

Presentation of the World Energy Outlook
Clean Energy Council, 24 November 2008
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SLIDE ONE

Distinguished guests, ladies and gentlemen, it is an honour for me to participate in the annual conference of the Clean Energy Council, and I thank the CEC, particularly, CEO Andrew Warren, for this opportunity.

[Let me briefly tell you a little about the organisation I represent. The IEA was established in 1974 by major oil consuming states, when the world was facing the first oil shock/embargo by OPEC. Its chief concern at the time of its creation was to ensure energy security, particularly during times of physical supply disruptions. But while the IEA was established principally to address energy security in terms of physical supply disruptions, our remit has now extended far beyond that, as energy issues and energy policy have become increasingly linked to wider global affairs. Climate change and the importance of clean energy technology – the topics that bring us here to this conference today – are prime examples of that.]

As the 4th Assessment Report of the IPCC makes clear, the global threat of climate change is very real. We – as a collective humanity – must respond. And with the energy sector as the single biggest contributor to global greenhouse gas emissions, energy must of course be at the very centre of that response. But bringing about far-reaching energy sector reforms in the near to long term will not simply be good for climate change. Such reforms are also vital for long-term sustainable economic development and for addressing global energy security. As such, we must view the challenges of climate change, sustainable development and energy security as inherently linked, and seek to address them together.

In the next half an hour or so, I would like to share with you the IEA's views on options for a cleaner, more sustainable energy future, drawing from the latest edition of the IEA's *World Energy Outlook*, released just two weeks ago.

The *World Energy Outlook* – or *WEO* – is a flagship publication of the IEA. Released annually, it provides projections on our global energy prospects to

2030. It is a crucial means by which the IEA seeks to contribute to a better understanding of the energy security and sustainability challenges facing our world. And with its focus on low-emissions energy policy scenarios this year, I believe that the 2008 edition of the WEO is more important and more relevant to addressing the global challenges of climate change and energy security than ever.

SLIDE TWO

Let me start briefly with the context. Clearly, the world looks a little different now than it did less than half a year ago.

Recent global events – such as lower oil prices, downward energy demand in some regions, and worrying global financial developments – may have eclipsed our focus on longer term concerns about energy and climate change over the past few months. This leaves many questions, such as:

- what the future is for energy demand;
- whether the increasing signs of reduced and deferred investment mean that we will face a future energy supply crunch when the economy recovers;
- and – most importantly for this conference – whether we can maintain our focus on energy security and environmental concerns, and whether the Copenhagen climate change negotiations next year can still gather the political will needed to ensure a sound post-2012 climate framework.

It is very easy at such times to cast aside our focus on longer-term concerns. But allow me to remind you of something by way of a small analogy: when you drive a car, it is very difficult to steer properly if you only fix your eyes on the road right in front of you. The path becomes much clearer if you rest your eyes further ahead, and also keep an eye out into the distance. My point is that the global financial conditions facing us at present are nothing short of critical, yet it is vital that we keep our eyes on the medium and longer term target of a more secure, sustainable energy future for all. This latest version of the *WEO* makes that strikingly clear, arguably containing some of our strongest messages on the topic yet.

So with that, I will turn to the substance of my presentation on the 2008 World Energy Outlook's messages for climate policy action.

SLIDE THREE

I will first start by setting the context, by outlining the prospects for global energy supply and demand to 2030.

SLIDE THREE

This first graph shows what would happen to energy demand if only existing policies were to remain in place until 2030 (our so called 'Reference Scenario' or 'business as usual model'). It demonstrates that world primary energy demand will grow by 45% from 2006 to 2030, which is an average annual growth rate of 1.6%. The graph also shows that fossil fuels will account for around 80% of the overall increase in energy demand between now and 2030. Though not shown in the graph, it is important to note that non-OECD countries account for 87% of global energy demand growth between 2006 and 2030. The increase in China's energy demand outpaces that of all other countries and regions.

Coal becomes an increasingly important part of the energy mix in the Reference Scenario. In fact, it consolidates its position as the world's 2nd most important energy source after oil.

