

Copenhagen article: much talk in COP15, waiting for action.

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Arriving at the conference

It is a sunny day in Copenhagen, December 8th, 2009 and I'm on the way to COP15; a global conference about climate change. There has been much discussion leading up to it and I'm interested in seeing where it leads. The meeting in Copenhagen is one of the most major international gatherings since Kyoto in 1997 when countries met to "put some numbers" on emission targets in order to reduce the climate change trend.

I am fortunate enough to have a personal invite, as studied for my Master's at the Technical University of Denmark. Back in 2004 when climate change was still generally considered by the world to be a fantastical idea, the Kyoto agreement was seriously being studied in the University. Those who were in the know discussed how USA and China did not ratify the Kyoto Protocol, two key omissions as the per capita largest emitters of carbon dioxide in the world. The political and economic relation between these two countries is bound tightly; and their assent on Kyoto was similarly linked. As an environmentalist and a businessperson, I work in the renewable energy industry both to better our energy future and to make a living. However, I can understand the thinking behind the American and Chinese Governments' decision to wait so long to become actively involved in the global carbon emissions negotiations. Both governments are driven by their economies first, and taking action on the environment is seen as a lower priority and possibly as a threat to those same economies; particularly in the midst of a severe recession. Even considering this history, there is a buzz surrounding the attendance of President Obama at COP15. Hopefully his appearance at the end of the week will lead to some real commitment by the United States to limit emissions, and encourage other nations politically to make their own strong commitments.

These meetings are expected to step up emission targets. Using 1990 global emissions as a benchmark, the European Union will decrease its carbon emissions 20% by 2020 with a 20% increase in the share of its power generated by renewable energy. The United States will hit a reduction target of 17% by 2020 and China 40% during this period. The American target is lower than the European, but probably more realistic. Even before being bound to these carbon targets, some states took action to reduce emissions years ago. Also, driven by a need to generate a framework for economic recovery, the United States has begun to embrace green energy. The first solar concentrating plant was, in fact, built in America.

Copenhagen has a thick Christmas atmosphere. After all, the legend of Santa Claus comes from this part of the world. This year there is a new theme; the city is being called "Hopenhagen", and people are caught up in the idea of building a better future. One of the city's main squares, Randhusenplasen, has a large Christmas tree which is lit from power generated by bicycles and their riders at its base. A huge balloon in the middle of the square represents the strength of human will, and solar modules have been added to the rooftops of several exposition buildings; which are largely symbolic during these darker, winter days.

The event show room contains many examples of sustainable technologies implemented around the world. Hybrid bus engines in London, green building practices in New York City and the Empire State Building in particular, and Copenhagen's district heating system. In Nytorv square, the World

Wildlife Fund presents on the receding ice in the Arctic and Panasonic sponsors a representation of the ice melting; a skeleton of bear revealed by melting ice.

In contrast with the generally relaxed Danish attitude, the atmosphere in Bella Centre is frenetic. People from all over the world are here, and I have the sense that there is an international movement; and again am hopeful that some meaningful decisions will be made. The conference also has a side event exhibition with non-profit organizations to familiarize attendees with the impacts of climate change in different parts of the world, particularly in the developing countries. In another section, the European Union Centre is just dedicated to delegates and has a big screen for the audience. In contrast, the US Centre has a meeting room for official delegates only and the general audience is not admitted. Overall, the Americans and Canadians have come in force. Large numbers of press and governmental organizations are here from these countries, a good sign of the increasing attention that climate change is receiving in the western hemisphere.

