, green economy, increased employment as well as social inclusion and combating poverty are demanded. In total, all draft regulations of the new INTERREG programme aim at all objectives of the strategy "Europe 2020". Eleven priority areas have been proposed to support a smart, sustaina-ble and inclusive growth and to link the economic, environmental and social issues together. Especially to be highlighted are the following priorities:

- promoting climate change adaptation and risk prevention and risk management,
- environmental protection and promoting resource efficiency,
- promotion of efforts to reduce CO_2 emissions in all sectors of the economy.

The German Act on Protection against harmful effects of air pollution, noise, vibrations and similar processes (Federal Pollution Control Act) may act as an example of a comprehensive approach to the multitude of entangled challenges. It states that, in the determination of proportionality between costs and benefits of potential actions and the principles of precaution and prevention, based on assets of a given type, in particular to take into account the following criteria:

- the use of low-waste technology,
- the use of less hazardous substances,
- promote the recovery and recycling of substances generated and used in the individual process materials and, if the waste,
- comparable processes, facilities or methods of operation which have been tried with success in the operation,
- advances in technology and changes in scientific knowledge,
- the nature, effects and volume of the emissions,
- the commissioning of the new or existing installations,
- to introduce the best available technique required time,
- consumption of raw materials and type of raw materials used in the individual processes (including water) and energy efficiency,
- necessity, the overall impact of the emissions and the risks to humans and the environment to avoid as much as possible or to reduce,
- need to prevent accidents and to minimize the consequences for humans and the environment,
- information to be published by international organizations,
- information contained in the given pamphlets.

This alone shows that the opportunities for simplification of messages as a stand-alone tool may be limited. All in all carbon calculators themselves may be a lesser productive avenue for much further exploration when only used in a reactive sense. The natural course for development will be in carbon reduction innovations. Carbon calculation itself can be a proactive benefit for the society when applied to indicate the "hot spots" of greenhouse gas emissions and to find the most valuable fields of action for concrete measures of carbon reduction. In this sense, it is a move also to be observed in Programmes' writings: away from the overall perspective towards individual changes in behaviour and performance. Thus, we see a specific need for tools that support the evaluation of measures applied for carbon reduction by enabling the appraisal of al-

ternatives under the aspects of financial, organisational and communication efforts. This differential view will be supported by a much closer integration of carbon calculation and carbon monitoring by sensors connected in the 'Internet of Things' and also by earth observation via remote sensing showing the impact of human activities as well as of measures for carbon reduction at multiple scales.

Finally, and especially in this context, a key aspect needs mentioning in connection with involving the private business sector, that being one of the aims in all current perspectives of the Juncker-Plan or ERDF Programming, Federal or local development concepts. The upcoming discussion of trading emission certificates will play a key role in the new funding period – be it in perception of validity of overall values or the dynamics of a market driven incentive.

Much of the greening and blueing will be vastly influenced by continued activities foreseen on this field of regulation, and more generalising is to be expected when combining established tools with those driving economic forces, that are ultimately taking their decisions outside the regional economy.

CO_2 CALCULATION

A TOOLKIT FOR INCREASING THE IMPACT OF CO_2 CALCULATION – PROMOTING A LOW-CARBON EUROPE

This Toolkit is designed to help you to achieve a practical objective: reducing carbon emissions within your sphere of influence. However, before you start work, it is necessary to be completely clear about the practical application of your work. Who are you aiming to speak to about carbon calculators? What are you expecting them to do with the calculators? What are you expecting them to do as a result of the calculations? This toolkit will help you to understand how a strategy can be constructed to define what you are attempting to achieve, and – critically – with which target group you should engage.

Being a product of a North Sea Region Programme project called North Sea Sustainable Energy Planning PLUS, this toolkit intends to bring the benefits of the work to as wide an audience as possible so that they can learn from the knowledge gained, and can put into practice much of the theory of what will work best for doing the job of carbon calculating.

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ISBN 978-91-979940-4-0