World Federation of Engineering Organisations

The Committee on Engineering and the Environment

Newsletter #11
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Engineers can initiate programs to maximize energy efficiency and reduce demand, thereby reducing users' costs for energy and lowering GHG emissions.

Mitigating Greenhouse Gases — Engineers Can Make the Difference!

By Darrel Danyluk, P.Eng. FEC, FCAE, FEIC, FCSCE

Darrel Danyluk chairs the WFEO Standing Committee on Engineering and the Environment (CEE).

The 2009 UNFCCC meetings in Copenhagen held the promise of political continuation of the Kyoto Protocol and renewed efforts to address the discharge of GHGs. Record numbers of NGOs and registrants attended, each expressing their views through every means of communication available. WFEO-CEE and the Danish Society of Engineers (IDA) put forward the engineering perspective outlined in WFEO's Geneva Declaration on Energy, and in the Future Climate – Engineering Solutions Report.

These messages state very clearly that, by using current technologies, the amounts of energy societies require now and in the future are available, and that GHG concentrations can be reduced to required levels by improving efficiencies in all consumption sectors and by increasing the contributions of renewable energy.

The Geneva Declaration states:

"We can do it – let's do it!

"To achieve the goals suggested by IPCC, the entire energy cycle (generation, transmission, distribution) has to be considered, as well as primary and renewable energy sources and efficiencies in utilization and transmission, and include assessment of the environmental and economic consequences. The solutions are of necessity customized for each region. Sustainable models for power interconnection of countries in a given region to complement local supply will have to be pursued and implemented."

The Declaration concludes:

1. To guarantee a good quality of life for everyone, all available energy sources must be considered.
2. The use of any technology requires a thorough analysis of the technological, economical and environmental feasibility of implementing scientifically sound, and efficiently engineered solutions.
3. The technologies needed to supply energy to substantially improve quality of life globally are available or at an advanced stage of development.

Furthermore, the Declaration assumes that society will acknowledge that engineers are recognized as legitimate contributors to the debate and that engineers will take action.

Future Climate – Engineering Solutions reported on 11 assessments on the potential to lower national GHG emissions by using existing technologies and improving efficiencies. The report concluded that while results varied by country, major emission reductions were feasible. This was an important and optimistic statement, led by IDA and endorsed by WFEO, related to the Copenhagen agenda and goals.

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Phase 2 and Phase 3

The Future Climate — Engineering Solutions Project

By Daniel Kenning, CEng.

A principal of Splendid Engineering and based in Essex, the United Kingdom, Daniel Kenning is a Fellow of the IMechE and a Chartered Environmentalist.

Phase 2 (2009 – 2011) of the Future Climate – Engineering Solutions Project was characterised by institutional support from the Institution of Mechanical Engineers (IMechE), and yielded an increase in the size of the network and the number of national energy and climate plans published. The project was led during this phase by Dr. Alison Cooke, a Fellow of IMechE, who brought the support and influence of the Cambridge University Engineering Department, and built a very strong Steering Group.

Phase 3 (2011-2014) has been characterised by a lack of institutional support, as both IMechE and Cambridge University were no longer involved, the engagement of the Steering Group diminished, and Dr. Cooke handed over to Daniel Kenning, also a Fellow of IMechE and a Chartered Environmentalist, and Paul Jowitt, Fellow of ICE, supported by the Institution of Civil Engineers. Work therefore focused on maintaining the project and its profile as a stand-alone contributor to the global energy and climate debate, and on preparations for the project's transfer for Phase 4 to a new, properly resourced, institution in the next host country.

Phase 2: 2009 – 2011

The project was developed substantially during Phase 2 in terms of outputs and influence. The Steering Group assembled by Dr. Cooke at Cambridge University included Dr. David Mackay, Chief Scientific Officer to the Department of Energy and Climate Change (DECC), among others. Strong links were developed with DECC, and its innovative and parallel work on the "Pathways to 2050" open source calculator tool for national energy planning. Financial support was also secured from Shell.