The United States focuses on smart transportation

In their meeting room, the American delegates discuss public transport and improvement of their transportation system. This is a major concern, as transportation is responsible for 75% of the emissions in the US. The City of Denver, Colorado is very focused on public transportation and is developing low emission alternatives for driving; as well as investing in public transit. Compact land use strategies create synergies that enhance greenhouse gas reductions. UC Berkeley Prof. Robert B. Cervero calls for urban re-development with program called Transit Oriented Development. Commuting in California is serious issue due to low efficiency public transportation and heavy reliance on cars. He makes the case that this can be overcome with a smart transportation system which utilizes information feedback from the transport grid. This is based on a Scandinavian model that the United States is interested in emulating. Because of this, the American delegation will be taking a tour during COP15 to examine the transportation system in Copenhagen. Also following a Scandinavian trend present for years in Copenhagen and in deployment throughout Europe, the US intends to push for new environmentally friendly techniques such as “bike sharing” in metropolitan areas. Fred Hansen, General Manager of Trimet demonstrates the tram and public system in Portland. Portland is a city that is growing and is investing \$8 billion in TOD programs. In January 2010, American Public Transport Association-APTA has announced a pilot programme. America seems to be very committed on the improvement of the transport situation in the states. Transport is causing high volume of carbon dioxide emission at the moment and the example of Scandinavia can be very positive to a smarter transport system of the United States. |

Solar Day

It's the fifth and last day in Copenhagen, and still no discussions about solar energy. This is weird to me as the growing population of the Earth is demanding more energy, and renewable should be one of the main topics for providing needed power and reducing carbon emission. While sitting at the café table, I see a leaflet titled “Solar Day at COP15”; just in time!

At Bella Centre, Bellona Foundation and Renewable Energy Corporation (REC) have organized a full day on solar energy. REC is a leading vertically integrated solar player, and is one of the world's leading manufacturers of cells and wafers for modules. Bellona Foundation is an international environmental non-governmental organization that takes a solutions-oriented approach to building a sustainable future. According to Bellona, today there are 5,000 gigawatt-hours of photovoltaic solar production with an overall energy market share of 0.6%; but is forecast to reach 8,100,000 gigawatt-hours by 2050 reaching a market share of 21.6%. There is an understanding

here that solar energy will be a significant contributor to the management of climate change and in meeting the world's need for energy.

The day is kicked off with an introduction from Mr. José Maria Figueres, Ambassador for the Global Observatory and former President of Costa Rica; leading into a presentation by the event sponsor, Mr. Ole Enger – CEO & President of REC. He's presenting the world energy environment, and where solar fits into the picture. By 2100, the energy requirement of the world will be 2,400 exajoules, an extremely high demand comparing with the present 500 exajoule consumption. 50% of this demand is expected to be fulfilled by renewable, 10% from oil, 5% from nuclear power, 4% coal, and 25% from natural gas. But what part does solar energy play in the renewable slice? A pro of solar energy is that the sun supplies virtually unlimited energy; there is more energy delivered by the sun in one hour than what is consumed by the world's population in one year. Carbon emission from solar energy is very low comparing with the other sources, the U.S. Energy Information Administration has identified that solar energy results in emissions of 35 grams of carbon dioxide per kilowatt-hour of energy produced. This is in the ballpark of nuclear and wind power and is expected to be reduced to 15 grams with continued improvements in the production process; which is the sole source of emissions related to solar energy. Carbon dioxide emission from solar energy is very low comparing with the traditional energy means such as coal gasification (including carbon dioxide capture and storage) with 200 grams of carbon dioxide per kilowatt-hour of energy produced or combined cycle gas turbine – CCGT, with 400 grams of carbon dioxide per kilowatt-hour of energy produced.

Another benefit of solar energy is presented, which is the payback period as defined as the time it takes a solar panel to generate the same amount of energy that was used to produce it. With current technological means, REC declares that its solar panels can reach around 1 year payback time comparing with 2.1 years standard for monocrystalline modules and 1.8 standard years for multicrystalline modules. This means that for the remaining 24+ years of its guaranteed lifetime, a solar panel will be "energy positive". An important consideration for the electrical grid is not just production but also the distribution costs, such as from the high and low voltage networks, the transformers, and the customer service. The price of consumer electricity includes generation cost as well as transmission cost. Solar energy has the advantage that it can be produced near or at the point of consumption. The major barrier of the solar technology is still the up-front price; the capital cost is what is limiting solar investment and installations for residential, commercial, and larger applications. Enger is presenting a case that these costs will be reduced drastically; reaching cost equivalence or "grid parity" with traditional energy means in the near future. The per Watt price of a photovoltaic module has dropped from \$60 in 1980, to \$6 in 2000, and crossed \$4 in 2006. This decrease is proportional to the increase in cumulative worldwide module production, which was 10 megawatts in 1980, 1200 megawatts in 2000, and 10,000 megawatts in 2006. The current status of grid parity shows that Italy has already broken even, while China, Japan, France, and some high energy costs states (such as New York) are just behind the curve.