This overall increase in global demand is driven largely by rising population and GDP. Economic development is of course very important. But our analysis shows that our current energy trends are unsustainable – socially, environmentally AND economically. Rising oil and gas demand would lead to higher imports and reliance on OPEC, heightening concerns about energy security. Increased use of fossil fuels would also worsen climate change. This is why the IEA is urging all governments to encourage a shift to cleaner and more efficient technologies that can curb the growth in carbon emissions.

SLIDE FIVE

As mentioned, the role of coal becomes increasingly important in the Reference Scenario. Between 2000 and 2006, global coal consumption grew faster than any other fuel, despite higher prices – by 4.8% per year between 2000 and 2006. Most of this growth occurred in non-OECD countries.

[CLICK TO REVEAL RIGHT CHART] In our Reference Scenario projections to 2030, coal demand advances by 2% per year on average (its share: 26% to 29%). As such, coal will account for over one third of the increase in total energy demand to 2030. And non-OECD countries account for 97% of the increase in global coal demand, with China alone accounting for two-thirds of the demand increase. Most of the increase in demand in all regions comes from power generation.

SLIDE SIX

Let's have a look at oil. This graph depicts global primary demand for oil (excluding biofuels). It shows that growth rises by 1% per year on average, from 85 million barrels per day in 2007 to 106 mb/d in 2030.

All of the projected increase in world oil demand comes from non-OECD countries: over four-fifths of the increase comes from China, India & Middle East. Notably, the Middle East will move to become a consumption centre. China's contribution to incremental global oil demand alone is 43%. [CLICK TO SHOW RED ON GRAPH] Meanwhile, OECD oil demand falls slightly, due mostly to declining non-transport oil demand. As a result, we see the non-OECD demand share of oil surpassing that of the OECD in around 2015.

SLIDE SEVEN

With regard to renewable energy, most of the increase in use is for electricity generation. The share of renewables in total electricity generation worldwide rises from 18% in 2006 to almost 23% in 2030 in the Reference Scenario, with renewables overtaking gas to become the second-largest source of power generation. This may sound significant, but in our two low emissions policy scenarios, which I will discuss shortly, the share of renewable energy in electricity generation is even higher – rising to 30% in our 550ppm scenario and 40% in our 450 ppm scenario.

In the reference scenario, most of the increase in renewables-based power generation occurs in OECD countries, where non-hydro renewables output grows strongly (from 3% to 14%). In non-OECD countries, the overall growth in renewable is lower, however, non-hydro renewables do grow from less than 1% to 5%. [Need bigger, larger, integrated markets – e.g. in Australia, need

federal system, not state by state. Also requires government support, particularly in the early years.]

SLIDE EIGHT

One important factor to take account of is fossil fuel subsidies, which encourage consumption by pricing energy below market levels. In most non-OECD countries, at least one fuel or form of energy continues to be subsidised, most often through price controls that hold the retail or wholesale price below the true market level.

According to our calculations, energy-related consumption subsidies in 20 non-OECD countries amounted to about \$310 billion in 2007. Oil products account for one-half, or \$150 billion, of this. Of course, it must be noted that most of these countries do have policies in place to phase out consumption subsidies eventually – which the IEA applauds – and we thus assume that these subsidies will gradually be reduced.

I would also add that in the context of the imperative to address climate change, the introduction of a comprehensive carbon price is a further reason necessitating the phase out of fossil fuel subsidies.

SLIDE NINE

This business as usual energy scenario is not only unsustainable from a climate change perspective. It is also limited from an economic perspective. The mismatch between demand growth and the sources of incremental production increase inter-regional trade in oil and heighten the import dependency of some regions. In particular, Europe and Asia become even more dependent on imports over the projection period. In Asia, the increase in dependence is particularly dramatic in India and China.

As such, the supply security risk for these regions may also increase to 2030. Not only does this heighten the need for the development of oil emergency, it provides a further basis for increasing efficiency and pursuing alternative sources of energy.

