Chapter One

Energy in an Era of Unprecedented Uncertainty: International Energy Governance in the Face of Macroeconomic, Geopolitical, and Systemic Challenges

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"The energy world faces unprecedented uncertainty."[1] This is how the International Energy Agency (IEA) started its executive summary grasping the major trends and developments in the global energy relations in autumn 2010—still some months ahead before the Fukushima-Daiichi nuclear catastrophe and the Arab Spring.

This chapter aims to draw a landscape of the uncertain geopolitical and macroeconomic environment of the global energy system. Uncertainty carries risks and opportunities, depending on what actors make out of it. Our existing energy system is internationally connected and intertwined, many segments have a global scope, and the effects of energy production and consumption do not stop at national borders but rather have transnational and global consequences for the climate and the environment.

In writing about "energy in an era of unprecedented uncertainty" one has to be aware of the "knowable" and "unknowable" in future macroeconomic, geopolitical and technological developments. The limited human ability to foresee developments and understand the triggering factors is obvious. It was on display when the macroeconomic, financial and debt crises unfolded in 2008 and 2011 and when the wave of Arab uprisings started in Tunisia and Egypt in 2010/2011. Theory is right in pointing to the fact that human knowledge about the future is limited. We dispose of transparent and

[1] IEA, *World Energy Outlook 2010* (Paris: OECD/IEA, 2010), p. 45.

encompassing information in the case of *known knowns*. As regards the risk dimension, these are well known threats. *Known unknowns* are goings-on where we lack necessary and sufficient information, which cannot be entirely understood and display a certain ambiguity. "*Wild cards*" may fall into this category. *Unknown unknowns* are comparable with *black swans*,[2] being highly improbable and not on the screen of relevant actors. Daase and Kessler enlarge this list by *unknown knowns*: things that are just looked on from the bright sight, ignored or even kept in secrecy.[3] Related risks to these situations are neither communicated nor addressed, making them a blind spot for international (risk) management.

For international energy policy the above is of paramount significance. This chapter aims to shed light on international governance and its (un)preparedness and (in)ability to address the major challenges, to manage the related risks, but also to draw opportunities from a situation in flux. In face of uncertainties, international energy governance should first and foremost be directed to reduce such uncertainties and should provide a stable framework for risk and opportunity management. Stability has always been the key to and the foundation for the energy business, with its long lead times, the life span of once erected infrastructure and the dilemmas of sunk costs. However, this recognition should not lead to perpetuating a given situation, thereby confusing dynamic stability with fossilized stagnation. Uncertainty is also induced by international (non)governance itself. This chapter does not aim to provide an exhaustive overview of existing energy governance mechanisms,[4] but rather points to initiatives with the potential to reduce uncertainties, turn them into opportunities or mitigate related risks. Moreover, it tries to identify certain barriers for the latter. In many respects, governance is still in the process of identifying the risks

[2] Nassim Nicholas Taleb, *The Black Swan: The Impact of the Highly Improbable* (New York: Random House, 2007).

[3] Christopher Daase, Oliver Kessler, "Knowns and Unknowns in the War on Terror: Uncertainty and the Political Construction of Danger," *Security Dialogue*, vol. 38, no. 4 (December 2007), pp. 411-434.

[4] For an overview see Dries Lesage, Thijs Van de Graaf, Kirsten Westphal, *Global Energy Governance in a Multipolar World* (Farnham, Burlington: Ashgate, 2010), pp. 51-72.

related to uncertainties and to judge possible damage, the magnitude of the damage and the probability of occurrence.

After the experiences of extreme oil price volatility in the second half of 2008, under the impact of the Deep Water Horizon accident in the Mexican Gulf in April 2010, the Fukushima-Daiichi nuclear catastrophe in March 2011 and the Arab Spring gaining momentum through 2011, risk identification, communication, assessment and management have recently been driving factors for international energy governance. However, new mechanisms and instruments have to be assessed against the related costs of risk management, be it prevention or crisis management. This means no less than a cost-benefit-probability calculation for the relevant actors. Who will take over the costs of enhanced energy (supply) security and of a sustainable energy (r)evolution and to whom is the responsibility attached?

Facing the Triple Energy Challenge—Uncertainties of Political Action

Three global energy challenges demand urgent, simultaneous and multi-level political action: ensuring energy security for every country; minimizing the effects of energy systems on the environment and the climate; and providing access to modern forms of energy to all people.[5] In essence the question is who can take action when, how and to what extent to address effectively the triple challenges of energy security, climate change and equitable access to modern energy sources.

The IEA has been right to point to the urgent need to transform our energy system low-carbon, more sustainable and resource-efficient. Global energy consumption is the major driver of climate change. The energy sector accounts for 70% of greenhouse gas (GHG) emissions. Meeting the internationally acknowledged, albeit non-binding, 'Two-Degrees-Goal,' i.e. to limit global warming by 2050 to an increase of two degrees centigrade in average temperature compared to preindustrial levels, would mean that GHG emissions would have to peak around 2020—yet energy consumption is expected to increase 40% by 2030. As the IEA first presented in detail in its

[5] Aleh Cherp, Jessica Jewell, Andreas Goldthau, "Governing Global Energy: Systems, Transitions and Complexity," *Global Policy*, Vol. 2, Issue 1 (January 2011), pp. 75-88.

World Energy Outlook 2008, this would mean limiting the concentration of greenhouse gases in the atmosphere to around 450 parts per million of carbon-dioxide equivalent (ppm CO_2-eq).

Our energy systems are far from being sustainable, either with respect to the environment and climate or with respect to equity in energy access. More than 1.4 billion people have no access to electricity, which is crucial for economic development. Moreover, more than 2.7 billion people still depend on cooking with biomass. However, energy is not an explicit part of the Millennium Development Goals; it has only lately gained more attention on the international agenda, for instance in the run-up to the Rio plus 20 Conference, as an element in the water-food-energy nexus. Sufficient, stable and affordable energy is not only the key to development and as such a basis of civilization, but clean energy is also a precondition for stable climate conditions and as such for humankind's livelihood and the preservation of the environment.

