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Interview: Adnan Amin, Executive Director IRENA

"Climate negotiators still have much to learn about the energy transformation"

"Everything we have seen is pointing to transformational change in the energy sector", says Adnan Z. Amin, Director-General of the International Renewable Energy Agency (IRENA). "We don't need a miracle, it's already happening." In an exclusive interview with World Energy Focus, Amin, under whose leadership IRENA has become the world's fastest-growing intergovernmental organisation with over 170 member countries, says that renewables are growing much faster than most people realise. "Many policymakers have a very rough understanding of the potential of decarbonisation. Even among climate negotiators there is surprisingly limited knowledge about what renewables can accomplish."

Adnan Amin does not give the impression of a man who is in a desperate race to save the world from climate catastrophe. When we meet him in Bonn, Germany, where the Innovation and Technology Centre of the Abu-Dhabi based organisation is located, Amin appears suave and relaxed, in spite of just having experienced serious

flight delay. He has reason to be: thanks to quickly falling costs, renewable energy is on a global growth trajectory that, as Amin puts it, "no one could have foreseen five years ago".

Indeed, according to Amin, "the power sector is no longer a problem" when it comes to decarbonisation. We must

now turn our attention, he says, to "the end-use sectors" (transport and heating/cooling), questions of market design ("we have graduated from the feed-in-tariff") and "the next generation of technologies", for example in storage and infrastructure. Amin is convinced that IRENA's ambitious REMAP scenario (doubling of renewable energy to 36% in 2030) is perfectly realistic. He sees oil companies transforming themselves, believes there is "no more room for coal", and is convinced the growth of off-grid technologies taking place in developing as well as developed countries is seriously underestimated. He is joined in the interview by Dolf Gielen, Director of the IRENA Innovation and Technology Centre in Bonn.

Bill Gates has said we need miracles [<http://bit.ly/28LNfDK>] to achieve a clean-energy breakthrough. What is your view?

Amin: The miracle is already happening. Everything that we have seen is pointing to transformational change in the energy sector. Costs of solar and wind are coming down rapidly. Last year we were blown away by solar PV prices as low as 5.4 cts/kWh in Dubai and 4.3 cts in Peru. Now we have had a record 2.99 cts in Dubai. Last year saw 8.3% growth in renewable energy capacity. Investment is up. Where Bill Gates has a point is that we now have to prepare ourselves for the next generation of technologies that will lead to us to an integrated energy system that's sustainable. This means we need innovation and investment in infrastructure, storage, grids, and innovations in market design.

According to IRENA's REMAP scenario (2016) [<http://bit.ly/1W3gu9X>], the share of modern renewables in final energy consumption could double to 36% in 2030. But the report also notes that if all countries follow their national climate plans (NDCs), the renewables share will rise to just 21%. This means that growth has to increase six-fold. Is that realistic?

Amin: Yes. Costs of solar PV have gone down 80% in 5 years. Costs of wind and storage are also coming down. Five years ago no one could have anticipated this. And it is still continuing. We have also gained > see page 2

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a lot of knowledge on what we need in terms of policy and regulations. Front-runner countries like Germany and Denmark are showing it is possible to integrate renewables into the energy system without major fixes. So we don't think we are overly optimistic. We just came back from a visit to China. Researchers there think they can go much further than what is in the plans right now. In the US we have seen that Republicans and Democrats agreed to extend the renewable energy tax credit for 7 years. That will have a great impact. And other countries are following the same path. We may even have been conservative in our outlook.

“Countries that don't have money for renewables don't have money for any kind of power. It's not a trade-off.”

Dolf Gielen: This is a point that we made in the REMAP – we believe today's policy plans underestimate what is going on in the market. Take solar. If you add up all the national projections, you get to 500-600 GW in 2030. Today we are at 230 GW and adding 50 GW a year. So even at today's growth rate you will hit 1000 GW in 2030. That's not rocket science. If you assume some growth, you will get to 1500 GW. And it's the same in other technologies.

