Minister Roessler, Commissioner Oettinger, Secretary Ichord, ladies and gentlemen. It is a pleasure and an honour to address such a distinguished room. I am particularly pleased to be addressing such important industry players – only with close cooperation between government and the industry can we tackle the challenges and realize the enormous investments which lie ahead of us in the power sector.

The world we face is changing rapidly. Over the longer term, electricity demand is of course growing thanks to rapid economic development and population growth in emerging markets - but it is also changing. Massive electrification will mark a global transition to a more advanced energy system. New demands, such as electricity for transportation through electric vehicles, and increased heating and cooling applications, will require very significant investments.

But uncertainties may put some of those near-term investments at risk. Economic concerns have diverted attention from energy policy and limited the means of intervention. Post-Fukushima, nuclear is facing uncertainty. And MENA turmoil raised questions about the region’s investment plans.

The result is that some key trends are pointing in worrying directions:

- \( CO_2 \) emissions rebounded to a record high
- energy efficiency of global economy worsened for 2\(^{nd}\) straight year
- spending on oil imports is near record highs
But one thing is certain, we will need more energy, and especially electricity, in the coming two decades.

Indeed, growth in electricity demand significantly outstrips that of fossil fuels.

In our baseline New Policies Scenario, global electricity demand is projected to grow by more than four-fifths between 2009 and 2035, or about 2.4% annually - driven by economic and population growth.

Despite anaemic European growth, electricity demand is still forecast to increase by around 0.8% per year. And even our most “green” and “efficient” 450 scenario sees European power demand to 2035 growing by the equivalent of one Germany.

Of course in emerging markets, where 6 billion people consume as much power as the one billion of the OECD, growth is already much more rapid. Even with a short dip in the wake of the economic recession, power demand has been growing by 6% per year in China since 2007.
Where will this demand growth come from?

Globally, industry remains the largest consuming sector.

But the increase in non-OECD demand is driven by faster economic and population growth – specifically expanding access to electricity, and rising per-capita consumption in the services and residential sectors thanks to the ever wider reach of televisions, computers, washing machines, and air conditioning.
Across our three principal scenarios, demand grows significantly, but differently.

The variation in demand growth is primarily due to the extent to which more energy-efficient technologies are adopted in end-use sectors in response to changing electricity prices and government measures. In the “greenest” 450 Scenario, for example, power demand derives largely from a significant penetration of electric vehicles.

Differences in end-user prices emerge across the scenarios because of the different mix of fossil-fuel plants, changes in fossil-fuel prices, the impact of carbon pricing in regions where this is introduced, differences in subsidies to renewables, and differing assumptions about the phase-out of subsidies over time.
In our baseline “New Policies Scenario” we estimate that meeting these massive electricity demand increases will require around $16.9 trillion in the power sector - around 60% on generation and 40% on networks.

The bulk of investments will be concentrated in Asia. China alone will invest almost $2 trillion.

Although consumption is not growing as fast in OECD countries, not only will existing generation capacity require replacement, but emissions targets will demand investment in more capital intensive technologies such as nuclear and renewables.

Concerns about timely investments, and possible impacts on energy security, are legitimate.

* In non-OECD countries, most of the investments in new power plants will be decided and financed by state owned companies or regulated monopolies. As electricity security is very high in the political agenda, meeting growing demand and avoiding electricity shortages will remain a challenge.

* In OECD countries, however, most states have liberalised their power sectors and will rely on private investments. Moreover, these countries will generally put greater emphasis on decarbonisation, likely pointing to a different mix of technologies. Some of them, like solar photovoltaics (PV), concentrated solar power (CSP), and off-shore wind are still maturing and seeing costs decreasing rapidly. Slightly more mature technologies, like on shore wind, are already nearing competitiveness in windy regions.
In Europe the investment challenge is compounded by the economic crisis, which hit the electricity sector hard in 2009. After a recovery in 2010, the year 2011 saw continued decline in power output, in part due to mild weather conditions.

But at the same time Europe has seen a particularly rapid deployment of wind and solar generation (+29% in 2011), accounting for 235 TWh in Europe by 2011.

Such a rapid increase was thanks in part to generous feed-in tariffs which led to bubbles in some countries. Many of those schemes have been reformed or are facing reform, to improve pricing flexibility in the face of rapidly falling capital costs. The trick is to make corrections in a way which is careful, selective, smooth, collaborative, and transparent. Policy instability and uncertainty can undermine investment security, drive up the cost of finance, and harm the domestic renewable energy industry.
Efficient and competitive electricity markets will be key to meeting the investment challenge, and can contribute to returning the global economy to stronger growth. Ensuring timely investments in low carbon and conventional power plants in liberalised OECD markets will be key to preserving electricity security of supply and the competitiveness of the industry.

Several issues will be key to attracting investments.

First, low carbon power plants have stable costs, with low variable costs and high capital costs. In electricity markets where the price is driven by the marginal cost of gas or coal plants, the cash flows of the low carbon plants are exposed to an important market price risk that deters investments.