This is even more true and pressing if one looks ahead to 2050. By then, the world will be populated by 9-10 billion people, compared with 7 billion in 2011. The stress on energy systems and the global climate would be unprecedented. In sum, the sheer magnitude of the triple challenges is daunting, because they are "massive, urgent, global and systemic."[6] Cherp et al. make the strong point that the transformation "will affect how the world produces, transmits and consumes energy and will penetrate all societal levels."[7]

The Global Landscape of Oil Production and Related Uncertainties

One of the main particularities of fossil fuels is their uneven global distribution: in the future, the world will have to rely to an ever larger extent on the energy-abundant countries of "strategic ellipsis:" the geographical area stretching from Siberia to the Caspian Basin, the Persian Gulf to the Arabian Peninsula. The region contains 63.5% of global oil reserves, compared to 47% share in overall production in 2009.[8] The

[6] Cherp et al, "Governing Global Energy," p. 76.

[7] Ibid.

[8] BP, *Statistical Review of World Energy 2011*, (London: BP, 2011), pp. 6, 8.

future role of the Organization of Petroleum Exporting Countries (OPEC) and the implications for security of supply rank among the geopolitical uncertainties. OPEC countries control more than 76% of global reserves; 63% are located in the Gulf region. The OECD disposes of only 6% of global oil reserves[9] and conventional oil production in the OECD area has leveled off. For the OECD and its multinational oil (and gas) companies, the time of cheap and easily accessible conventional oil is over. Because of restrictive policies in many energy-abundant states, but also because of depletion paths in the OECD world, the international oil companies (IOCs) have to go to areas that are geologically and geographically ever more challenging.

All of these factors together are driving oil (and energy) prices. The escalation of costs is remarkable: in the 1990s it cost between $500 million and $1 billion for oil field development from exploration until the start of production; today it ranges between $5-10 billion.[10]

As a result, "(t)he size of ultimately recoverable resources of both conventional and unconventional oil is a major source of uncertainty for the long-term outlook for world oil production."[11] The "Peak Oil" discussion has contributed to raise public awareness of the fact that hydrocarbons are exhaustive and non-recoverable. Among the known unknowns is the time when oil production has or will reach its plateau. Estimates differ widely: the Association of Peak Oil (ASPO) argues that the peak of oil production will be reached somewhere between 2005 and 2010; multinational companies are much more optimistic. BP estimates that known reserves will be able to cover demand for the next 40 years. Exploring unconventional oil seems more a matter of cost and price, since new explorations, both off- and on-shore in large "unexplored and untapped" areas, such as deep waters, the Arctic, the Caspian Basin and East Siberia, have contributed to increase the global reserve basis. However, as the Deep Water Horizon accident of April 2010 revealed, these are all potentially related to new significant risks.

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[9] BGR, *Energy Resources 2009. Reserves, Resources, Availability*, Hannover: BGR 2009, p. 37.

[10] Andreas Oldag, "Eine unbequeme Wahrheit", *Süddeutsche Zeitung*, September 12, 2011, p. 20.

[11] IEA, *World Energy Outlook 2010*, p. 48.

Uncertain Oil Price Developments, Cyclical Investment Swings and Resource Nationalism

Oil prices are set in a complex interplay among market fundamentals, market expectations, financial transactions and speculation. Oil prices are the major reference point for investment in oil exploration, production and infrastructure, and they are the major incentive to reduce oil consumption. Moreover, and this is of utmost importance for the argument of the following section, they determine the state income of oil producing states. Last but not least, they are a lead currency for most other raw materials.

Oil price levels and oil price volatility have been a constant source of concern for all relevant actors. The uncertainties around price development are closely intertwined with the issue of appropriate and sufficient investments. Cyclical investment swings (pig-cycle), albeit being well-known phenomena, have proven to be extremely difficult to cope with. This particularity of the raw materials investment cycle is reinforced by the fact that projects in the energy sector do have remarkable lead times until they are fully developed and on stream, e.g. the respective pipeline is being filled. A certain cycle can unfold: price volatility and uncertainty discourage investment, which in turn prompts country governments to under-invest in productive capacity, a behavior that constrains capacity over time. With the increase in demand, oil prices rise, thereby resulting in a tightening of the supply/demand balance. Both sides take action: in the face of high prices, consuming country governments take action to curb oil-demand growth. Oil demand slows with a lag. At the same time investment rebounds in producing countries, boosting capacity with a lag. This together leads to over-capacity and causes prices again to fall.[12] The (vicious) cycle restarts again.

At the beginning of the 2000s, when a steep increase in demand drove oil prices to new record levels, many oil (and gas) producing states took a more assertive stance towards foreign investments in these strategic sectors. Russia and Kazakhstan alarmed energy investors: renationalization and wide scale corruption even challenged fundamental rights guaranteed under production-sharing-agreements. The empiri-

[12]IEA, *World Energy Outlook 2010*, p. 141.

cal bases unfolded for Friedman's first law of petro- politics, which states that the price of oil and the pace of freedom move in opposite directions.[13] Whereas the 1990s witnessed a phase of significant inroads into producing countries, the pendulum swung back in early 2000s. Re-nationalization of the oil industry, or at least of its core parts, as exemplified with the Yukos case in Russia, significantly changed the business environment for multinational oil companies, which serve as the major instruments for OECD countries to secure timely, stable and affordable supplies. Today it is the National Oil and Gas companies (NOC) that control over 80% of reserves.[14] NOCs are subject to political considerations and serve as a major instrument for ruling elites to stay in power. Resource nationalism results in limited access for IOCs. It might be simplifying, but their advantage is that they are subject to calculable business considerations and engage in research and development of ever more efficient technologies.