SLIDE TEN

As my final point in this introduction to the IEA's reference energy scenario to 2030, let me make a comment on oil production. Our analysis of 800 oil and gas fields globally indicates that declines in crude oil production at existing fields mean that the gross additions needed for capacity far exceed the net additions needed to meet growth in demand. To keep the current level of production, gross additions between 2007 and 2030 amount to 45 mb/d – or four times the current capacity of Saudi Arabia. So we need four Saudi Arabias just to offset the decline in production. And by 2030, two-thirds of world production will come from new fields that are either awaiting development today or are yet to be found.

This will require significant investment. In fact, let me tell you here briefly about the overall investment in energy infrastructure needed to 2030 in the reference scenario. Our projections call for cumulative investment in energy supply infrastructure of \$26.3 trillion (in year-2007 dollars) during the period 2007 to 2030. \$13.6 trillion of total investments must be directed toward the power sector, while \$6.3 trillion must go to the oil sector.

But there are now concerns about whether all of this investment will in fact be forthcoming – particularly in the near term in view of the current financial crisis. But we would urge governments and the private sector not to back track or delay on investments. In fact, such investment can play an important role in stimulating the global economy, including by investment in green and lower emissions energy activities.

SLIDE ELEVEN

So I have now set the scene. I have explained to you that in the IEA's view, our 'business as usual' energy pathway is patently unsustainable. Let me now address the climate policy scenarios set out in this year's World Energy Outlook.

SLIDE TWELVE

I will begin this section with a general comment on projected CO₂ emissions from energy related activities, which currently account for around 66% of emissions. In the Reference Scenario, rising global fossil fuel energy use will continue to drive up energy-related CO₂ emissions to 2030. World emissions

will jump by 45% between 2006 and 2030 to 40.6 gigatonnes, with a growth rate of 1.6% pa.

As you can see in the graph, coal in non-OECD countries remains the biggest contributor to global emissions and its share increases over time (having overtaken oil as the leading source of emissions in 2004). [Meanwhile, China, India and the US together account for more than half of total global emissions in 2030 – 20.8 Gt.]

This trajectory puts the world on track for a long-term concentration of greenhouse gases in the atmosphere of over 750 ppm of CO₂. Based on the IPCC's 4th Assessment Report, this could result in a global temperature increase of around 6 degrees to the end of the century. As you all well know, this could in turn affect natural ecosystems, agricultural activity, the likelihood of extreme weather events, human health, and so our very prosperity. This is a disastrous scenario.

SLIDE THIRTEEN

To respond to this greenhouse gas challenge, the 2008-WEO considers the climate-policy framework for moving the world to two different lower emissions scenarios:

1. the 550 Policy Scenario – where the atmospheric greenhouse gas concentration is stabilised at 550 ppm of CO₂-equivalent. This implies a temperature rise of 3°C.
2. the 450 Policy Scenario – where concentration is stabilised at 450 ppm and a temperature increase of around 2°C is anticipated.

One thing is clear – in order to meet a 450 or 550 ppm Scenario, action needs to be global. While there are many options for who ultimately pays for emissions reductions, reductions to Reference Scenario emissions are needed in all sectors and all regions.

The chart provides a stark demonstration of this. In 2030, the emissions level that needs to be achieved globally in the 450 Policy Scenario is lower than the business as usual scenario emissions of just the non-OECD countries. One can apply a similar logic to show that all major world regions, whether in OECD or

non-OECD countries, would have to be actively engaged in abatement relative to the Reference Scenario, in order realistically to achieve these scenarios.

SLIDE FOURTEEN

In developing the two policy scenarios (550 and 450 ppm), we focused on the role of the energy sector, concentrating on the period to 2030. To take account of the different circumstances and preferences of different countries, both scenarios assume a hybrid policy approach that combines:

- a cap-and-trade system with
- international sectoral agreements
- and national policies & measures

In both instances, three distinct country groupings were applied: OECD+, Other Major Economies and Other Countries. (B.R.I.C., Indonesia, Middle East etc)

Before I explain the policy approach in each scenario, let me make an important point: the IEA is not prescribing or recommending that these actions must take place. Rather, the WEO simply presents a scenario projection of what would be required for us to actually meet – with concrete policy changes – greenhouse gas stabilisation of 550 or 450 ppm.