Battery storage for example. That's being taken up by the market whether policymakers believe in it or not. All this is not fully reflected in the national plans. Nor has it been accommodated by the incumbent players.

Amin: Even among climate negotiators there is a lack of comprehension of the potential of renewable energy for decarbonisation. I just came back from a meeting in Paris and I was struck by the fact that even people who have been around for a long time still have a very rough understanding of the economics of the energy transition today. They tend to look at their own country and not see the larger picture. They still believe renewable energies are too expensive, that they can't be handled by the grid, that there will be large system costs. They say they don't know how to do it. But in the energy community this is not the case at all.

Where do you see the cost of storage going?

Amin: Let me tell you one anecdote. We visited a technology company in China where we were shown a new storage device, comparable to the Tesla Powerwall. We were told this is going to deliver the same kind of storage capability at one-third of the cost. We will certainly see sharp decreases in cost, but it's difficult to predict which technologies will win out and how. **Gielen:** If you look at the price gap between stationary storage and car batteries, that's a factor 2 to 3. So that magnitude of cost reduction is still possible for today's lithium-ion

batteries. What I see as a bigger problem is if we all start driving EVs, we will need an awful lot of lithium. At our latest conference there was a lot of buzz about ultracapacitors for cars. If something like that would work where you don't need that amount of materials that would be a real breakthrough.

In countries like the US there is a debate about centralised versus decentralised generation. What do you think is the wave of the future?

Amin: I don't think it's either-or. The trick is to achieve the optimal combination. I do believe that people are underestimating what is happening in off-grid. We have all been talking for many years about 1.3 billion people without access to modern energy services. Nobody ever questions this figure. But when we looked into this recently we discovered there is a lot of investment going into solar home systems, particularly in developing countries. You don't see this in the energy statistics, that's why we looked at the trade statistics. There are thousands of these home systems developed by entrepreneurs. They provide very low-cost basic power services for cell phone charging, refrigeration, and that sort of thing. So we see this picture changing dramatically, although we would still like to see it change more quickly. We need to improve the investment framework in developing countries. The aid model doesn't work. We need to incentivise entrepreneurs to start new businesses. That will lead to new revenues and new skills being developed.

Energy transition is often presented as win-win but surely there are also losers. Do you talk to the international oil companies or fossil fuel producers?

Amin: Yes, we talk to them. We see a huge change in attitude. Their scenarios are changing. They are investing in renewables. They more and more see themselves as energy rather than oil companies. Utilities like Enel are already developing towards a service-oriented model. Oil companies will follow. Oil producing countries also. Why do you think Abu Dhabi hosts IRENA? They are looking at a world beyond oil.

Do you think low oil prices will hinder the energy transition?

Amin: Low oil prices? In the renewable energy sector we are pushing the price down! Very few countries use oil for power generation, so there is no direct relation there. Renewables could form a virtuous combination with gas as balancing fuel. Nobody wants coal anymore. Even countries that are investing in oil are looking for an exit. Investors are beginning to realise that a lot of these assets will be stranded in 5, 6, 7 years.

What are the most promising developments in market design?

Gielen: We see a clear trend away from feed-in-tariffs (FITs) towards auctions. Auctions have resulted in much better prices. Amazing prices. Although the devil is in the detail: you have to look carefully at how you organise your auction. On the whole in power market redesign there is still a lot

of testing go on. We don't think there is a one-size-fits-all solution.

Amin: FITs were essential to bring costs down initially. But they are a long-term fiscal burden. We have graduated from FITs to more market-reflexive methods. You know, the power sector is really not a problem anymore. More important is how renewable energy can change end-use sectors such as mobility and heating.

Do we need a supranational framework to advance the energy transition?

Amin: I don't think there is much appetite for that. For countries sovereignty over their energy resources is essential. Security of supply comes first. I think that countries that don't have money for power from renewables don't have money for power from anything. It's not a trade-off. There is a business case for renewable energy. Especially for off-grid in developing countries.