This is where another vicious cycle unfolds. One of the major drivers for the Arab Spring has been price explosions for food. It is here where global oil price increases rebound on energy-abundant states due to the fact that oil prices serve as the lead currency for other agricultural/ raw materials. It does not matter that domestic energy prices are highly subsidized in energy-abundant countries for social, political and economic reasons. The resource curse in most cases of energy-abundant states hinders diversification of their economies. The rent-seeking attitude of the regimes binds the resources for perpetuating the system. This spiral of subsidies is resulting in ever-higher state spending, boosting the state budget. This in turn fuels the global oil price that has to re-finance the additional expenditures.

This is part of the story of why the times of cheap oil are over. Do higher prices guarantee that investments are undertaken? As the *World Energy Outlook 2010* states, "estimates of the world's total endowment of economically exploitable fossil fuels and hydroelectric, uranium and renewable energy resources indicate that they are more than sufficient to meet the projected increase in consumption to 2035."[15] The ques-

[13]Thomas L. Friedman, The First Law on Petropolitics, *Foreign Policy*, May/ June 2006, pp. 28-36.

[14]BGR, Reserves, p. 37ff.

[15]IEA, *World Energy Outlook 2010*, p. 117.

tion rather is whether the energy resources will find the money, that is will they be developed in a speedy and timely manner to make them fully available when and where they are needed.

International Attempts to Address Oil Price Volatilities and Investment Uncertainties

It is fair to say that international governance has developed remarkably over the last decade in addressing energy price issues. But it also has experienced some backlashes with regard to investment security.

The Joint Oil Data Initiative by the International Energy Forum (IEF) has been built up as a major initiative to step up dialogue and cooperation between consuming and producing countries. The year 2008 was a watershed for cooperation in the IEF because the decrease of oil prices from $147 to $100 a barrel proved to be equally painful for producing and consuming countries. Since then, there have been efforts to improve transparency in both the oil and financial markets, both under the umbrella of the IEF as well as under the roof of the G20.

But of course there is an ambiguity per se in addressing uncertainties over the demand and supply balance. A shift in any particular direction may result in either a sellers' or a buyers' market, but would certainly bring about significant profits and gains for the relevant actors. Insufficient information and imperfect markets are part of the game. In that respect, market actors naturally object to initiatives by state actors to create greater transparency, in particular with regard to collecting detailed data of investments, as discussed under the JODI umbrella. Uncertainties are only problematic for sellers when they become too big and therefore damage the image of the particular good, or when they encourage buyers to search for alternatives.

While we have seen improvements in tackling high and volatile energy prices, international governance to improve investment stability was dealt a severe setback when Russia ended the provisional application of the Energy Charter Treaty (ECT) in July 2009. Without a doubt, the ECT is a child of the 1990s, when consuming countries managed to make significant inroads into producing countries. The

ECT is an outstanding example of international multilateral governance, aiming for a high level of investment security among its then-51 members.[16] The ECT has produced limited overall results in matters of trade and transit, but its investment provisions generally work well. That was precisely the reason why major energy-producing countries such as Norway and the United States have abstained from ratifying the ECT, because they fear losing sovereign rights.

Lessons learnt from the Arab Spring— More Uncertainties Ahead

With the Arab Spring uncertainty has grown about short- to mid- and long-term developments in the Middle East and North Africa (MENA) region; indeed, the movements mark a watershed.[17] The OECD world had long counted on the autocratic regimes of the region because they seemed to provide stability. This proved to be an mistake: it is "stable societies(,) that hold the key to future reliance on MENA hydrocarbons."[18]

The Arab Spring has caused widespread fears about the prospect of oil (and gas) supply disruptions. Libya was a case in point: regime change resulted in major supply disruptions due to attacks, damaged infrastructure from fighting or as a consequence of international sanctions. In the mid- and long-term perspective any government in the region will have a strong interest in exports, as they offer a major source of income, and an instrument to maintain power as well as to pursue social and economic policies.[19] However, uncertainties stem from internal reforms that may go hand in hand with new depletion

[16]Andrey Konoployanik, "Energy Security and the Development of International Energy Markets," in B. Barton, C. Redgwell, A. Rønne, D.N. Zillman, ed., *Energy Security: Managing Risk in a Dynamic Legal and Regulatory Environment* (New York: Oxford University Press, 2005), pp. 47-84.

[17]Hakim Darbouche, Bassam Fattouh, *The Implications of the Arab Uprising for Oil and Gas Markets*, MEP 2, The Oxford Institute for Energy Studies, September 2011, p. 1.

[18]John Roberts, The Arab Revolution of 2011, *Energy Economist*, March 3, 2011.

[19]Kirsten Westphal, *Energiesicherheit und -kooperation auf dem Prüfstand*, in Muriel Asseburg (ed.), Proteste, Aufstände und Regimewandel in der arabischen Welt, Akteure, Herausforderungen, Implikationen und Handlungsoptionen, SWP-Studien 2011/S 27, October 2011, pp. 55-57.

strategies, a revisiting of existing Production Sharing Agreements, changes in the managements of National Oil Companies etc. This in turn, may affect the business conditions for IOCs and the access regime. Moreover, political and socio-economic reforms may affect the volumes and direction of exports, and there are strong indications that necessary investment into new sites is on hold, funds are being redirected and domestic price reforms are being reversed. This is a preoccupying trend for oil and gas supply prospects from the region.

Regionally, there is an immediate risk of contagion and changing balances of power. Iran and the Shiite minorities in the Gulf countries are of concern. This is particularly sensitive when it comes to the three countries of the Gulf Cooperation Council: Saudi Arabia, United Arab Emirates and Kuwait. The sword of Damocles for the global oil markets hangs over Saudi Arabia. The kingdom's strategic importance for world oil markets cannot be overstated. It is not just the sheer size of its production and exports, but mainly its spare capacities to increase oil production at short notice. Saudi Arabia produces around 10 million barrels daily, and has another 2.5 million barrel capacity,[20] which gives the kingdom the opportunity to act as a balancing swing producer. There is no significant spare capacity outside the Gulf region. Its reserves are still easily accessible, of super giant or giant size, with low production costs. More than 40% of global oil exports originate in the Gulf Region.