So what does each scenario suggest? In both scenarios, OECD countries such as Australia are assumed to take on cap and trade schemes, as well as sectoral activities and other national policies and measures. In the 550 scenario, Other Major Economies are assumed to implement national policies and measures in the power generation, industry and buildings sectors. It is also assumed that they would participate in sectoral agreements in the iron & steel, cement and transportation sectors (vehicle- and aircraft-manufacturing).

The report assumes different approaches for Other Major Economies than for OECD countries, based on their different national circumstances. For example, in the 450 Policy Scenario Other Major Economies are assumed to participate in the cap and trade system in power generation and industry. But this is only assumed to take place from 2020 onwards, leaving plenty of time to prepare for such a system. The 450 policy scenario also sees the average fuel efficiency of the global Light Duty Vehicle fleet improve 43% beyond 2008

standards (as compared with an improvement of 24% on 2008 standards in the Reference Scenario).

SLIDE FIFTEEN

[CLICK TWICE TO REVEAL ALL OF GRAPH.] This graph shows the trajectories for energy-related CO₂ emissions to 2030 in for the 550 and 450 ppm scenarios. Assuming 3.3% global GDP growth to 2030 as in the Reference Scenario, we have to reduce emissions from a projected 40.6 Gt in 2030 to 33 Gt in the 550 ppm scenario and 26 Gt in the 450 ppm scenario. So we must think of reducing not from the current 29 Gt, rather, the reduction is from the projected 40.6 Gt in 2030 in the business as usual scenario. As such, the two low emissions scenarios require a transformation of the energy sector. Measures in three areas in particular will be vital:

First: Improved energy efficiency makes the biggest contribution to lowering emissions in both scenarios as shown here, comprising 54% in the 450ppm scenario. Realising these efficiency gains is an enormous challenge. This depends on the purchase of efficient technologies, such as clean vehicles, efficient appliances or energy-efficient buildings by hundreds of millions of households worldwide. But these are highly cost effective measures and can even lead to savings on energy infrastructure. [I would mention here that the IEA made a set of 25 policy recommendations on energy efficiency to the G8 Summit in Hokkaido in July this year. The IEA is urging global implementation of these recommendations, including by Australia. The recommendations cover a wide range of sectors – from buildings, to appliances to transportation to industry. I have no doubt that the organisations represented here today can play a role in seeing these recommendations realised in Australia.

Second: carbon capture and storage, or CCS, plays a key role in emissions savings, particularly in the 450 ppm scenario. This technology is of course especially important for the sustainable future use of coal. I note in this regard the particular interest in and leadership of Australia in this area, something that the IEA warmly welcomes.

Third, a change to the energy mix is necessary, particularly through the use of renewable energy and nuclear power. This will require the widespread

deployment of low-carbon technologies, both existing and new. Again, your organisations, with government guidance and support, have a key role to play.

SLIDE SIXTEEN

This chart illustrates the scale of transformation needed in the power sector: it is more than a money issue. [CLICK SLIDE SEVERAL TIMES TO GET TO 450 ppm] Power sector emissions need to be cut by two-thirds in the 450 Policy Scenario, relative to the Reference Scenario.

Here the annual global capacity additions needed in this scenario: On an annual basis, over the period 2012-2030, in the 450 Policy Scenario we need to build around 20 nuclear plants, 50 hydro plants, 18 000 wind turbines, 300 CSP plants, and 30 coal & gas CCS plants. The real challenge here is how to get around the 'Not In My Backyard Syndrome', to show the general public that everyone must accept such changes if we are to accept climate change.

SLIDE SEVENTEEN

The climate policy scenarios require a substantial shift in investment patterns and a major transformation of the way investment decisions in the energy sector are taken. I mentioned before that the Reference Scenario projects that investment of \$26.3 trillion is needed in energy infrastructure just to meet growing demand and production decline. Well, in our two low emissions scenarios, significant additional investment is needed in power plants and in more energy efficient energy-related capital stock.

For example, the 450 Policy Scenario requires further power plant investments of \$3.6 trillion and efficiency investments of 5.7 trillion over the period 2010 to 2030 (in addition to that in the reference scenario). In total, these additional investments amount to 0.55% of world GDP on average per year.