What is the finish line for IRENA?

Amin: All of us who work in this field are very passionate about what we do. This is not just a job. We believe in what we are doing. Our real job is to support countries in the transition. That job is being made easier by the way technology and economics are working out. If we are successful in positioning the business case for renewables as both a driver for growth and employment as well as a critical plank of climate policy – if this becomes the operating model for the majority of countries – we will have succeeded. ●

World Energy Perspective report on e-mobility

Electric vehicles key to closing the emissions gap

Photo: Open Grid Scheduler

Electric vehicles represent one of the most promising technologies for reducing oil use and cutting emissions, according to a new study from the World Energy Council in collaboration with Accenture Strategy. The study looks at fuel economy targets in the world's biggest car markets – the EU, US and China – and identifies ways for increasing the numbers of electric vehicles in order to meet fuel economy standards and “close the emissions gap”. Policymakers, utilities, consumers and vehicle manufacturers all have a part to play in what will be a burgeoning market for e-mobility.

The EU, US and China, the world's largest car markets with collective annual demand of over 40 million passenger vehicles, have all set fuel economy improvement targets of approximately 30% for cars from 2014 to 2020 (as measured in gCO₂/km) – remarkable for their similarity and ambition.

However, as the World Energy Council's Director of Policy and Scenarios, Professor Karl Rose comments: “I'm not sure how many realise that the standards that are

being set are out of range of the internal combustion engine. You have to look at the numbers to see what the implications are. In order to close the emissions gap, you need e-mobility in a central role in any policy and technology portfolio.”

This is called the ‘EV gap’: it refers to the electric vehicle (EV) sales required to meet fuel economy targets for passenger cars. In the EU, the EV gap is 1.4 million (10% of the estimated 2020 passenger car sales), in the US,

it is closer to 0.9 million (11% of the projected 2020 passenger car sales), and in China, it is about 5.3 million (22% of the projected passenger car sales). Closing the ‘EV gap’ could make a significant impact towards country-level CO₂ emissions reduction goals.

CONSUMER CHOICE

But what do consumers want? A lot is going to depend on the costs. And the new study has some interesting results on this. According to Ted Walker, Managing Director in Accenture's North America Utilities Strategy practice group, who participated in the study: “The fuel price spread between gasoline and electricity isn't all that big. So for now, TCOA (total cost of ownership) is about the same, but projecting five years ahead, as battery prices come down, electric vehicles will be the more economical option by about 21 percent.”

Then of course there is the question of what is called ‘range anxiety’. Justin Davidson, Senior Manager in Accenture's Strategy Practice, notes that “although upfront cost of ownership plays the largest role in consumer decision-making, another major factor is the customer's range anxiety. This is a real issue. But looking at the average commute, 70 percent can be met currently by electric vehicles.”

“What we
need for government
is to stop talking
and start doing.”

AN OPPORTUNITY FOR PARTNERSHIP

Various incentives – including tax breaks and free parking – have been used by governments to support EV take-up. However, as Davidson says, “In terms of consumer incentives, it's a chicken and egg situation – TCOA versus charging solutions. Which comes first? Really it is both.”

Combining consumer incentives with charging solutions can provide “an opportunity for vehicle manufacturers and utility electricity providers to partner to deliver a superior value proposition to consumers”, according to the report. Walker explains: “It's > see page 4

ABOUT WORLD ENERGY FOCUS

The **World Energy Focus** magazine is published monthly by Energy Post Productions. For more information please contact us at info@worldenergyfocus.org

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ELECTRIC VEHICLE SALES GAP

Even capturing less than 1% of combined sales across the three markets, electric vehicles can be key to lowering overall fuel economy to meet new requirements. The EV GAP is the number of electric vehicle sales that will be needed in each market to meet the regulatory requirements.



important to have comprehensive charging access solutions, but also to align incentives such as cheap night time electricity with current incentives such as tax breaks."