Risk assessment here easily goes beyond everything what we so far have experienced regarding supply disruptions, because of the potential magnitude with which the energy system, the oil price level and the global economy would be affected. In a certain sense, the image of a Saudi Arabia in turmoil is even a "black swan" because few even dare to think about it. The probability of such an occurrence, of course, ranges beyond the scope of this chapter, but the entire world economy and industrialized countries would be highly vulnerable in such a scenario. Petroleum- based road and aviation transportation is the lifeline of global trade. There is almost no short-term price-elasticity in demand.

[20]Own calculations based on EIA, Saudia Arabia and BP, *Statistical Review*, p. 8.

However, this brings us to the physical trade flows of oil and the major chokepoints in the region. One third of all sea-based oil trade is crosses the Strait of Hormuz. The February 2011 revolution in Egypt raised concerns over the SUMED pipeline and the Suez Channel, through which LNG exports from Qatar to Europe cross. The remarkable gap between West Texas Intermediate Oil and Brent Oil prices made it evident: the U.S. has managed to become increasingly independent from the MENA region. Europe has proved to be much more vulnerable, in particular from trade disruptions in North Africa. Yet, the bulk of GCC crude oil exports go to the Asia-Pacific region.[21] What do the physical oil trade flows tell us? In future, North American oil markets may become less interconnected depending on the amount of deep water off-shore exploration in the Mexican Gulf; unconventional (shale) oil production in the U.S. and Canada; and the prospects for offshore production in Brazil. What does this mean in future for U.S. commitments to ensure exports from the Arab Peninsula to world markets? How will China and India behave with regard to supply risks from the region?

International Crisis Mechanisms and Producer-Consumer Cooperation Revisited

When it comes to dealing with the well-known pig-cycles in raw materials and the shift in the supply and demand balances, the year of the 2008 has been a watershed that has brought energy governance further but not far enough: The drop in high peak in prices from about $147 to $100 per barrel (Brent) in less than seven months raised the awareness of the mutual vulnerability consumers and producers have to volatile oil prices. They bring about a high level of uncertainty. In that respect, the Joint Oil Data Initiative of the IEF is something that has to be backed and developed. Transparency is not easy to achieve, but it is an important asset in an appropriate balance of supply and demand. However, this obviously is a sensitive issue in commercial terms, as buyers favor liquid markets and sellers profit from

[21]For Saudi Arabia the figures are as follows: 57% of crude oil exports and 50% of refined product exports go to the Far East (Energy Information Administration, 'Saudi Arabia, Country Analysis Briefs,' January 2011, p. 6.

tighter market situations. This hinges on the question of a right level of oil prices, which is an eternal source of debate amongst the different players in the market.

The approval of the Charter of the IEF in February 2011 was welcomed as a decisive step forward in producer-consumer relations. The test soon followed, as disruptions in Libya drove global oil prices to sensitive levels. The IEA repeatedly called on OPEC to boost supply. OPEC however failed to achieve a respective consensus in its meeting in June 2011, and major dividing lines became visible among its members. Two weeks later the IEA decided to release 60 million barrels of oil from emergency stocks. This step was criticized at as an attempt to calm gasoline prices. In sum, the two sides failed to produce a coordinated approach to the supply disruption of 1.6 barrel a day of light and sweet Libyan oil. Their respective actions revealed rifts in producer-producer and in producer-consumer relations. It will take time for confidence to be restored, since the actions exacerbated price volatility rather than easing the costs of adjustment."[22]

Uncertainties in Conventional Gas Supply: Wild Cards and Geopolitics at Play

To state the main point directly: the resource base of natural gas is abundant when compared with that of oil, and may easily meet projected demand.

The biggest uncertainty for gas supply again relates to the question whether the investment undertaken will be sufficient and in time. For gas, the share of proven gas reserves in the strategic ellipsis of 71.2% is even higher than oil, and almost 60% is located in four countries: Russia, Qatar, Iran and Turkmenistan. The countries of the strategic ellipsis also dominate gas production with 37.5%.[23] In a global perspective, most of the reserves are conventional gas. The OECD share equals to about 10% share of the world total.

The Caspian Basin, with its vast, partially unexplored and untapped resources, is the region where wild cards and black swans could

[22]Darbouche, Fattouh, *The Implications of Arab Uprisings*, op. cit., p. 21.

[23]BP, *Statistical Review*, pp. 20 and 22.

change the future pattern of resource development and exports.[24] In the Caspian Sea Basin and in Central Asia, geopolitics and geoeconomics are at play, for instance with regard to territorial disputes such as the Russia-Georgia conflict in August 2008; the unclear legal status of the Caspian Sea; policy reversals with regard to depletion strategies, and upstream access, export routes and domestic energy use. Political risk in the region is considered high and these perceptions have preempted larger export projects. At the same time, there are wild cards because parts of the region are unexplored and have promising geological formations, namely in Turkmenistan (as approved by Gaffney and Kline), Afghanistan or Tajikistan.

The region is landlocked, which creates a decisive barrier to the development of its vast resources, notably because of the complexities of financing and constructing pipelines across several countries. With the dissolution of the Soviet Union, and most visibly illustrated in Ukrainian-Russian gas disputes of 2006 and 2009, transit became a, if not *the*, security of supply issue for Europe. Transit issues have been prominently addressed in the ECT and its related Transit Protocol.[25] But at the end of the 1990s, the question of transit (both the rules contained in the Treaty and the Transit Protocol as an annex to the Treaty) became a crucial point of contention for Moscow. The Russian gas company Gazprom feared the loss of its strategically important position as the narrow gateway to Central Asian gas. The decisive point here is that Gazprom buys and resells Central Asian gas instead of simply providing transit services. Russia has put Turkmenistan in the position of being a swing gas supplier, exposing the country twice to two sharp collapses in deliveries to Russia because of disputes over prices and volumes (1997–1998 and 2009). But with the commissioning of the Turkmenistan—China pipeline, gas export has started to diversify. Yet the uncertain legal status of the Caspian Sea so far has prevented the building of a Trans-Caspian Pipeline and the emergence of large scale offshore projects in Turkmenistan.

