Sound Energy Policy for Europe

Pragmatic Pathways to a Low-Carbon Economy

EUROPEAN POLICY DIALOGUE—SPECIAL REPORT

EXECUTIVE SUMMARY

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SOUND ENERGY POLICY FOR EUROPE: PRAGMATIC PATHWAYS TO A LOW-CARBON ECONOMY— EXECUTIVE SUMMARY

INTRODUCTION: FROM "WHERE" TO "HOW"

Europe has set the goal to move toward a low-carbon economy by 2050. The specific target is to reduce emissions of carbon dioxide (CO_2) across the entire economy by 80–95 percent by 2050 from 1990 levels, with several staging posts along the way. The power sector would make disproportionately large emission cuts, moving to near-zero emissions by 2050.

With the goal in place, the strategy for getting there is under intensive development. Europe must now move from "where are we going?" to "how do we move in the right direction?" That is, policymakers and the industry need to move to a concrete analysis of what would be required to move toward this unprecedented and ambitious goal. Power is integral to everyday living and economic viability. Given the sheer size and complexity of the electric power system, it is imperative that the challenges and risks of moving to a low-carbon economy are carefully considered. The current reappraisal of the future of nuclear power among some member states following the Japanese nuclear incident at Fukushima adds to the significant challenge of moving to a low-carbon power system.

This report aims to contribute to the discussion of long-term energy policy within Europe and specifically to provide independent input as DG Energy develops its 2050 Energy Roadmap and its own long-term energy scenarios. The report makes three contributions within the power generation area.

- First, we have developed a cost-emissions trade-off matrix for policymakers and industry that makes transparent the trade-offs and implications of various power generation choices. The matrix shows the costs of fuel choices set against varying levels of CO_2 emissions. IHS CERA does not advocate a single optimum or best solution. All options involve trade-offs, advantages, and drawbacks. Moreover these trade-offs will vary for each member state. Our objective is to clarify some of the main trade-offs.

- Second, we have highlighted five policy enablers of decarbonization. For each enabler, we review the key issues and make practical recommendations that can help the industry move in the proposed policy direction. We consider that each of these five enablers could potentially play an important role in the quest toward a low-carbon power sector, but they are meant to be neither a comprehensive list at the exclusion of other important issues nor a sufficient condition of success.

- Third, we place particular emphasis on the role of natural gas. Natural gas is one of a number of technologies that will need to be deployed. A focus on natural gas is therefore selective. However, we highlight natural gas because we believe that much policy debate to date has failed to give a level of attention to the fuel proportionate to its potential role and the scale of its potential impact.

Our focus is on the power generation sector and in particular on supply-side options. We focus on power generation because this sector is the largest single emitter of CO_2 within the European Union, has the largest abatement potential, and perhaps has the lowest abatement costs. We focus on climate change and CO_2 emissions even though we highlight the trade-offs with security of supply and affordability. Our focus on supply-side options is not meant to diminish the importance of the demand side. Energy efficiency, a new model for energy services, and demand-side management among many other approaches are of great importance and covered in other IHS CERA research.

It will be important for the Commission to link up policy between climate action, energy, competition, transport/mobility, and other areas. An integrated energy and industry policy is needed.

The key conclusions and messages from the IHS CERA European Policy Dialogue are summarized below.

TRADE-OFFS

- **European energy policy needs to be constructed around three core priorities set out by the European Union: economic competitiveness, the transition to a low-carbon economy, and security of supply.** IHS CERA has previously described these three priorities as The Energy Trilemma.* Policymakers will need to make informed trade-offs among these goals. Each potential power generation source ranks differently according to the three metrics.

- **There is no technological silver bullet.** A portfolio of technology solutions from both the demand side and the supply side will be required to meet Europe's future power needs. All options include trade-offs, advantages, and risks. That does not mean, however, that they are all equally good. Given the considerable uncertainties that surround future technologies over such a long time horizon, policymaking needs to be predictable, coherent, and nonprescriptive and should minimize future regret costs.