Policymakers take note: standardisation will be a key factor in enabling cooperation between utilities and manufacturers. Walker says: "There's a many-to-many solution (vehicle types to utilities) which needs to happen. Standards will encourage more interoperability here. If you look at the United States, there are competing networks but there are also aggregators that allow more convenience for the consumer, which is very important."

And EV charging networks may look quite different to traditional hydrocarbon refuelling. Allison Myers, Strategy Consultant at Accenture, says: "Charging an EV is not the same as refuelling at a gas station. A mind-shift is necessary here. The ability to charge at home is actually the most important, followed by the workplace."

How eager are utilities to engage? Rose: "Overall, utilities are reluctant to move in this direction. I'm the chairman of a utility here in Austria, and we are currently investing millions in a nationwide charging network. It's a huge gamble – but we're doing it because the government is not doing anything. What we need is for government to make investments in infrastructure – to stop talking and start doing."

Vehicle manufacturers are also slow to capitalise on this new market opportunity, according to Rose. "In general, their strategy is defensive and it can be difficult to determine who is sincere. I think that Toyota is sincere, and that the French manufacturers are really trying and offering many new models – they understand that this is a future they need to be part of."

In fairness to the manufacturers, change on this scale is not instantaneous, Walker says. "Manufacturers can ramp up only so fast. It

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might take ten years to increase production to 500,000 vehicles per year.”

MANY PATHS

At the country level, the report cites successful EV initiatives in New Zealand and Norway. Myers notes: “Solutions can be provided more easily in smaller countries which are more homogeneous – it’s easier to raise awareness and build the infrastructure.”

Norway’s model of tax breaks, subsidies and preferential treatment of EV drivers on the road has led to EVs capturing over 20% of new vehicles sold in 2015. Low-cost hydro-powered electricity and no domestic car manufacturers to protect were distinct advantages in achieving this degree of market penetration. In 2015, Norway was the 4th biggest EV market in the world – behind China, the US and the Netherlands.

But what of the three biggest car markets in the world – the EU, US and China: who will be successful in closing the gap?

Davidson speaks for the team at Accenture: “We think all three can close the gap, but for different reasons. China has a much bigger target to meet. But its policymakers have a much higher degree of control. China can steer the ship and meet goals purely by mandate.”

“Here in the US, it’s more of an innovation story. Tesla, Ford and others are investing in the belief that this will be a mass market product. The EU has demonstrated the most seriousness on emissions as a societal issue. For example, Norway is considering banning the sale of internal combustion engine vehicles by 2025, and it wouldn’t be a surprise if other countries followed suit. So I think via different pathways all three will mind the emissions gap.” ●

RECOMMENDATIONS

Industries: Vehicle manufacturers will need to respond to regulatory pressures and shift their product portfolio to avoid material penalties. There is an opportunity for vehicle manufacturers and utility electricity providers to partner to deliver a superior value proposition to consumers.

Utilities: Electricity demand attributed to new EVs can be managed with proper planning by utilities (expected annual incremental generation requirements fall below 0.5% of 2014 total electricity generation in all three markets analysed) and could be further mitigated at the local level with emerging technologies such as vehicle-to-grid (V2G) solutions.

Policymakers: Ensure that consumer and manufacturer incentives align with new or considered emissions standards. Monitor effects of increased electricity demand to preserve the integrity of grid operations.

Regulators: Examine how the proposed fuel economy requirements can be matched with incentive programmes (financial and operational) and collaborate with industry in order to realise desired reductions in CO₂.

The report “*E-mobility: closing the emissions gap*”, will be available to download on 29 June 2016 on <https://www.worldenergy.org/publications>

It was written in collaboration with Accenture Strategy and is based on expert insights from the World Energy Council’s network.