[24]IEA, *World Energy Outlook 2010*, p. 523.

[25]Kirsten Westphal, *The Energy Charter Treaty Revisited. The Russian Proposal for an International Energy Convention and the Energy Charter Treaty*, SWP Comments C08, March 2011.

For the EU, which has repeatedly sought to diversify its imports, it seems very likely that gas exports from the Shah Deniz II phase will find their way through a Southern Corridor into Europe. This might not necessarily have been realized through the Nabucco Pipeline, but rather with a smaller project that is being developed first, and with possibilities to be upgraded later.

In any case, however, these long, overland and multi-country projects make the reliability of exports contingent on a long chain of political arrangements, frameworks and circumstances.

With regard to conventional gas, the creation of the Gas Exporting Countries Forum (GECF) raised concerns, given the dominance of a few exporters and the concentration of reserves in four countries. Pipeline-dominated gas exports and the existence of oil-price-indexed contracts had been seen as factors hindering the formation of a cartel. However, since spot market transactions in Europe and global Liquefied Natural Gas (LNG) trade have increased, the maneuvering room expanded for gas exporting countries to steer the volume and direction of exports. In 2008 the Forum adopted a Charter and set up a permanent secretariat in Doha. The gas glut of 2008/2009 provided incentives to coordinate and discuss production and export strategies among the major players. And indeed, Algeria called for coordinated action in face of depression of spot gas prices in the Atlantic Basin. However, given the then-sensitive situation, the initiative was not taken up effectively by Qatar and Russia. As in OPEC, effective cartelization is constrained by diverging (geo)political and commercial interests of the members. Nevertheless, consumer states should keep an eye on these developments, which are a source of concern.

A Regional Story: MENA Gas and an Uncertain Outlook for Future Exports

The natural gas reserves in the MENA region present some 45% of the world's total, and its marketed production amounts to 20% of the world's total output.[26] Despite the fact that the region is seen as an import asset to (southern) EU gas markets and as an opportunity to diversify EU supplies, as well as the outstanding role Qatar in particu-

[26]Darbouche, Fattouh, Implications of the Arab Uprisings, p. 21.

lar plays regarding LNG, the region plays only a modest role in international gas markets.

The Arab Spring may reinforce certain trends, namely underinvestment and rising domestic demand. Major uncertainties in the short term relate to the political situation in Algeria and Qatar, but so far both countries have not been shaken by uprisings. However, most likely the Arab Spring will affect domestic pricing and market regimes, upstream investment terms, and export policies in the region. The MENA countries will experience steeply increasing demand. This is particularly the case for natural gas, which in turn may constrain the region's export capabilities. Most countries of the region, with the exception of Qatar, have faced supply shortages. Gas will be used extensively in the power sector and as a feed stock for energy-intensive industries, while at the same time upstream production costs will increase as "easy gas resources" are depleting. Gas consumption in the Middle East is expected to grow by 3.9% per annum between 2010 and 2030.[27] North African countries will see a quadrupling of their electricity consumption by 2030, given annual growth rates of 4-8%. This is a major source of uncertainty regarding available export volumes. Algeria is a case in point. Incentives to curb demand will be low, as the Arab Spring most likely will delay and set back domestic price reforms for socio-political reasons.

Rising gas demand and antagonistic relations between neighboring countries are a threat to regional stability. Since the Egyptian revolution in February 2011, the country's gas export contracts with Israel and its other neighbors have been constantly questioned, and the pipeline through the Sinai has been blown up several times. This is a source of geopolitical instability in the region, as Israel gets 40% of its imports from Egypt. Israel could be pressed to exploit disputed offshore resources in the Eastern Mediterranean Sea. The Levant Basin witnessed the world's largest deepwater gas discoveries in 2009 and 2010. This may lead to conflict with the Palestinian Authorities and with Lebanon. Moreover, these vast reserves increasingly have been a source of dispute between Cyprus and Turkey.[28]

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[27]BP, *BP Energy Outlook 2030* (London: BP 2011), p. 51.

[28]Vlad Popvici, "Europe's new energy frontier," *European Energy Review*, October 27, 2011.

The fact that production in most countries of the region has not kept pace with demand is very telling: the value-added chain of gas is quite different from that of oil, given the challenges for exporting infrastructure, be it pipelines or LNG terminal. At the end of 2011, Qatar still had a moratorium in place for new gas export projects, pending the outcome of a study of the effects on the reservoirs of the country's North Field, being also the world's largest gas field. The uncertain evolution of Iran and Iraq adds further uncertainty regard the timetable and nature of any production increases.[29]

Shale Gas—A Global Game Changer?

Gas markets have undergone a revolution due to the shale gas boom in the U.S. This illustrates best the uncertainties related to new technologies: fracking was a wild card par excellence. Whether this boom can be reproduced in other parts of the world, namely in (eastern) Europe and China is however uncertain.

The steep increase in shale gas in the U.S. resulted in a remarkable drop in LNG imports to the U.S. This LNG was then exported to Europe, helping to increase the liquidity of its gas hubs and sport markets significantly. The gas glut also unfolded because the economic crisis in 2008/2009 resulted in lower demand. Gas prices eroded in continental Europe and consumers were able to buy gas at a much lower price than under long term contracts with their major Norwegian and Russian suppliers.