INVESTMENTS, AFFORDABILITY, AND COSTS

- **Power market design needs to evolve across the European Union to set up a framework that encourages the required investment.** The move to a low-carbon power sector requires very significant capital investment. This includes investments in

  – CO_2-free energy technology that usually involve high upfront capital costs but thereafter either no or low fuel costs

  – conventional generation, for both primary power generation, possibly in conjunction with carbon capture, and backup for intermittent renewables

  – transmission, both within countries and across borders

*See the 2010 IHS CERA Special Report *Sound Energy Policy for Europe.*

About €70 billion per year on average will be needed for renewables and conventional plant additions over the next two decades, a significant increase over the past decade investment rates of around €45 billion per year. Over 20 years this is €1.4 trillion. These investments are unlikely to materialize with the existing market framework, which creates too many risks and uncertainties. The requirement for major investments will require the establishment of new frameworks for power markets—the so-called market design reform, one of our five key enablers.

- **There is a trade-off to be made between the level of emission reductions and the cost incurred.** Fuel substitution from high-carbon old technologies to lower-carbon and more efficient new fossil fuel technologies can reduce emissions in the power sector by as much as 58 percent at relatively low cost relative to 1990, based on today's demand levels. However to achieve greater cuts in emissions requires either the phasing down of fossil fuels to be replaced by zero-carbon technologies, such as renewables or nuclear, or the use of carbon capture applied to fossil fuel plants. Both options would further reduce emissions, but at extra cost.

- **Policy assumptions that fossil fuel prices—notably natural gas prices—will inevitably rise in real terms over time are not warranted.** Fuel prices are unpredictable, uncertain, and likely to be cyclical. However, an understanding of the resource and cost base of natural gas and coal suggests abundant potential supply of both commodities through 2050 and beyond. Recent technological breakthroughs in unconventional gas have significantly expanded the potential global and European recoverable resource base of natural gas.

  Scenarios assuming rising fuel costs and a rapid decline in renewable costs are also unlikely to materialize. Scenarios of commodity price inflation cannot be discounted, but it is the cost relative to alternatives that matters: there is likely to be some correlation between fossil fuel costs and the price of other commodities (such as steel and silicon) that make up the bulk of the costs of renewables.

  Moreover, fuel prices are dynamic and will respond to the competitive environment. Prices can be expected to adjust if other technologies expand significantly: the higher the level of penetration of zero-carbon forms of generation at a global level, the less pressure on global fossil fuel prices. This lowers the target point at which new technologies become cost competitive with the lowest-cost option of fossil-fired power.

- **The costs of newer technologies can be expected to fall over time.** The costs of deploying clean energy—notably renewables—will depend on the rate of future cost reductions. Cost reductions come about through a combination of research and development (R&D), market pressure and support mechanisms, and learning as global manufacture grows. IHS CERA's analysis of learning curves concludes that the high end of learning and global roll-out assumptions are needed to deliver a mix of renewables at cost parity with combined-cycle gas turbines (CCGTs) by 2050. It is therefore important that policy on R&D and market mechanisms supports the learning impact

if cost reductions are to meet expectations. Moreover the current balance of policies is weighted toward deployment and could be more cost effective if rebalanced more toward R&D.

- **The imperative of reliable power supply will need to be reconciled with the expansion of intermittent—nonconstant—renewable power.** Substantial backup power capacity will be required to support higher levels of intermittent renewable generation even with transformational grid change and storage. These backup costs will be required not only in power capacity but also in the broader fuel supply chain, notably if gas is used as backup. The system cost, which is large and in addition to the stand-alone costs of renewable generating assets, needs to be recognized. The enormous operational complexity of incorporating large swathes of intermittent generation also needs to be recognized, and the resulting issues will need to be handled with the utmost attention.

- **The costs of decarbonization need to be recognized and balanced against the expected benefits.** The extension of renewables into the system will entail significant costs above lower-cost alternatives for many years. IHS CERA finds that subsidy costs—supporting the legacy investments made before renewables costs reach cost-competitive levels—could peak in 2020–30 at around €45–€60 billion per year. Subsidy supports are not expected to fall below today's levels before 2035 at the earliest and could continue at high levels through to 2050. If passed through on a pro-rata basis, this would add up to €100 to the average annual residential electricity bill and up to €2,000 to the typical annual business company. Although these costs are necessarily uncertain, it is clear that costs will be significant and likely in this range. These costs need to be weighed against the wider benefits to the macroeconomy and society. The big risk to power investment is that consumers will revolt and not pay for all of the decarbonization costs or that the costs will make the European Union uncompetitive.