During Phase 2 the support of IMechE and Cambridge University enabled these substantive outcomes:

- An updated and enhanced Framework was developed to enable participating national organisations to develop better national energy and climate plans, retaining the overall project objectives to meet the overall target of achieving a <2C rise in average global temperatures, and the achievement of an energy system that is resilient to peak oil.
- A better website was developed in collaboration with the Mayden Foundation (www.fc-es.net)
- A new plan was published in July 2011 for the UK, *UK 2050 Energy Plan - The challenge continues*, which also delivered the UK government commitment to reduce GHG emissions by 80% by 2050 compared to 1990 levels. (http://www.fc-es.net/wp-content/themes/fces/uploads/2012/08/UK+2050+Energy+Plan+2011.pdf)
- Altogether, 11 national plans were published on the website
- The network of national organisations was expanded to include the following 23 countries; Australia, Belgium, Brazil, Canada, China, Croatia, Cyprus, Denmark, Finland, Germany, Honduras, Hong Kong, India, Ireland, Jamaica, Japan, New Zealand, Norway, Russia, South Africa, Sweden, the United Kingdom and U.S.A.
- A conference at IMechE in London in September 2011 to disseminate the results.

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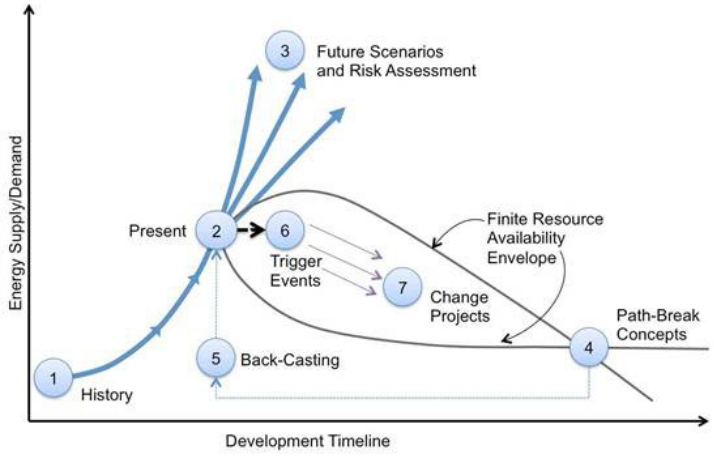
Transition Engineering



Transition Engineering's Seven Steps:

Step 1: History: use of historic data to understand how an energy using system has reached the current status; "how did we get here?"
Step 2: Current Status: use of high-quality data to create a detailed description of the current status in terms of energy use and energy supply,
Step 3: Scenarios: an exploration of future scenarios that are possible based on extrapolation of past trends. This step highlights any false assumptions about whether the current pace of change is likely to lead to a sustainable future.
Step 4: Path-break concepts: this is an envisioning step in which a desirable, sustainable, future scenario is described, separately from past trends. This becomes the objective for future activity instead of the current, possibly inadequate, future scenarios.
Step 5: Back-casting: this is a relatively familiar concept, used to identify a planning pathway that could achieve the desirable future vision.
Step 6: Trigger events: this is a challenging change activity; the engineers must identify means to break the momentum that forces adherence to possibly inadequate and unsustainable trajectories. This requires the identification of specific actions that can serve to get out of a rut; for a national climate and energy plan the act of participating in a global alliance like FC-ES may prove to be the required trigger event. Other trigger events include changes of national government (a new government may be more amenable to sustainable change), a climate change disaster (after which change may be more acceptable), or others that national project teams may identify.
Step 7: Action plans: this is the stage at which engineers establish workable plans to implement the bold visions and courageous change-making activities in the previous steps.

Phase 3: 2011-2014

During Phase 3, the nature and output of the project was much more limited, but included the following key steps designed to ensure that the project can continue, ideally with renewed and increased energy and effectiveness, when a new and well-resourced national host organisation is established for Phase 4.

A new Phase 3 Framework was developed for use by and in consultation with participating national engineering organisations. This built on the Phase 1 & 2 framework documents and incorporated some key enhancements to enable the creation of much higher value national energy and climate plans.