As a consequence of these latest developments, gas markets are in flux in respect to their markets, different price regimes and relevant actors. This creates uncertainties. It is very likely that over the next decade, the (North) American gas market will further decouple from the Europe-Asian and the Asian-Pacific market. Due to shale gas, North America will see a price cap on shale gas production costs. The question is open, however, whether the U.S. will become a gas exporter.

Whether Europe will still see an increased availability of LNG (redirected from the U.S.) depends on the level of demand increase in the Pacific region. After the Fukushima nuclear catastrophe, gas

[29]IEA, *World Energy Outlook 2010*, p. 189.

demand is projected to rise, also because of Germany's so-called "Energiewende" and the decision to re-approve the nuclear phase-out of 2002, which had been reversed only some months earlier in 2010.

In continental Europe, oil indexation has come under pressure and we are already witnessing a mix of oil-indexed, gas-to-gas or electricity-based pricing with components of forward spot-market-based elements. This evolution of new price formulas is surrounded by severe doubts as regards risk-reward balancing in long-term contracts. The move toward a new regime means also a break with the former risk-sharing mechanism, under which the buyer took the risk of volumes and the seller the risk of prices under a take-or-pay clause. These contracts were seen as the basis for developing the long value chain of gas upstream projects to transport and distribution nets. There is considerable uncertainty whether this move will secure the needed upstream and infrastructure investments, whether the markets will remain liquid, and whether gas will herald an era of lower gas prices compared to oil or at least whether gas will be competitive when compared to coal in the power sector.

Moreover, these developments have put important gas companies in Europe under pressure. The landscape of European gas companies is in flux, not only because of the uncertain future of long- term contracts and pricing mechanisms but also because of EU internal market regulation. The major uncertainties here relate to the question which actors will be acting in which segment of the gas value-added chain. While on the one hand European gas companies have been faced with unbundling, on the other hand the large gas producers outside the jurisdiction of the EU have actively sought to enter transport, storage and end-user market segments. What this means in terms of price security as one element of security supply still remains to be seen.

In the Asia-Pacific region, major uncertainties stem from a competition between Qatari and Australian LNG about to enter the markets. In addition, the Asia-Pacific region is expected to see the steepest increases in demand and a dominance of oil-price indexed prices due to the Fukushima-Daiichi nuclear catastrophe and to demand increases in the Middle East.

Paradigm Shift Ahead? The Demand Side and Future Energy Trends

It is almost a banality to note that major uncertainties relate to the unknown level and the future structure of energy demand. However, the preconditions are very different around the world: the industrialized countries have almost reached their peak in energy consumption, but the emerging countries and the developing countries have to cope with a (sharp) increase in demand. Over the past 20 years energy consumption grew by 45%, and is likely to grow by 39% over the next two decade. This translates into a 1.7% average growth per annum.[30] The big challenge is to decouple energy consumption from growth of GDP and to decrease energy intensity.

After a short recovery from the deepest economic crisis since World War II in 2010, the debt crises in the U.S. and the eurozone have again shaken financial markets and the world economy. Macroeconomic developments are uncertain, as is the demand for energy. Nevertheless, a pattern is emerging: for the OECD world it seems that due to efficiency gains, the levels of demand after the crisis is unlikely to swing back to pre-crisis levels. 93% of the increase in energy demand will be driven by non-OECD countries.[31] What is unclear, however, is what this means in terms of relative loss of geopolitical weight of the OECD consuming countries and of shifting resource flows, and last but not least for the mix of relevant actors in energy production, trade and consumption. How do and will Chinese and Indian NOCs behave on the world's energy and raw material markets and in trade relations? Will this translate not only into competition over scarce resources but also into conflicts?

Moreover, what does rising demand in energy-producing countries in the strategic ellipsis mean? For supply security considerations of the OECD world, domestic demand in the MENA region, the Caspian Basin countries and in Russia is one of the major sources of uncertainty, and carries significant risk for supply constraints. So far, there are no incentives to tackle the demand side under the paradigm of energy efficiency; to the contrary, cheap and highly subsidized energy prices are the rule and part of the power play of ruling elites.

[30]BP, *BP Energy Outlook 2030* (London: BP, 2011) p. 17.

[31]IEA, *World Energy Outlook 2010*, p. 47.

The demand side is key to a more sustainable energy future, as energy savings and increases in energy efficiency are the widest available and cheapest source of energy and thus a low hanging fruit, as has been widely acknowledged. But can the world live up to this potential?

Energy efficiency is the low hanging fruit that is still hanging. Even in the EU, with its 20-20-20 goals by 2020—that is, to achieve a 20% reduction in CO_2 emissions, a 20% share in renewables in energy consumption, and a 20% boost in energy efficiency—the goal to increase energy efficiency is the only one that is non-binding and indicative. Tackling the demand side requires significant steering and administrative capacities of which most of countries do not dispose.

There is another side story to tell: if the EU takes its own objectives regarding GHG reductions seriously and sticks to its commitment to a 2 degrees Celsius track, then this will have a significant impact on the future demand of fossil fuels, which will have to decrease significantly. Uncertainties as well as major opportunities lie in the development of technologies such as CCTS or new fuels in the transport sector. Yet demand issues are highly intertwined with climate security and with supply security. Consuming countries that send the wrong signals with regard to future demand might find themselves in a desperate security of supply situation if they are unable to realize their own plans and estimates.

China, for instance, will have a huge impact on all hydrocarbon markets. Today it accounts for 47% of global coal consumption, and this is expected to increase to 53% by 2030.[32] By 2030 the country's consumption will reach 17.5 million barrels per day, overtaking the U.S.[33] Moreover, gas demand is growing rapidly in China, and by 2030 the country's consumption will be comparable to that of the European Union today. That is remarkable since the share of gas is comparably low in China's energy mix (4% in 2010).[34] China has undertaken steps to reduce its emissions, to a large extent in reaction to local environmental considerations. For gas, major issues are new technologies, developments in the transport sector towards CNG and the price of carbon in the market. Depending on these factors, gas will

[32]BP, *Outlook 2030*, p. 61.