But let’s remember that conventional power plants are also exposed to investment risks:
- Rapidly deploying renewables impact the functioning of the electricity market in a way that is difficult to anticipate accurately by market players.
- For flexible peak power plants, designing a competitive and well functioning market that provides enough revenues to cover the annual fixed cost, remains a challenge.

Finally, the energy policy risk is perceived to be increasingly important.
- For variable renewables, generous feed-in tariffs in some European countries have been, or are being, significantly reduced.
- Energy efficiency policies will impact demand in a way that is difficult to forecast accurately.
- Unpredictable nuclear policies, such as the German nuclear phase-out, increase the policy risk not only for nuclear but also for all the entire power sector.

Lastly, there is the carbon price risk in Europe, if the EU ETS fails to provide a credible long term investment signal. Fixing this problem and providing stable and credible long term carbon price signals turns out to be extremely challenging.
Decarbonising the electricity sector in liberalised electricity markets while maintaining security of supply, is one of the most challenging and political energy questions.

Technical, market design, and financing questions are extremely important, but have to be put in perspective.

Given that reducing carbon emissions will likely remain a priority, where do we currently stand with regard to emissions from electricity?

While the EU and US have reduced carbon emissions since negotiations began in 1992, other countries have still a very high carbon intensity.

China’s importance is clear due to its population and growth, and thanks to its coal sector remains a significant emitter. In India, the carbon intensity of power plants has actually increased.

Brazil’s relatively low carbon intensity stands out as a notable exception among the major emerging economies, and in some respects can serve as a model – even if it has very specific natural endowments, particularly in hydro-power.
What do we need to do to achieve those carbon reductions on the generation side?

The answer lies in diversifying the fuel mix.

In the New Policies Scenario, coal remains the largest source of electricity generation globally throughout the Outlook period, growing in absolute terms by 48% to 2035. Still, its share of generation falls from 41% to 33%.

A market increase in electricity generation from renewable sources offsets the fall in the shares of coal and oil. The share of generation from non-hydro renewables grows from 3% in 2009 to 15% in 2035 - almost 90% of this increase coming from wind, biomass, and solar photovoltaics (PV).

Natural gas (22%), hydro (16%) and nuclear (13%) all maintain relatively constant shares of electricity generation throughout the period.

Changes in the mix of technologies and fuels used to produce electricity are driven mainly by their relative costs, which are influenced by government policy.

Government targets to reduce greenhouse-gas emissions, local energy-related pollution, and the power sector’s dependence on imported fuels, have a significant impact on technology choices, via costs.
One thing is sure: in order to meet growing electricity demand while de-carbonising the electricity mix, low-carbon technologies on the generation side will have to gain ground.

Pushing renewables to enable an increase in production by 8400 TWh will be an industrial challenge in the next 25 years.

In order to reach the 450 ppm targets, it will also be necessary to increase the share of nuclear power.

Given the scale of the challenge to reduce CO2 emissions globally, all low-carbon technologies will be necessary.
Integrating these new technologies will be a technical challenge. The large-scale deployment of variable renewable technologies in particular will require more grid flexibility.

IEA analysis indicates that large-scale deployment of variable renewables is feasible. We estimate that existing flexible resources could technically support variable renewable generation levels of 20% to 60%, but will lead to more volatile real-time power flows – with implications for maintaining electricity security. At the same time, risks can be compounded by changes to electricity demand patterns – such as increased use of electric vehicles, and heating & cooling applications.

Greater power system flexibility – including through flexible back-up generation, more integrated regional markets, greater demand response and electricity storage – can mitigate those risks.

This will require strong commercial incentives to harness existing flexibility, including markets that fully value flexibility and effective carbon prices. And it will require investing in technologies that promote flexibility, such as smart meters, smart grids, electricity storage, and back-up generation.

In our view, well functioning electricity markets will be needed, more than ever before, to deliver greater system flexibility, innovation, and sufficient investment.

Governments have a crucial role to play. Policies that encourage appropriate sharing of risk, costs and benefits can stimulate the development of innovative and improved electricity systems. Better integrated and more effective policies, regulation and support programs will be needed to complement and reinforce incentives for market-based flexibility and investment.
Power consumption globally is rising quickly – particularly in the emerging economies of Asia. Huge investments will be required not only to meet growing demand, but also to cope with changes to how we generate power, and in particular a growing penetration of renewables. Given the scale of the transformation needed, a broad portfolio of technologies will be necessary to succeed in reducing carbon dioxide emissions.

This raises many challenges, in particular to encourage greater power system flexibility and the efficient, timely investment needed, without compromising electricity security during the transition.

The IEA is continuing its efforts to assist governments to reduce carbon emissions from the power sector. IEA member countries endorsed the electricity security action plan (ESAP) at our Ministerial meeting in October last year. In the coming months we will publish the first results of the Action Plan, on Generation and Networks. It will analyze market design, regulatory, and financing issues, and propose options available for governments to address them.

Getting the regulatory framework and market design rights can help us to mobilize the investments into the electricity sector, to keep the lights on in a way that is affordable, secure, and sustainable - and lay the groundwork for the modern and clean energy economy our society’s welfare demands.

Thank you.