Phase 3 Framework – in consultation with the international network of FC-ES partners, some new elements and principles were introduced. The Framework Document comprises:

Engineering Basis – plans to be based on sound engineering expertise, and not on political whim, short-term expedience or ideology.

Data – plans should be based on high-quality data describing historical demand and supply, as well as trends in supply and demand that inform sensible forecasts.

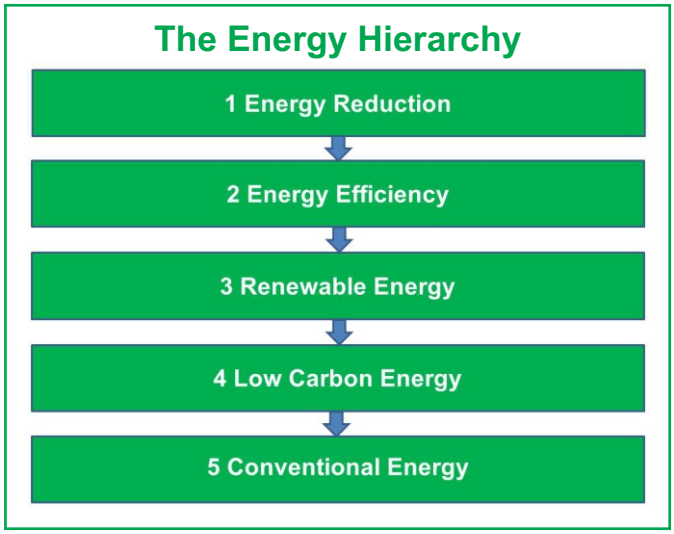
Sustainability – plans should enhance all interdependent aspects of sustainability; the environment upon which society is wholly dependent, society – including employment – and a better, and more stable, economy.

Energy Hierarchy – plans should recognise that the demand side is as important as the supply side, and use the energy hierarchy both as a framework for making decisions about the design of national energy systems, and, just as important, as a testing tool for proving proposals. (The Energy Hierarchy published by IMechE http://www.imeche.org/knowledge/policy/energy/policy/the-energy-hierarchy)

Inclusion of Mitigation of *and* Adaptation to Climate Change – Mitigation of climate change and adaptation to unavoidable climate change are sometimes seen as completely different challenges, but overall there is a need to adapt complex human energy using systems to a changed future, a future which will include both reduced greenhouse gas emissions and changed climate. There is also a need to adapt to a future which will include more constrained energy supply.

Whole-System Climate and Energy Plans – National climate and energy plans should address sectors that are sometimes omitted from purely supply-side energy plans, including: water, food (growing, processing, transporting), transport, waste minimisation and recycling, the built environment, and industry and manufacturing.

Transition Engineering Methodology – the Framework incorporates a new approach to engineering which enables and facilitates change from unsustainable, possibly inherited, orthodoxies, towards a sustainable new development direction. This includes a key seven-step process (Krumdieck, 2009) developed by the Global Association for Transition Engineering. (www.transitionengineering.org) This methodology can enable new ways of thinking to tackle apparently insoluble problems, such as the apparently intractable problems of global or national energy supply and demand post peak oil. See box (page 2) for explanation of the Transition Engineering approach.



Two-Tier Process – simple and advanced, to allow the effective introduction of new participants, and to support the continual learning and improvement process for experienced participants. Each climate and energy plan requires a simple set that a first-time participating organisation should be able to adopt, and some advanced principles for use by experienced participants.

Learning Lessons From Others – because so many others are working on similar endeavours, and because the FC-ES project is as much about "how" a national climate and energy plan is created as it is about "what" goes into that plan, participants are encouraged to collaborate with and learn lessons from other organisations in their home countries.

The project's profile and presence was maintained at key conferences, with the objective of ensuring that the momentum built up so far is maintained for Phase 4.

2012 – COP 18 – Doha

A small project delegation went to Doha for COP-18 to host, for the first time, an event at the conference targeted at government delegations. We organised a side event, sponsored by Shell UK, at which we also launched the new website – www.fc-es.net.