[33]Ibid., p. 33.

[34]Ibid, p. 49.

either remain a "fuel of consequence" or become "a fuel of choice." The question is still open whether natural gas will be only a bridging fuel to a low-carbon energy system, or become a destination fuel, in terms of being the cleanest, vastly available and efficient fossil fuel. BP expects that gas will be the fastest growing fossil fuel in power generation and sees its share in the global electricity growth increase slightly from 20.5% in 2010 to 22% in 2030.[35] The answer to the question is likely to differ between regions and countries.

International governance has only recently focused on the demand side. The most prominent examples are the G8 plus G5 International Partnership on Energy Efficiency Cooperation (IPEEC) and the Sustainable Building Network platforms at the IEA.[36]

Renewables in the Energy Mix: Fundamentals in Flux—Dilemmas at Play

As the IEA outlines,[37] global investment in renewable energy assets grew seven-fold over the period 2004-2008, reaching $126 billion. However, the global financial crisis has hit the renewables sector, which is also likely to be buffeted by the unfolding debt crisis in the EU. Investment in renewables fell 9% and investment in biofuels fell sharply by 60% between 2008 and 2009. The biofuels industry was directly affected by the fall in oil prices and the lower overall demand for oil. Global investment in electricity projects remained stable at around $108 billion between 2008 and 2009.

Major uncertainties relate to the share and structure of non-large-hydro renewables in the overall energy mix. The predominant fuel mix changes relatively slowly, but gas and non-hydrocarbons are projected to gain share at the expense of coal and oil by 2030.[38] The potential for renewables varies greatly however, depending on cli-

[35]Ibid., 53.

[36]Dries Lesage, Thijs Van de Graaf, Kirsten Westphal, "G8+5 collaboration on energy efficiency and IPEEC. Shortcut to a sustainable future?" *Energy Policy*, December 2009, online version.

[37]IEA, *World Energy Outlook 2010*, p. 283

[38]BP, *Outlook 2030*, p. 17.

matic, geographical, geological or weather conditions. In order to fully exploit their potential, the world should consider locational advantage and harvest renewable energy under the best possible conditions. This will not come, however, without political, financial and economic costs. It will mean changing the fundamentals of the energy system.

The power sector will be key for enlarging the share of renewables. An increase of end-use electricity consumption will be part of the strategy to curb GHG emissions. Thus far, however, major uncertainties relate to the grid and the interplay between transmission and distribution levels, combining centralized and decentralized power generation. Another uncertainty is related to the development of storage technologies. The shift toward electricity use may help for the 450ppm trajectory, but brings about new challenges for a resource-efficient energy system, as other raw materials such as rare earths are needed for batteries. Here again the question of new technologies is a wild card.

What are the uncertainties ahead? Whether the globe will embark on a more renewable non-hydrocarbon-based energy system, and to what extent it might do so, is unclear. Political and regulatory developments remain particularly uncertain. Moreover, inter-regional and transnational cooperation is a key condition for developing green electricity markets, as reflected in the Seatec concept of large offshore windparks in the North Sea or envisioned in the Desertec concept. The idea of an energy partnership between the EU and the MENA region in combining wind, photovoltaics, and concentrating solar power (CSP) to the benefit of the MENA countries and to meet the green electricity demand in the EU illustrates the challenges ahead: to break with hydrocarbon path dependencies, to develop and deploy a new technology, make it bankable and commercially viable to achieve the necessary market introduction and penetration. CSP is a case in point that a European technology needs international cooperation in order to achieve effects of scale and cost-efficiency. Whether such North-South partnerships will become real is still an open question due to the lack of supportive economic and political frameworks.

The large-scale use of renewables is not free of geopolitics. It shapes future regions through interconnections. The case of biofuels is closely related to land mass and the water-food nexus. To what

extent inter-regional and transnational cooperation can be exploited is still questionable and depends on a level playing field for renewable energy sources compared to fossil and nuclear-based energy sources. Moreover, the development is not free of tradeoffs: any one decision could preempt, constrain or even block alternative solutions. This hints at the systemic character and the complexity of the energy transition challenge. For instance, large photovoltaic installations take up a possible market share for CSP installation, although the latter is able to provide base load.

Without going into detail here, a major source of uncertainty in the development paths of renewables stems from the fact that due to physical, climate and geographical conditions the production patterns of renewables will diversify and differ widely, tailored to the respective situation on the spot. There is no panacea and no one-size-fits-all approach that may spur one global answer. Consequently, the major players have already embarked on different paths. As regards international governance, this has complicated concerted approaches to open question of know-how and technology transfer. The most prominent case in point is the fact that Brazil has not joined IRENA. Here, completely different approaches to renewable energy and clashes over environmental standards are at play.

Coping with Uncertainty and the Limits of International Energy Governance

In sum, in the short and mid-term perspective it is the economic environment that causes the major uncertainties. This study has also tried to shed light on the enormous and related uncertainty about the future price developments, the size of energy resources and the costs to develop them. Moreover, we have seen to what extent new technologies can really be game-changers. But the *World Energy Outlook* is right to point to government policies as "the biggest source of uncertainty to 2035."[39] Whether and which governments will act, and "how, when and how vigorously is far from clear."[40] This is all the more true for international governance.

[39]IEA, *World Energy Outlook 2010*, p. 60.

[40]Ibid.