Currently the stake in the solar market has Germany with around 3,000 megawatts in 2009 installed capacity; with Italy, Japan, the United States, and Spain with less than 1,000 megawatts installed capacity. However, the growth in installed capacity is looking to be exponential; global cumulative installed capacity was 2,000 megawatts in 1998 and was almost 16,000 megawatts in 2008. This is approximately enough solar power to energize one of the world's largest cities; such as New York or Mumbai. Looking at differences in national markets, both Germany and the United States have increased their annual added capacity by 50% between 2008 and 2009. These come off two different bases, however. Germany installed 2,700 megawatts in this last year versus 500 megawatts in the US; despite the Americans having 4 times the population. Three reasons contribute to the relative success of the German solar model: development targets and policies, well

designed incentives, and effective bureaucracy. The Germans have set national long term targets and clear policies, while the US remains fragmented and insecure. Access to the grid was facilitated, their feed-in-tariff is simple to understand and cost efficient. The American model still lacks sound rules for grid connection, and there are many complex incentive schemes that add costs and hurt efficiency. Less well known is that the German bureaucracy is efficient with documentation while the American system is difficult to understand and has numerous delays associated with processing.

The European Photovoltaic Industry Association (EPIA) has supported solar photovoltaic as a mainstream power source for Europe by 2020, stating that PV electricity can provide up to 12% of the EU electricity demand by 2020, from less than 1% today provided, given that the right conditions are created by policy makers in national government. A 12% market share is a lofty goal, but completely achievable and desirable, not only for Europe but for the world as a whole. To do so, it is important to set long term targets and policies that build confidence for investments in manufacturing and deployment. Second, incentive schemes have to be effective and cost efficient, the lifetime of incentives has to be decreased in a way that fosters further innovation; which has to be prioritized over economic generosity. Finally, the industry must continue to bring down costs to achieve grid parity through increases in scale, efficiency, and the ongoing development of technologies.

Eric Sauar, Senior Vice President and Chief Technology Officer of REC elaborates on a joint venture between REC and the Energy research Centre of the Netherlands (ECN); aiming to achieve a new world record in solar energy: making the world's first multicrystalline solar modules with 17% efficiency. The previous world record stood at 16.5%, and its breaking represents the innovation race currently underway in the solar industry. These current world-record wafers are characterised by a very low level of impurities and dislocation densities achieved by using REC's latest generation wafer furnaces. ECN produced the cells and assembled the world record solar module. This modest improvement alone can reduce carbon dioxide emissions by 15 million of carbon dioxide emission.

At the end of the solar day Dr. Murray Cameron, vice president of EPIA, emphasises the importance of industry support to reach the 12% solar goal by 2020. His perspective is that this target can be met through price reduction alone. He underlines the point that the solar industry has created more jobs than nuclear and coal respectively. Talking about the growing use of the feed-in-tariff to support solar, he reminds the group that this was not a German invention but comes from the United States. A wider use of the feed-in-tariff in the US can expand the market and balance environmental and economic interests. The solar market also has to expand in China, the world's leader in carbon emissions. Sauar reveals that the price of solar modules will decrease under 1€ per Watt in 2010. After a question from the public about the green certificates for solar, Mr. Sauar uses rhetoric comparing a 5 years old boy as Solar with 10 years old boy as wind: "when we will reach 80 gigawatts in 2020, we will be ready to get green certification".

Fortunately, solar energy had its voice in COP15 and the 12% solar goal for 2020 will hopefully not be just a dream. The sun is shining every day and the energy it provides can make a significant difference in climate change and in meeting our energy needs. It's becoming clear that greenhouse gasses, climate change, and environmental damage have the potential to change the socio-economic balance of the world in ways we can't yet predict. Yet the solutions to some of these problems lie in the environment itself. There's potential that if we continue to work to conserve and justly use our resources, the environment will return the favor and protect us.