A video interview about the Future Climate – Engineering Solutions (FC-ES) project with Daniel Kenning is available at: http://climatechange-tv.rtcc.org/cop18-energy-planning-too-complex-for-politicians/

2013 – World Engineers Summit

To maintain an FC-ES presence, and to avoid the cost and climate impact of flying, a paper was delivered on behalf of the project by Wilson Ang, President of the Environmental Change Organisation, Singapore, who is a British Council Climate Ambassador and an IMechE member in Singapore.

2013 – COP 19 – Warsaw

The project was represented at COP-19 by Daniel Kenning, as encouraged by Christiana Figueres, Executive Secretary of the UN Framework Convention on Climate Change, who in 2008 put engineering at the centre of her vision: "The challenge we face calls for nothing less than a transformation of the world economy onto a green, sustainable pathway. Technology, both for adaptation and for mitigation, cannot but be at the very centre of this transformation."

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Future Climate – Engineering Solutions
The Project – the Story

By Pernille Hagedorn-Rasmussen

Pernille Hagedorn-Rasmussen is a Political Advisor with The Danish Society of Engineers (IDA).

Future Climate - Engineering Solutions is an international project involving engineering associations. Its purpose is to demonstrate sustainable energy technologies and solutions in order to support national and international efforts to reduce emissions of greenhouse gases (GHG).

The core of the project is national climate plans developed by the participating associations.

The project began in 2008 in order to gather engineering associations around the world on the climate change agenda. With the Association of Nordic Engineers serving as the coordinating body, the original partners behind the project were: The Swedish Association of Graduate Engineers, The Norwegian Society of Engineers and Technologists, The Association of German Engineers, and The Danish Society of Engineers.

According to Johan Sittenfeld, of The Swedish Association of Graduate Engineers: "The Swedish Association of Graduate Engineers participated because we think that climate change is one of greatest challenges to society. Different technical solutions are among the most important components in dealing with the problems along with a change in views and attitudes. Therefore, it is important that technical organisations take responsibility through the skills they possess.

"Project Future Climate – Engineering Solutions highlighted the areas in which the countries had substantial knowledge. This helps developing technologies nationally that can have a significant impact globally. We feel that the project has successfully demonstrated that technology in many cases is available or can be accessed only if the political climate and the incentives are favourable."

The participating associations have developed their own national climate action plans. The plans give a technical evaluation of the national possibilities for reducing climate gas emissions to a level matching the best-case scenario of the Intergovernmental Panel on Climate Change (IPCC).

Future Climate - Engineering Solutions,Copenhagen conference.

The national plans have been offering an opportunity for the participating organisations to show the proficiency of their members both with regard to a national and international audience.

The first milestone was the COP 15 meeting in Copenhagen and during the project period several international conferences have been initiated. We have also presented the result of the projects several times at the UN COP meetings, in 2009, 2010, 2012 and 2013. The aim is to show the international community that engineers and their technical knowledge are part of the solution to climate change.

Participating associations are: The Danish Society of Engineers (IDA); The Swedish Association of Graduate Engineers; The Norwegian Society of Engineers (NITO); The Association of German Engineers (VDI); The Institution of Engineers (IEI), India; Institution of Mechanical Engineers, U.K.; The American Society of Mechanical Engineers (ASME), U.S.A, (European operations); The Japan Society of Mechanical Engineers (JSME); APESMA, Australia; The Finnish Association of Graduate Engineers (TEK), Finland: Union of Professional Engineers (UIL), Finland; and Engineers Ireland.

Shalini Sharma, of the Institution of Engineers India, observed: "By participating in the Future Climate Project, we could study the status of carbon emission (from various sectors) in India and its implications and related policies, which was a comparatively new subject in India in year 2008-09. Also we represented India which was the only developing country and fast developing economy in the international group of 11 countries. Further organisations could make this project a base and can expand its research efforts for mitigation/adaptation."

Future Climate – Engineering Solutions Project (continued from page 3)

A short video was recorded - http://climatechange-tv.rtcc.org/2013/11/19/cop19-daniel-kenning-on-transition-engineering/

Preparations were made in collaboration with the network members for the handover from the U.K. to the next national host organisation.