The existing institutional framework is not "fit for 2050" because it reflects the old conventional energy system and there are few loci to address the triple challenge in a really integrated manner. So far, collective action hardly goes beyond paying lip service. It is not so much technological and industrial uncertainties that surround the much needed "industrial energy revolution," but rather "the measures needed to bring this about, the way in which they are to be implemented and their timing are often unclear."[41]

International governance can make a difference. The story behind the G-20's initiative to phase out inefficient fossil fuels, which was taken at the Pittburgh Summit in September 2009,[42] is telling and highlights the related political and regulative uncertainties. Price distortion of fossil and nuclear fuels through subsidies is a decisive obstacle to more efficient energy use, expansion of renewables and effective action on climate protection. If fossil-fuel subsidies were phased out, growth in energy demand would be cut by 4.1%, oil demand would fall by 3.7 million barrels a day and CO_2 emissions would be cut by 1.7 gigatonnes.[43] It is pretty much self-evident that a concerted international effort to reduce subsidies is needed. Energy subsidies interfere massively with national and international energy markets and distort market and price structures. They prevent fair competition between individual fuels and create a cost spiral where renewable alternatives also need greater subsidies. Subsidies on fossil fuels are the root of the evil with regard to price distortions. Their abolishment offers a means to enhance energy efficiency, expand renewables and decarbonise the energy system. Pruning back subsidies can also compensate in a small way for the lack of a market for CO_2. Although this route cannot end the externalization of costs, it would stop the overt promotion of consumption and production of fossil fuels and introduce competitive market conditions. Unless the G20 initiative is

[41]Ibid.

[42]In more detail: Tobias Belschner, Kirsten Westphal, *The G20 and Inefficient Energy Subsidies. Grasping the Cause of Price Distortions by the Roots?*, SWP Comments 2011/C 22, September 2011.

[43]Euractiv, "*IEA top economist calls for bonfire of the fossil fuel subsidies*" http://www.euractiv.com/specialreport-solarpower/iea-top-economist-calls-bonfire-fossil-fuel-subsidies-news-508497?utm_source=EurActiv+Newsletter&utm_campaign=52f296ba43-my_google_analytics_key&utm_medium=email, accessed on October 26, 2011.

implemented consistently and globally, it will be difficult and expensive to tackle the two big challenges in the energy sector: transforming the energy system and eliminating energy poverty. The latest figures for autumn 2011 are discouraging, however: according to the IEA, the equivalent of $409 billion in fossil fuels subsidies are in place, representing a $110 billion increase from the 2009 levels.[44]

The major geopolitical uncertainties relate to fact that the energy system is largely interconnected through price development, but may become less global in the future. The U.S. and the North American market have undertaken significant steps to become largely self-suppliers. This may result geopolitically in a more isolationist attitude towards issues of supply security, in particular in regard to securing oil and LNG flows through major chokepoints. Will Europe and China step in? For Europe, the major challenges to be faced are to develop further the strategic partnership with Russia to the energy relationship with China. Both regions are looking to the same resources in the Caspian region and in Central Asia. It is also an open question how China, as a major consumer of oil and gas flows from the Middle East, will behave as a power invested in ensuring stability and free and open access to supplies. So far, consumer countries' cooperation is limited by the institutional landscape of international governance. Neither China nor India are members of the IEA. However, it is common sense that the consuming countries will be the ones to make the difference and where we can expect action to be taken in regard to climate and energy security.

At the same time, the energy world will become much more differentiated with regard to energy production, consumption paths and the landscape of actors. Major uncertainty relates to the different development paths and their effective implementation. Depending on the locational prerequisites needed for renewable energies, storage facilities etc., the energy production and consumption map will be become much more diversified, being tailored to the circumstances on the spot. This brings about many uncertainties in respect to the development of costs and winning technologies.

[44]Ibid.

The landscape of international governance is highly fragmented and rather weak when it comes to addressing the necessary energy transition and at the same time stabilizing the conventional energy (security) of supply without perpetuating it. To put it bluntly: our institutional energy landscape is not 'fit for 2050.' Given the complex nature of relations among actors, the interdependence of energy systems, and interconnections among the energy sectors, as well as the interplay along the whole value-added energy chain, governing or even steering the energy transition is a Herculean task: it demands long-term commitment, shared international energy goals, enormous financial and political resources and integrated energy and climate policies across the different national, regional and global "scales of energy governance, the demand and supply side of energy systems and energy technologies."[45]

There is no single venue to discuss energy issues; instead there is a patchwork of various dispersed, segmented and sometimes competing institutions and organizations. What is equally important is that in many cases the mandate for such groupings was developed decades ago under different circumstances. In many aspects they also no longer reflect existing global energy relations, as traditional roles and boundaries between producers, consumers and transit countries have been blurred. Nor do they mirror the increasing role of non-OECD countries. To make the point very clear, what is missing is not an overarching World Energy Organization. What is needed is a concerted and integrated approach to the triple energy challenge, which as a side product could bring about more coherence in the institutional setting.

It can be reasonably argued that the G-8 has had a good record "as an agenda setter and as a forum for deliberation on energy and climate issues"[46] since the milestone summit in Gleneagles in 2005. Whether the G-20 is able and willing to pursue such an integrated approach is more than open. It would be promising because established and emerging powers meet on an equal footing, but so far the G-20 has

[45]Cherp et al, *Governing Global Energy*, p. 75.

[46]Thijs Van De Graaf, Kirsten Westphal, "The G8 and G20 as Global Steering Committees for Energy: Opportunities and Constraints," *Global Policy*, vol. 2, Special Issue on Global Energy Governance ed. by Ann Florini, Navroz K. Dubash (September 2011), pp. 19-30, 28.

taken a more narrow approach to energy. In that respect, it is also telling that sustainable development, with its guiding theme of a green economy, which is supposed to be a major theme at the UNCSD in Rio de Janeiro (Rio plus 20), and has been promoted as an answer to the financial and economic crisis by the OECD, has so far not been taken up seriously by the G-20.[47] As long as the UN Framework Convention on Climate Change (UNFCCC) does not achieve a breakthrough in putting a price on GHG emissions and establishing a global climate regime, and as long as the Post-Kyoto Process remains open, the major elements to spur an energy transition are lacking.

[47]Nils Simon, Susanne Dröge, "Green Economy: Vision mit begrenzter Reichweite," *SWP-Aktuell*, 19 (March 2011).