



# Copenhagen – end of the beginning

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**Speech date:** 16 February 2010

**Venue:** Yale Centre for Environmental Law and Policy

It's good to be here at Yale this evening and my warm thanks to Dan Esty for his kind invitation.

It's just two months since Copenhagen but the dust is settling. The world invested heavily in the climate summit and there was a powerful political build up. All the big global players were present – Premier Wen Jiabao of China, President Obama, President Barroso of the EU, UN Secretary General Ban Ki-moon and many others.

And yet – despite this truly heavyweight participation – the outcome suggested disappointment and failure. Why? Were expectations simply too high? And have we really failed?

We believe there is room for a more pragmatic view.

In reality it was always doubtful the deliverables from such a complex multilateral negotiation could match the hype that preceded it. But a number of important tasks were accomplished. For these reasons I concur with Professor Robert Stavins at another great American University when he wrote that after Rio and Kyoto, Copenhagen was a “potentially very important third step” towards meaningful global action on climate change.

In simple terms this is because, for the first time, Copenhagen brought the US and China into a global framework for committed action. The Copenhagen Accord may not be perfect but it could be deliverable – and it is this combined with the level of participation which gives reason for encouragement.

The participation of so many world leaders at the crucial moments means it would be genuinely surprising if the issue was allowed to slip too far down the international agenda. So personally, I do see Copenhagen as ‘the end of the beginning’ in moving from thinking and global debate to concerted and material action.

It can also be argued that the Copenhagen Accord shifts the architecture of the global climate change response. In many respects a ‘top down’ approach of ‘dividing the cake’ of global CO<sub>2</sub> emissions has been replaced by a ‘bottom up’ architecture of national and regional undertakings. It may not be neat and tidy and the models may indicate an outcome outside the consensus ‘safe’ limit of an average 2°C temperature rise.

But at least we will know where we stand. Governments will then have to decide if they are doing enough – and voters will be able to make similar judgements. Meanwhile there should be more scope for each major jurisdiction to decide and deliver its own next steps.

My argument today, therefore, is that we now need to move forward with material action in each major economic jurisdiction on a pragmatic basis - not to give in to despondency about what was not achieved but to focus instead on what can be done over the next two decades. We know enough to do a lot and we must start now.



I said the next two decades because the underlying urgency has not disappeared. Of course the immediate priorities in the US and Europe have shifted to dealing with the recession, while the erosive impact of some poor climate change science needs to be recognised and addressed.

However, the basic physics of global warming have not changed and the longer term impact remains of fundamental concern. The progress we make by 2030 will still determine whether we have a chance of halving global emissions by 2050. If we sit paralysed by our current inability to agree binding dates and targets, we will find ourselves in real peril. Copenhagen correctly recognised the long-term challenges but I also believe we need to stop “polishing the 2050 diamond” and instead deliver material action today in the right direction.

If the magnitude of our actions is large enough and the direction approximately on-target, then we can move forward now and if necessary adjust as we go, both in terms of the signals we put into the economy, and in light of new technologies and innovation. If we begin the right way, being careful to respond to all the challenges of energy security, competitiveness and climate change, then we can also benefit through making our economies more secure, cost efficient and competitive at the same time.

This morning I would like to deal with three steps in a pragmatic response. The first is practical action and what this really means. The second is to think about the policies that can support practical action. The third is to consider which partnerships are key to success. Before concluding I would also briefly like take a look at the role of BP as one of the world’s leading global energy companies.

## Practical actions and energy pathways

### Foundations of action – good for all seasons

There are a whole range of actions we can take that are good for all seasons – not only for climate change but for energy security and economic competitiveness. The most important of these in my opinion are energy efficiency, technological innovation, ensuring markets are efficient and setting an economy-wide price for carbon.

If there is a silver bullet it is energy efficiency. This means efficiency in energy production and distribution, in transport and in end use including equipment and buildings.