The continuity maintained during Phase 3 will enable a new national host organisation to take on the FC-ES project during 2014-2015. The handover will include workshop activities to introduce the concepts of the project, the Framework Document and its principles, the introduction to the international network, and introduction to lessons learnt about the project. Key stages in the handover include planned activities at the UN Climate Conference in Bonn, June 2014, and at COP-21 in Paris, December 2015.

A Climate Plan for Denmark

By Pernille Hagedorn-Rasmussen

Pernille Hagedorn-Rasmussen is a Political Advisor with The Danish Society of Engineers (IDA).

As part of the Future Climate Project, members of the Danish Society of Engineers (IDA) developed a national climate plan for Denmark, called the IDA Climate Plan 2050. It is a holistic message on the way in which the Danish climate gas emissions can be reduced by 90% by 2050 while also improving Denmark's self-sufficiency, economy, and developing Danish trade and industry.

The starting point of the project was the Intergovernmental Panel on Climate Change (IPPC) findings and the United Nations recommendations made in and around the year 2006. It was noted that the inhabitants of the well-to-do OECD countries cannot in the long-run sustain greater greenhouse gas emissions per capita than inhabitants of other parts of the world. Since Denmark's per capita greenhouse gas emissions are approximately double those of the average world citizen, this means that we as a country must undertake and have taken a substantial reduction commitment. The IDA Climate Plan 2050 has therefore aimed to show how it is technologically and economically possible to reduce greenhouse gases emissions in Denmark by 90%. This corresponds to each Dane contributing no more than around 1.3 tonnes CO_2 equivalents by 2050.

A Danish Climate Plan Based Solely Upon Renewable Energy

Wind turbines and biomass constitute the backbone of the IDA Climate Plan 2050, which is based solely upon renewable energy. In 2050, Danish greenhouse gas emissions will originate largely from agricultural production and the emissions that are linked with the Danish people's food consumption. In the IDA Climate Plan 2050, 60-65% of the electricity production will be based on wind power. The majority of the combined heat and power production will be based on biomass and waste and thus constitutes the stabilising element of an otherwise fluctuating energy production.

The remaining electricity and combined heat and power production will be based on solar cells, wave power, geothermal and solar heat. Such a comprehensive development of renewable energy sources requires a number of consecutive initiatives.

It will be necessary to increase research and development within the critical technologies. It is particularly important to also provide necessary opportunities to test and demonstrate the technologies and to establish innovation markets and feed-in tariffs that can support a market characteristic following the new technologies. With windmills, it is also important to draw up as soon as possible a long-term development plan for off-shore and on-shore wind turbines.

Reducing Energy Consumption In Buildings

The IDA Climate Plan 2050 also looks at the energy consumption in buildings and homes being markedly reduced in the forthcoming years, and at making the housing mass CO_2 neutral through a combination of energy savings, the integration of renewable energy and the development of district heating based on renewable energy. The energy consumption in buildings and homes currently constitutes more than 40% of the total Danish energy consumption. Denmark currently has the world's most stringent energy requirements for buildings, but it will still be necessary to enhance those requirements.

The first houses that do not use energy have already been erected, and it is recommended that requirements be introduced at this early stage into the building regulations requiring houses erected after 2020 to be erected in accordance with the Zero Emission Housing standard. However, the greatest savings potential is in the existing housing mass, and even by 2050, the majority of the housing mass will consist of homes erected before 2009.

The Climate Plan looks at a substantial reduction in energy consumption through continuous renovation up to 2020 and at bringing 75% of most poorly insulated structures up to the current building regulation requirements. In 2030, through further reductions, energy consumption in buildings will be halved compared to the present level. Many energy savings are privately financially profitable. In order to support renovation of private buildings, it will be necessary to