- **The carbon market needs to be reformed to send a stronger and longer-term price signal to investors and consumers.** The European Union Emissions Trading System (EU ETS) carbon market should continue to take center stage in the pursuit of the decarbonization of the European economy, as it ensures cost-effective abatement through the deployment of clean technologies. Further targeted policies could undermine the primary announced intention of a market approach and increase the overall cost of decarbonization, and their interaction with the EU ETS should be carefully examined. However, a critical review of the current market arrangements should be conducted to

  – recognize the impact of targeted policies to support renewables and energy efficiency on the EU ETS carbon price and limit the induced structural carbon price uncertainty

  – strengthen the carbon price signal to provide investors with a longer-term incentive to invest in low-carbon technologies through either a tightening of the current cap and guarantees on banking beyond Phase 3 or the introduction of a carbon price floor

  - broaden the range of sectors covered by the EU ETS when technically possible and/or supplement the EU ETS through the transformation of current energy taxes into their equivalent carbon content tax (e.g., through a review of the Energy Taxation Directive). Focusing on sectors that are not trade exposed would limit the competitiveness effects in the absence of similar carbon pricing in other parts of the world. The impact of border tax adjustments measures should be investigated further.

TIMING, OPTIONALITY, AND THE ROLE OF NATURAL GAS

- **The period to 2030 will need a two-pronged approach of continued use and investment in proven conventional plant as well as the buildup of zero-carbon technologies.** Although the option exists to deploy further renewables, to prove up commercial-scale carbon capture technologies, and to focus on demand-side measures, continued investment in conventional fossil fuel plant, which has a clear track record as a proven and cost-effective technology, is also indispensable. This build-out can be consistent with the planned trajectory to reduce emissions through to 2050. It is important that

  - long-term decarbonization goals do not deter the necessary investments in fossil fuel options in the early period

  - investments in the early period in fossil fuels do not lock in future emissions that frustrate further emission reductions

- **Policy needs to keep options open and not make early decisions that close off alternatives.** The period beyond 2030 presents wide technology choices and also major uncertainties on the maturity and cost of these technologies. The level of fossil fuel prices is also uncertain.

- **Natural gas–fired power offers policymakers a key policy tool: optionality.** In the period to 2030 natural gas can help meet power needs at low cost and within a framework of reduced overall emissions—especially through substitution for coal. This is widely recognized. However, less widely recognized is that the choice of natural gas in the first period leaves options open for the post-2030 period.

  - A build-out of natural gas–fired power before 2030 could transition into a backup role for renewables post-2030. The use of existing plants for backup would be much more economic than building dedicated backup for renewable capacity after 2030.

  - A build-out of natural gas–fired power could provide further emission reductions at a later stage through retrofitting of carbon capture as this technology comes to fruition.

  - In cases where carbon capture technologies prove inapplicable and where alternative zero-carbon solutions are not developed in a timely fashion,

unabated CCGTs still offer the best fall-back position—certainly if concerns about natural gas prices and availability are dispelled—until lower-carbon options prove affordable and are deployed.

IHS CERA believes that natural gas is a low-regrets choice with significant option value. Policymakers should recognize the key role that natural gas can play in establishing a flexible and sustainable pathway in the power sector within a diversified low-carbon generating portfolio. This might extend to ensuring that enabling supply infrastructure is made available.

THE FIVE KEY POLICY ENABLERS

If Europe is to move toward its decarbonization goals, the following five enablers are important levers for the power generation sector.

- Reform of power market design
  - Power markets need a predictable long-term investment framework that reduces regulatory risks, rewards availability in addition to output, and provides incentives for renewables to contribute to system balancing.
- Carbon market reform
  - The EU ETS should be revised and/or supplemented by carbon taxation to strengthen the carbon price, broaden the sectors covered, and provide long-term visibility to investors and consumers.
- Clean technology support
  - Support should be rebalanced in favor of R&D as opposed to the current focus on deployment and should drive investment in least-cost technology at the best location.
  - A threshold for subsidy withdrawal should be defined to provide long-term visibility to investors and to contain support costs.
- A strong role for natural gas
  - Long-term decarbonization goals should not deter investment in gas-fired power and related investments over the next several decades that are required to bring early emission reductions at acceptable cost.
  - The natural gas industry needs a predictable long-term investment framework for infrastructure that reduces regulatory risk and provides incentives for accommodation of flexible and renewable sources of energy.

- Carbon capture technologies
  - Carbon capture is essential if fossil fuels are to play a role in the longer-term stages of decarbonization. Commercial-scale demonstration carbon capture power generation plants—for both coal and natural gas—need to be developed as soon as possible to give industry and policymakers a clearer view of the costs and practicality of carbon capture.
  - More R&D is required into the area of carbon usage as a possible alternative to underground storage.