The well-known McKinsey curve is a powerful reminder of what could be achieved. Energy use could be cut by more than a fifth by 2020 - and 8 billion tonnes of greenhouse gases avoided - through energy efficiency investments that could pay for themselves without a price on carbon dioxide.

Innovation can sound like a cliché but it is clear that technology development is essential to resolve the trade off between immediate costs and long-term benefits in addressing energy security and climate change.

Of course innovation is not a new subject and certainly not here at Yale. For our part in BP we have learned a great deal from the ‘innovation machine’ in the US and also from emerging economies such as China. There is still much that can be done through good policy and well structured incentives to move US and global innovation into an even higher gear.

Efficient markets are the key to effective resource allocation and the delivery of quality goods and services at the lowest cost to society. This is equally true in energy. From this perspective the highly competitive energy markets of the United States are a true source of global advantage. Europe still



has some way to travel in this direction but a single energy market is nevertheless central to affordable, secure and lower carbon energy supply.

If efficient markets are the key to effective resource allocation, then a carbon price is indispensable to an effective energy and climate policy. A credible carbon price will drive energy conservation and make lower carbon energy choices more cost competitive.

A carbon price can be established by capping carbon emissions and allowing a traded market to find the clearing price. The carbon price can also be imposed through a direct tax or other charge or can be implied by regulation. In our view the cap and trade system has merits for large industrial installations - such as power stations or oil refineries - as it is targeted directly at the desired outcome of reduced CO<sub>2</sub> emissions.

However, the overall choice and mix of instruments is a matter for public policy and should ensure two things. As far as possible there needs to be a consistent carbon price across the economy as a whole and there should be a direct link between the policy instrument and the choices available to the operator of the source of CO<sub>2</sub> emissions – for example operating a refinery, driving a vehicle or heating a building.

Over time the carbon price – actual or implied - will signal the path to a lower carbon economy but targeted transition measures may also be needed to accelerate the commercialisation and deployment of material new technologies. In such cases, any transition support which implies a price for carbon, should apply only as long as is needed to achieve the commercialisation objective and should ultimately merge with the longer term carbon price.

And finally we must not forget the challenge of public acceptance. We are talking about changes that will impact people's lifestyles and expectations. Whether this is about nuclear power, vehicle efficiency or home insulation, the trust of the public must be secured and education and information will play a central role.

Having covered the necessary foundations, I would now like to turn to the core of my talk - energy pathways and what is required in terms of policies and international partnerships.

## Energy pathways

Over the last few months in BP we have worked hard to build on these foundations and to develop practical proposals for the two core products that we deliver to our customers – fuels for transport and primary energy for electrical power generation. Working through an extensive process of technological and economic evaluation and peer review, we have attempted to define cost-effective pathways to a lower carbon economy in both these areas.

The outcomes suggest that a great deal of progress can be made through the progressive application of cost effective technologies and energy mix decisions.

Let's look first at vehicle transport.

This chart shows declining CO<sub>2</sub> per km driven versus the purchase cost of vehicles with new technology relative to conventional gasoline cars today.

The key is to distinguish between near-term and longer-term options. In the longer-term, electric vehicles and hydrogen fuel cells may well have a part to play but will need a much higher availability of decarbonised grid electricity to deliver full CO<sub>2</sub> reduction potential. You will see on the right hand



side that the grid has to get below current average emissions for Battery Electric Vehicles to become better than hybrids and they are significantly more expensive today.

In the shorter term, by far the most effective pathway to lower carbon transport is to make existing vehicle engines more efficient. In particular there are major gains to be obtained from advanced gasoline engine technology. Combined with step by step hybridisation – starting with recovery of braking energy – we can see the potential for nearly halving CO<sub>2</sub> emissions per km. And importantly this can be delivered at a much lower incremental cost than a full battery electric vehicle.

When such a vehicle pathway is combined with the use of the right biofuels, it becomes even more effective in reducing CO<sub>2</sub> from transport.