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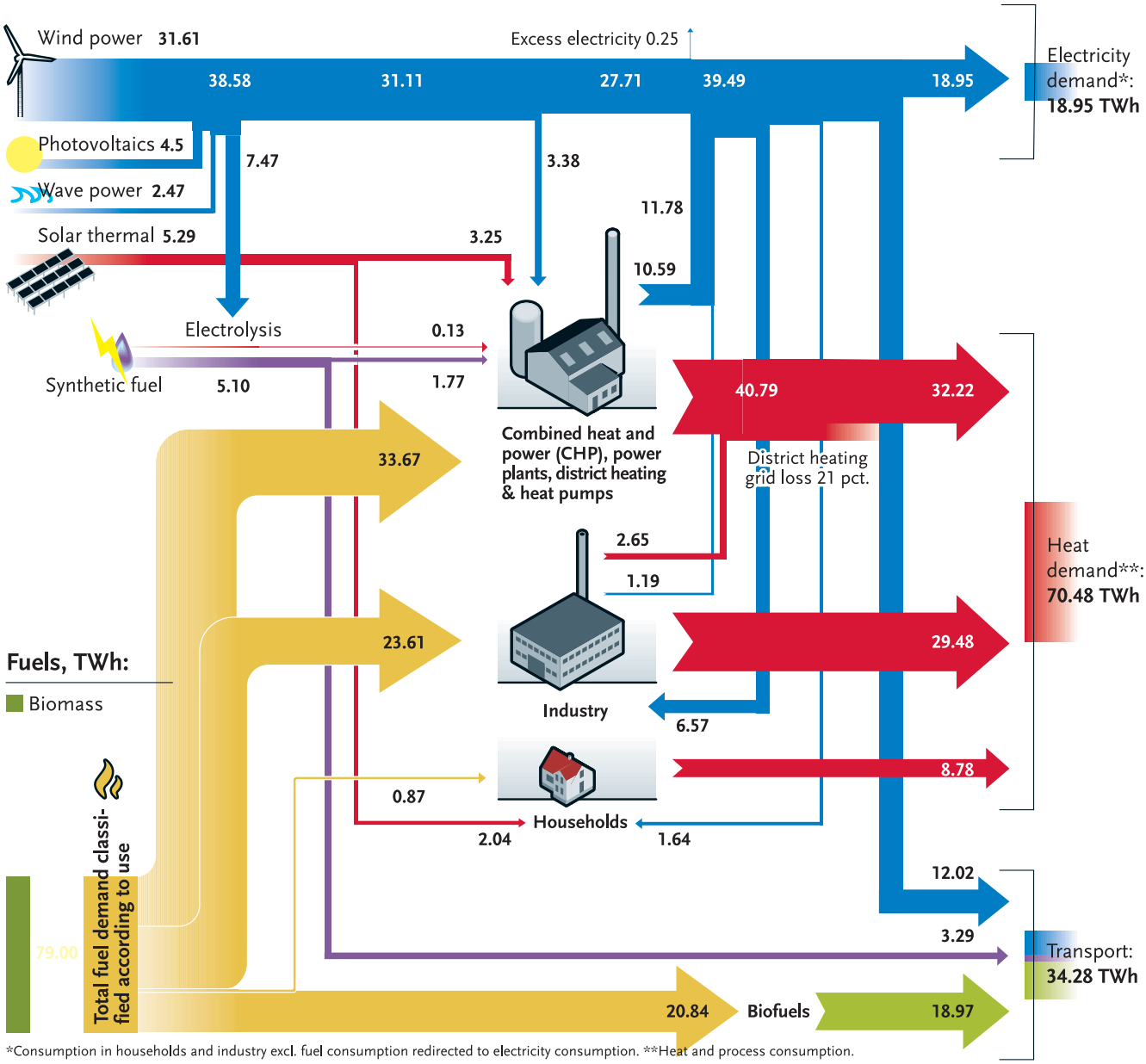
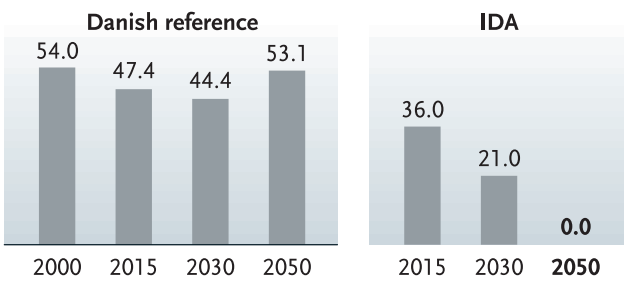
100% renewable energy. Primary energy supply, total: 122.86 terawatt hour (TWh)