IEA: cities must be transformed to meet climate goals

The city of the future must be radically redesigned to make a “decarbonisation” of the global economy possible, says a new report from the International Energy Agency (IEA). It provides policymakers with practical advice on how to transform their cities: dense urban development, low-carbon heating and cooling systems and sustainable transport systems are key.

“Cities are at the heart of the decarbonisation effort”, according to the new Energy Technology Perspectives (ETP) from the IEA. “Cities today are home to about half the global population but represent almost two-thirds of global energy demand and 70% of carbon emissions from the energy sector, so they must play a leading role if COP21 commitments are to be achieved,” said IEA Executive Director Fatih Birol at the launch of the

report at the Clean Energy Ministerial in San Francisco.

Energy Technology Perspectives (ETP), is an annual publication from the IEA that should be seen as a companion to the World Energy Outlook (WEO). The WEO shows future energy mixes under various policy conditions, including a “2-degree scenario” that is most ambitious on climate. ETP shows what technologies and solutions can (and

cannot) be used to actually achieve this 2-degree scenario.

For instance, ETP consistently shows that without carbon capture and storage (CCS), the 2-degree climate goal will be very difficult to reach. It also consistently shows that progress is too slow.

This year’s edition focuses on the role that cities must play in the low-carbon transition. By 2050 there will be 40% more urban development than today, most of it in cities in emerging and developing economies. These areas will be responsible for at least two-thirds of the anticipated growth in global energy demand and so have a vital role to play in tackling climate change (see chart). What happens there will affect the whole planet.

A DIFFERENT APPROACH

A key takeaway is that energy use in

urban areas can be reduced by 60% simply by designing cities differently so people don’t need to use so much energy. This requires a different approach to planning – a compact city design that eliminates the need for long and frequent private car journeys. It includes highly insulated buildings and neighbourhood plans that encourage the use of public transport, walking and cycling. If these neighbourhoods can also generate their own renewable energy then the report says that greenhouse gas emissions could be reduced by about 8 giga-tonnes by 2050 – that’s no less than 15% of all the world’s current emissions.

Designing cities this way brings other benefits as well: inhabitants get access to modern energy services and their living standards become higher. A win-win. But a lot needs to be done to get there.

For example, adopting and enforcing building codes that promote energy efficiency and encouraging the purchase of energy efficient equipment is crucial to reducing the energy demand in buildings for heating and cooling.

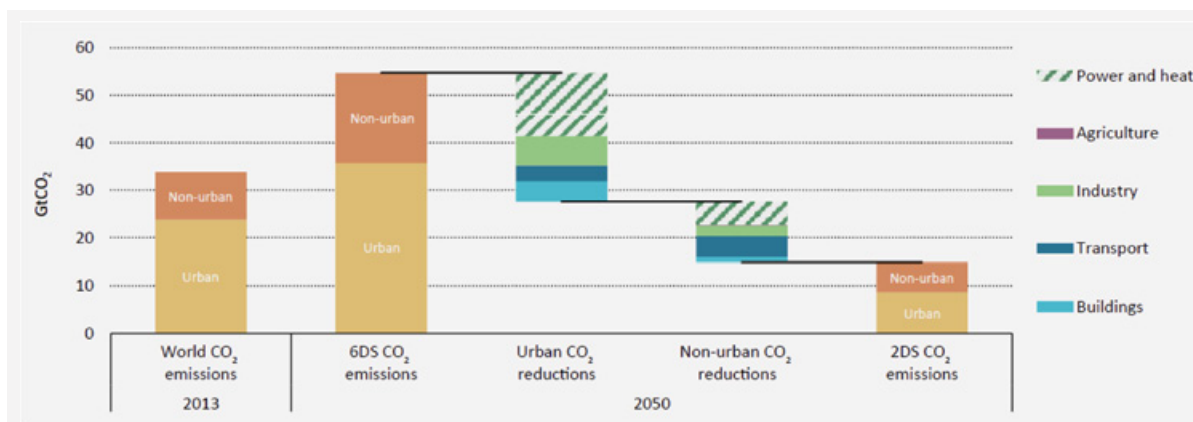
Another example: a combination of electric vehicles and public transport can not only reduce emissions but cut investment needs (in roads and infrastructure) by \$20 trillion compared with current development trends. On the other hand, if business continues as usual, energy demand and emissions from passenger and freight transport in developing countries are

expected to double – if not triple – up to 2025 as car ownership mushrooms. But this shift will not happen automatically. City planners should take various measures to support non-motorised and public transport, such as pricing policies, regulatory policies, investments and subsidies.