Biofuels work by removing CO<sub>2</sub> from the atmosphere during growth before releasing again in combustion. Indeed some biomass sources such as grasses can remove more CO<sub>2</sub> from the atmosphere than they release in combustion by also fixing CO<sub>2</sub> in the soil – a potential reduction of greater than 100%.

This is why as BP we are investing significantly in sugarcane ethanol, advanced biofuels such as biobutanol and ligno-cellulosic conversion, to provide biofuels that don't compromise food production or endanger biodiversity but do produce substantial 'well to wheel' CO<sub>2</sub> savings. When combined with advanced gasoline technologies and hybridisation, the way is open to even more significant improvements in overall vehicle CO<sub>2</sub> performance.

The development of electrical vehicles will continue but we need to be clear that the next steps on the pathway to lower carbon from transport will come from advanced engine technologies (especially gasoline), progressive hybridisation and greater use of the right biofuels.

This in turn will lever the huge existing infrastructure of vehicle manufacture and supply of high energy density liquid fuels, to provide efficiency gains and substantial CO<sub>2</sub> reductions, while still allowing the time and resources needed to find and develop longer term solutions. We also must remember that transport accounts for 20% of global GHG emissions and about one third here in the US.

I would therefore now like to turn to pathways for lower carbon power generation.

Huge additional electrical power capacity is required globally by 2030 and the decisions made about this capacity will impact energy security and CO<sub>2</sub> emissions to 2050 and beyond. If we make the wrong decisions now, we are locked in to the consequences for a long time to come.

In this context, there are a small number of really material things which can be done. We see a pathway which has at its heart first energy efficiency and then the use of more natural gas, together with entry or deepening into nuclear in some jurisdictions and the potential use of CCS for some coal applications. Renewable sources will also play a role, but we believe will not provide material scale capacity addition with the required level of certainty until 2030 and beyond.

Why do we believe it makes sense to use more natural gas for electrical power? Gas is easily the cleanest burning fossil fuel, with CO<sub>2</sub> emissions in power generation around 50% of those from coal. It's also very efficient with conversion efficiencies about 35% better than coal. Combined-cycle turbines, fuelled by natural gas, are quick and relatively cheap to build. As indicated on this chart, Combined Cycle Gas Turbines produce about 400 kg CO<sub>2</sub>/MWhr or about half that of Super-Critical Coal, while average capital per kW is about \$1,000 compared with around \$2,500 for coal. So on the basis of capital cost per kg CO<sub>2</sub>/MWhr, gas generation can be seen as about four times as efficient as coal.



Furthermore, the flexibility of natural gas fired plant can provide an efficient complement to renewable energy, by covering the inevitable intermittency of wind and solar power operations.

The good news, especially in the US, is that there is also plenty of natural gas available. The development of so-called 'unconventional gas' – in shales, coal beds and tight rock - has approximately doubled US resources to between 50 and 100 years of consumption. The US has [again] just overtaken Russia as the largest natural gas producer in the world.

So although natural gas is sometimes described as a 'bridge fuel' to a lower-carbon future, it also has the resource base and natural performance advantages to be a preferred energy choice.

And in terms of energy security there is another important factor at work. A great deal of liquefied natural gas (LNG) capacity is being developed around the world, in part in the expectation of supplying the US market. With the growth of US indigenous resources, some of this production is being displaced from the US onto the world markets, where it is competing for the first time with other gas on the basis of price rather than indexed contracts.

This is especially important for Europe, because it address the perception that greater use of natural gas would mean greater dependence on a narrow range of gas suppliers and on Russia in particular. In fact the opposite is becoming true. And this is also important for the US through placing domestic supplies in the context of a diverse and well supplied global position. Under these supply circumstances it is unlikely that the price of natural gas will see the same volatility as in the past, and indeed today it has become de-linked from the oil price.