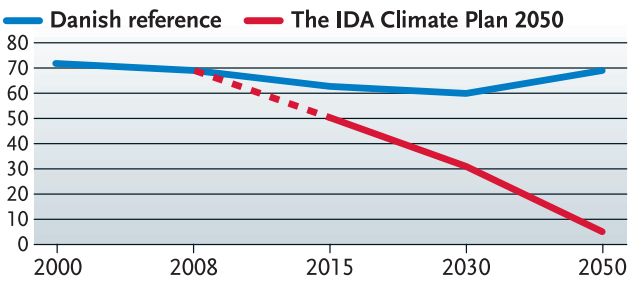


*Consumption in households and industry excl. fuel consumption redirected to electricity consumption. **Heat and process consumption.

CO_2 emissions from the energy system (million ton):



All Danish climate gas emissions in CO_2-eq (million ton):



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A Climate Plan for Denmark (continued from page 6)

prepare a long-term plan for increasing energy efficiency and for state funds to be earmarked to speed up energy savings in private residences and in non-profit residential buildings.

Energy Savings Are a Major Tool

The IDA Climate Plan 2050 for Denmark emphasises cost-effective solutions, which mean that energy streamlining and more efficient utilisation of nature's resources constitute a cornerstone of the plan. The plan looks at the Danish energy consumption being reduced by 50% by 2050.

Danes have this objective in common with the participants in the international project. One of the main points in the report issued by the Future Climate Project is that a large proportion of reductions could be reaped through energy savings. Most organisations, therefore, expect to be able to reduce the emission of greenhouse gases at a national level by up to 50% – solely through energy efficiency improvements within areas such as manufacturing, industry, construction and transportation.

Five Years Work With National Climate Plan

Since the climate plan's publication in 2009, IDA has continually worked to make politicians and the public aware of the possibilities of curbing the CO_2 emissions while at the same time creating jobs.

In 2010, it used the political opposition by the government to the IDA Climate Plan to create a common climate plan. In 2011 there was a change in government in Denmark and the three parties from the opposition took over and brought some of the ideas from their plan into effect.

For the past three years, IDA annually has made a “smiley” report where we match the results of the IDA Climate Plan up against the actually national status in Denmark. We have chosen indicators on the basis of which we evaluate if Denmark is on the right track towards the national goal of CO_2 reductions and share of renewable energy. With this report, we participate in the public debate on climate change and energy planning.

WFEO-CEE and Related Upcoming Events

WFEO Meetings

- Nov. 2, 2014, Abuja, Nigeria – WFEO-CEE Face-to-Face Meeting #7
- Nov. 2–9, 2014, Abuja, Nigeria – WFEO Executive Council Meeting

WFEO Events

- Nov. 2–7 2014, Abuja, Nigeria – WECSI 2014 – World Engineering Conference on Sustainable Infrastructure in Africa www.wecsi2014.org
- Nov. 28–Dec. 4, 2015, Kyoto, Japan – WECC 2015 – World Engineers’ Conference and Convention www.congre.co.jp/wecc2015

United Nations Framework Convention on Climate Change

- June 4–15, 2014, Bonn, Germany – UNFCCC Bonn Climate Change Conference www.unfccc.int
- Dec. 1–12, 2014, Lima, Peru – UNFCCC Conference of the Parties – Meeting #20 (COP-20) www.unfccc.int

Meetings Relating to WFEO-CEE Themes

Themes 1 and 2 – Climate Change Adaptation and Mitigation

- Sept. 23, 2014, United Nations Headquarters, New York, New York, U.S.A. – Climate Summit 2014 - Catalyzing Action www.un.org/climatechange/summit