MEXICO

Mexico’s efforts are highlighted in the report because the problems it faces are typical of many developing countries. The country has embarked on an ambitious transition to sustainable energy, adopting a goal to halve carbon dioxide (CO₂) emissions from year 2000 levels by 2050. Since the percentage of Mexicans living in cities is set to increase from 73% in 2010 to 83% by 2020, building more energy efficient buildings is an important way to reduce energy use, in addition to increasing renewables in the power sector and decarbonising the transport sector.

According to the IEA, Mexico can achieve its goals “if a stable and effective policy framework is implemented, and particularly if Mexican cities are enabled and incentivised”. Too often in cities and governments, different departments and levels of government operate at cross-purposes. Solving this case requires “a more effective vertical integration of all levels of government”, says the report. This of course does not only apply to Mexico. National and local policymakers need to take policy measures that reinforce each other. The challenge remains daunting. ●



Key point

Urban areas are key to decarbonising the buildings and transport sectors.

Can Asia-Pacific region shake off coal addiction?

In a new Energy Demand and Supply Outlook, the Asia-Pacific Energy Research Centre (APERC) raises concern that the Asia-Pacific region will fail to meet targets for energy security and climate change because of a long-term commitment to using coal as the main source of energy. APERC was set up by the Asia-Pacific Economic Cooperation (APEC) to conduct research and promote energy cooperation between the 21 member countries.

The report identifies three challenges for the region: affordably meeting the energy demands of a growing and more prosperous population; reducing carbon dioxide emissions; and developing and deploying new technologies to support the other goals. It concludes that progress “falls far short of these objectives as well as APEC’s energy goals”, which include reducing energy intensity by 45% by 2035. The report foresees total final energy demand reaching seven billion tonnes of oil equivalent by 2040 – 32% above 2013 levels.

Its key message is that energy efficiency represents the best way to improve energy security and address

climate change. The report also offers an economic pathway to achieve APEC’s goal of doubling renewables – seen as the fastest-growing energy source. But even so, it sees fossil fuels as remaining dominant, accounting for 80% of fuel use in 2040. In the absence of alternatives, coal would supply half of all power, increasing emissions and pollution. APEC therefore calls for cleaner coal technologies, which could cut emissions by 1.3 giga-tonnes of CO₂ – almost 4% of current global emissions. It also calls for increased use of natural gas and nuclear. Even with these, though, the area will continue to rely on imports of energy without further investment. ●

Single Central-South Asia power grid gets a step closer

Work has begun on a transmission line from Kyrgyzstan and Tajikistan through Afghanistan to tackle the severe energy crisis in Pakistan. Called the CASA 1000 project, when completed in 2018 it will carry 5 TWh of electricity a year. Generated by large Soviet-era hydroelectric plants, the power will add an extra 9% to the existing generating capacity of Pakistan, mainly during the

summer, when demand in Pakistan and production levels in the plants both peak. The \$997 million cost is being met by grants and loans from partners. A further line will connect Turkmenistan with Afghanistan. The four countries involved plan further transmission lines that will eventually form a single power grid and a Central Asia-South Asia Regional Electricity Market. ●

Helping companies switch to renewable energy

Google, Amazon, Walmart, Equinix, and Microsoft have already switched to sourcing 100% of their electricity from renewable sources.