Given these facts it seems extraordinary that the US is still focused on building coal fired power plants instead of natural gas. At present coal firing accounts for 50% of US electricity generation but 81% of CO2 emissions from power generation. Ramping up US natural gas consumption by a readily achievable one trillion cubic feet per year would allow 150GW of the oldest and most polluting coal plants to be retired – some of them after nearly one hundred years of service.

So to summarise, we see natural gas as a key ingredient of a secure pathway to lower carbon power, together with energy efficiency and nuclear, coal with CCS and renewables to the extent that they can with certainty provide material additional capacity.

And where nuclear is part of the energy mix, as in the US, the process of renewal needs to start now, in order to progressively replace the existing fleet of stations even before providing real growth.

Finally, a word on heating. Again, natural gas can provide a very effective solution and on top of that the key theme is once again energy efficiency. We have much further to go in making our use of heat and power in homes, offices and buildings generally more efficient. Policies have not been effective yet in changing behaviour in this regard. So, let us now turn to policy.

## Policies

Energy policy must enable the pathways to take effect as quickly as possible and should be designed to achieve three things:

1. enable choices and actions consistent with these pathways to deliver significant impact
2. limit and ideally minimise the cost to society
3. build capability to sustain, improve and innovate



Policies should aim to deliver a more secure and lower carbon economy through enabling cost effective pathways in the crucial transport and power generation sectors. So what policy options can be pursued to make these pathways a more immediate reality?

First it is important to be clear that the US is already well advanced in terms of many of the things that need to be done.

The decision of the Obama Administration in 2009 to significantly tighten the Corporate Average Fuel Economy (CAFE) standards in coming years, will act as a substantial incentive towards the development of more fuel efficient engines.

The support of the Administration for the development of advanced biofuels is also extremely important. As we have seen, there is great potential both for efficiency gains and CO<sub>2</sub> emissions reduction, from a combination of advanced gasoline technologies and greater biofuels blending.

And this in turn can secure and strengthen the hugely important place of the auto sector in the US economy for decades to come.

In terms of economic incentives, we continue to believe that a consistent price for carbon applied across the economy, whether determined through cap-and-trade or some other mechanism, offers the best means of promoting efficient pathways to a lower carbon energy future.

However, if a carbon price does not materialize in the immediate future, then there are still many pragmatic and productive actions that can be taken.

One that we have placed on the table is to incentivize the retirement of the oldest and dirtiest coal-fired power plants and their replacement by modern combined cycle natural gas-fired installations.

We believe this would be the single best step that could be taken at this point in time both to enhance energy security and to move us down the pathway towards lower carbon power generation.

Any bill in Congress that aims to strengthen security and reduce CO<sub>2</sub> and other emissions must address the oldest and most polluting coal-fired plants and increase the use of natural gas.

Encouragingly this approach appears to be gaining support in Washington. Interior Secretary Ken Salazar has said that natural gas should play a more prominent role in the US energy picture. And so have former Vice President Al Gore, Senate Majority Leader Harry Reid, and Energy Secretary Steven Chu.

Looking further ahead, new electricity generation capacity should be met by a combination of natural gas, nuclear, coal with CCS and renewable energy sources, developed at a pace that is technologically and economically feasible and aided where appropriate by transitional incentives.

If we do this, then I believe we have a good chance of satisfying energy demand in a secure manner at an affordable price and at the same time significantly reducing the amount of carbon dioxide we put into the atmosphere.

## Partnerships

I have argued today that Copenhagen is not an end but a beginning and each jurisdiction, including the US, needs to find a pragmatic way forward. However, it is equally true that working together we



can achieve more than we can by working alone. This does not require a detailed treaty between 192 countries, but it does imply much greater alignment between the major blocs.

There is both a need for and a benefit from partnership and here the US and Europe have a real opportunity.

The trans-Atlantic relationship still accounts for the largest part of global trade and investment flows and of scientific and technological capital. As successive surveys show, our basic values and views still have much more in common than there are differences. Our commerce and industry are structured in similar ways and have huge areas of overlapping investment, trade, technology and ownership. And within these industries, we have similar advantages of accumulated capital, expertise and infrastructure and comparable challenges of modernisation, renewal and global competitiveness.