SLIDE EIGHTEEN

As well as a need for institutions and a market to enable carbon trading, there will need to be a means of allocating emissions allowances. This could be left to individual countries to decide according to their national circumstances, but for competitiveness reasons, a consistent approach across countries is desirable. One option is auctioning, which allows the revenues to accrue to governments, rather than to exist as windfall profits.

Our projections suggest that annual revenue from full auctioning in 2030 could exceed \$400 billion in the 550 Policy Scenario and \$1.8 trillion in the 450 Policy Scenario, depending on the proportion of emissions auctioned and assuming they were sold at the carbon prices set out in our analysis. Auctioning of emissions allowances could raise substantial funds, to help fund investments and research, or reduce national taxes. Significantly, in both scenarios, revenues from full auctioning exceed the total additional global energy investment needed.

Of course, regions may not wish to engage in full auctioning (indeed, the EU ETS has been increasing auctioning only gradually). However, even with partial auctioning, substantial revenues could be raised. With only 10% auctioning, revenues in OECD countries between 2021 and 2030 would outweigh current public energy sector R&D in these countries by a factor of five.

SLIDE NINETEEN

For my final point in this part of the presentation, let me emphasise that climate change and energy security can be enhanced together: limiting CO₂ emissions will also improve energy security by reducing global fossil-fuel energy use.

This graph shows total oil production in 2030 for the different scenarios. In the 550 ppm scenario, oil demand is 9 mb/d lower than in the Reference Scenario. In the 450 Policy Scenario, oil demand is 16 mb/d lower than in the RS, but is still slightly higher than in 2007. But the world's major oil producers should not be alarmed. Even in the 450 Policy Scenario, OPEC production will need to be 12 mb/d higher in 2030 than today. So demand security for OPEC remains.

SLIDE TWENTY

To summarise the results in terms of climate policy:

Both scenarios are markedly different from the Reference Scenario and require the transformation of the energy sector. While the 550 can be achieved mainly through existing technologies, the 450 ppm scenario requires the rapid development and deployment of new technologies.

Most of the additional abatement in the 450 Policy Scenario is in non-OECD countries. This Scenario involves major economies like India, China and the

Middle East graduating to the cap-and-trade system in 2020, in order to achieve the sharp emissions cuts post-2020.

The impacts of the cap-and-trade system are a carbon price that reaches \$90 per tonne of CO₂ in 2030 in the 550 Policy Scenario and \$180 per tonne in the 450 Policy Scenario.

It is not so much the question here of the additional investment cost, ranging from 0.25% in the 550 to 0.6% in the 450 scenario, that pose the biggest challenge. Rather it is the practicalities and scale of the transformation that will arguably be the most difficult: we need a global energy revolution.

SLIDE TWENTY ONE

NOTHING.

SLIDE TWENTY TWO

I will close with a few brief conclusions.

Current energy trends are unsustainable — socially, environmentally and economically.

To avoid "abrupt and irreversible" climate change, we need a major decarbonisation of the world's energy system. Limiting temperature rise to 2°C will require significant emission reductions in all regions, as well as technological breakthroughs. But it is important to note though that mitigating climate change will have significant co-benefits such as improved energy security and reduced local air pollution. Investment in clean energy can also boost the global economy and here Asia-Pacific can play a leading role. The IEA recognises that Australia takes energy issues and climate change seriously, and we greatly appreciate the steps that Australia has been taking in this regard at the national, state and municipal levels, and abroad. Such steps are both welcomed and encouraged.

Finally, let me conclude this presentation where I began - by linking these longer term challenges back to our shorter term concerns about the global financial system. That is simply to say that the present economic worries do not excuse back-tracking or delays in taking action to address energy challenges. Let's face the new reality: in the long run, the age of cheap energy

(oil) is over, due to the fundamentals of demand and supply and the move toward the imposition of a price on carbon. Only with adequate investment can we ensure a more secure and sustainable energy future for all.

The Clean Energy Council represents businesses and organisations that are at the vanguard of the important work needed to secure a sustainable energy future. And so I wish you very well – both with your discussions at this conference and with the longer term task that lies ahead.