Theme 3 – Engineering and Agriculture

- Aug. 13–14, 2014, Nairobi. Kenya – The Africa Food Security Conference & Agric Exhibition www.aidembs.com/africafood-security_conference
- Aug. 6–7, 2014, Singapore City, Singapore – 2014 4th International Conference on Environmental and Agriculture Engineering (ICEAE 2014) www.iceae.org
- Sept. 16–19, 2014, Beijing, China – 18th World Congress of CIGR – International Commission of Agricultural and Biosystems Engineering www.cigr2014.org

Theme 4 – Engineering and Sustainable Mining

- June 12–13, 2014, Falmouth, United Kingdom – SRCR'14 – Sustainability through Resource Conservation and Recycling '14 www.min-eng.com/srcr14
- June 25, 2014, Johannesburg, South Africa – Capacity Building Workshop on Mining and Sustainable Development, 25th Anniversary Meeting of Society of Mining Professors www.miningprofs.org
- Feb. 15–18, 2015, Denver, Colorado, U.S.A. – Society of Mining Engineers (SME) 144th Annual Meeting – “Navigating the Global Waters” www.smenet.org

Mitigating Greenhouse Gases (continued from page 1)

Unfortunately this message was lost amid withdrawals from the Kyoto Protocol, amid the political intrigue, environmental activism and the spectacle of failure that followed Copenhagen. The resulting Copenhagen Accord had one new and positive element. It recognized that all GHG emitters must take action and engage in the discussions those major emitters who are not signatories to the Kyoto Protocol. At subsequent UNFCCC meetings, WFEO and the Future Climate team have continuously brought forward our message and updates on progress of our efforts, and have now achieved recognition to the extent that our community is now seen as a contributor.

Engineers Can Initiate Programs

Engineers, in all countries and all sectors, can initiate programs to maximize energy efficiency and hence reduce demand with the dual benefit of reducing the user costs for energy and the reduction of GHG emissions. Secondly, by implementing renewable supply sources and negotiating effective inter-regional sharing in times of peak and growing demand, surplus energy can be sourced and shared. Over time, traditional carbon-based sources can be phased out and replaced with more efficient and less-GHG-intensive infrastructures.

Transitional Plans Required

Significantly, this can and will only happen if transitional plans are formulated and implemented for all GHG-intensive facilities as they reach the end of their useful and economic lives. Engineers worldwide are in positions of influence and decision-making such that these choices can be made without the rigid constraints of local, regional, global corporate politics.

“It can be done - Let's do it”.

Assessments a Success

This newsletter updates on the progress of Future Climate – Engineering Solutions and demonstrates that the format of a national assessment has proven successful. Engineers everywhere need to press for a national assessment, one that outlines the transition plan and subsequently leads to implementation. The template and format are available. Let's take the initiative, and solve the problem – take leadership.

Update on WFEO Model Code of Practice for Sustainable Development And Environmental Stewardship for Engineers

The Model Code was unanimously approved by the World Federation of Engineering Organizations General Assembly in September 2013. It was published and distributed electronically to all national and international members of WFEO in late October. Please see link on the opening page of the WFEO website www.wfeo.net.

The Code has a one-page listing of ten principles, similar in format to the Model Code of Ethics. An Interpretive Guide accompanies the listing and provides additional amplification and guidance on how engineers should interpret and implement the principles. National members may adopt it as their own guide or use it to develop their own.

The Model Code and Interpretive Guide have now been translated into Spanish. Thanks to national member Costa Rica for completing that task. The one-page listing is also available in French. Translation into Arabic by national member Bahrain was completed and posted on the WFEO website. Negotiations to translate into several other languages are in progress.

A PowerPoint presentation on the Model Code was completed in March 2014. It is approximately 30 minutes long, and includes speaking notes so that others may deliver the presentation. The presentation is the first of a series of communication and training products to increase awareness and uptake of the Model Code over the next few months. It may be delivered in person or via webinar.

In April, the presentation will be made widely available after the WFEO Executive Board meeting in Paris. The CEE Secretariat will work with members to facilitate and support speaking opportunities in the coming months. Initial target audiences include national members of WFEO and their engineers as well as United Nations agencies.