Of course policy and regulatory choices are a matter for our respective Administrations and legislatures, and our energy mix is a little different. But given the scale of global challenges, it makes sense to look for the many areas of alignment and common interest in the way we approach these questions. And it would certainly make no sense at all to allow the development – even through unintended consequence – of new barriers within the trans-Atlantic economy.

Nowhere is this more true than in energy and climate policy. There is a huge opportunity to move at a broadly similar pace in a broadly similar direction in a way that strengthens our shared economic interests and does not produce misalignments and dislocations.

This does not mean that we necessarily need the same instruments of policy. The emissions trading system is well established in Europe but other approaches may be taken in the United States. The issue is not the regulatory instrument but the direction and pace of policy implementation.

If we can move at a broadly similar pace and remain coherent in terms of the timing and magnitude of key signals into the marketplace, we will strengthen both the US and European economies and – even more important – the competitiveness and influence of the trans-Atlantic economy in the global picture. An aligned approach in Europe and the US would naturally lead to other economic blocs joining in, especially those which trade extensively with the US and Europe, such as China.

And if we insist on sticking to narrowly defined interests, then we will in due course achieve the opposite.

The call for broad trans-Atlantic alignment in energy and climate approaches is a challenge, not least when political confidence is at a low ebb in Europe in particular. However, we have a new trans-Atlantic structure in place in the form of the Energy Council and strong areas of common understanding and commitment on both sides of the Atlantic. It seems to be the right moment to take up the challenge with renewed vigour.

## BP's role

Before closing, let me say a few words about the role of BP.

Against the backdrop of the world after Copenhagen, our aim is to contribute more fossil fuels today, to enable their more efficient production and use and to make a material contribution to a lower carbon future. It is a journey we began in 1997 and which extends out to 2050 and beyond, and it is what we mean by 'Beyond Petroleum'.



For this journey the world still needs fossil fuels and we will strive for exploration success, to access new frontiers, to bring in more natural gas and local hydrocarbons and to deliver secure fuels to the market safely and at a competitive price every day of the year.

In the drive for efficiency, we will collaborate with the vehicle manufacturers on advanced engine technology and lubricants and provide better and cleaner transport fuels through less energy intensive processes.

And we will make a material contribution to the lower carbon journey, through the development of natural gas, the right biofuels, through carbon capture and storage and wind power and by addressing the challenges of solar energy.

I would remind that we were the first energy company to be widely recognised as accepting the obligation to act on climate change. We have invested nearly \$4bn in our low carbon business since 2005 and we are on course with our commitment to invest \$8bn in alternative energy by 2015.

We have a track record of collaboration and investment in cleaner fuels and manufacturing processes. We are investing heavily in current and future energy supply to the United States and Europe and we are committed to well-informed interaction with Administrations and legislatures on energy and climate policy.

I hope you will agree that it is a pragmatic approach that addresses the need for practical action.

## Conclusions

Ladies and Gentlemen, to summarise.

It is clear we know enough already about what can be done to make a material impact on energy security and a lower carbon future. We are at the end of the beginning and the start of a next phase of pragmatic and material action. We must stop “polishing the diamond” of the destination. We need to pursue policy not politics. We need to pursue good policies that stimulate a material response. And we can be confident that there are clear and logical pathways ahead for both transport and power generation that can move us in the right direction.

Our Administrations and legislatures must continue to drive policy in this direction, with continuity and predictability and wherever possible with trans-Atlantic alignment in terms of pace and signals to business.

And business is also ready to do its part.

I think it is a robust agenda and one where we can make a real contribution, and I have no doubt that universities such as Yale and my Alma Mater Imperial College can contribute materially to shaping the thinking, to stimulating innovation and to enabling the solution.

Thank you for listening.