Walmart in Ponce Puerto Rico with solar roof. Photo Walmart

They want others to follow suit, and so have formed the Renewable Energy Buyers Alliance (REBA). Its members assist each other in sourcing clean power. At a REBA summit held at Microsoft’s HQ in May, executives from over 30 corporations committed to together investing in 60 GW of additional renewable energy capacity by 2025. Financiers and renewable energy suppliers told potential buyers how new types of contracts and financing arrangements help minimise risk to buyers. This will make it progressively easier for other companies to switch to renewables. ●

BP Review: while energy demand falters, supplies proliferate

While energy demand growth is waning, global supplies of both fossil fuels and renewables are growing strongly as a result of technological advances. This is one of the key conclusions of the annual BP Statistical Review of World Energy, published on 8 June. “This is truly the age of plenty”, said Spencer Dale, BP’s Chief Economist at the launch of the 65th edition of the Review, which is by many in the industry used as a standard reference work for oil, gas and coal statistics. Nowadays the Review also includes figures on renewable energy – a sign of the times.

Looking back on 2015, Dale drew some interesting conclusions. “Despite the weakness in energy demand, 2015 saw solid growth in: oil (+1.9%), buoyed by the sharp fall in oil prices, with its share in primary energy increasing for the first time since 1999”, natural gas (+1.7%) as it bounced back from the weather-induced weakness of 2014; and, renewable energy in power (+5.2%).”

The main casualty, Dale noted, was coal, “which saw its largest decline on record (-1.8%), driven by large falls in the US and to a lesser extent China, with its share in primary energy falling to its lowest level for a decade.”

“Carbon emissions from energy use were essentially flat (0.1 %),” Dale said. This meant that “energy intensity declined by 2% in 2015”. While good news, this is insufficient to achieve the Paris Agreement goal of limiting global temperature rise to 2°C, BP’s Chief Economist pointed out. To achieve this, “energy intensity needs to fall at an average rate of close to 5.5% for the next 20 years”.

Dale also made an important point about the spectacular growth of renewables. “The key lesson from history”, he said, “is that it takes considerable time for new types of energy to penetrate the global market. Starting the clock at the point at which new fuels reached 1% share of primary energy, it took more than 40 years for oil to expand to 10% of primary energy; and even after 50 years, natural gas had reached a share of only 8%.”

According to Dale, “some of that slow rate of penetration reflects the time it takes for resources and funding to be devoted in scale to new energy sources. But equally important, the highly capital-intensive nature of the energy eco-system, with many long-lived assets, provides a natural brake on the pace at which new energies can gain ground. The growth rates achieved by renewable energy over the past 8 or 9 years have been broadly comparable to those recorded by other energies at the same early stage of development. Indeed, thus far, renewable energy has followed a similar path to nuclear energy.” ●



Finland is one of the few countries in Europe in which a solid consensus has been forged in favour of expansion of nuclear energy. In fact, it is the first country in the world that is building a final repository for nuclear waste. At the same time, the country is developing innovative renewable energy solutions, particularly in heating, that can serve as models for other cities in the world. Transport will be the most difficult nut to crack in the way to a low-carbon society, says Lauri Muranen, Executive Director of World Energy Council Finland.

In the early 2020s, Finland will be the first country in the world to have a final repository [<http://bit.ly/28MTzMy>] for spent nuclear fuel. Not that the country is rushing to finish this unique project. The Finns, notes Lauri Muranen, who heads the Finnish committee of the World Energy Council, have spent 30 to 40 years on research, in cooperation with Swedish company SKB, before they decided on a concept developed by specialised nuclear waste management company Posiva, a joint-venture of nuclear power generators Teollisuuden Voima (60%) and Fortum (40%).

"The spent fuel will be stored in copper canisters at a depth of 400-450 metres inside bedrock at Olkiluoto, which is 1.8 billion years old. It is one of the most stable places on the planet", says Muranen. "We know this will be safe for millions of years." Total costs for the repository are expected to be €3 billion.

What is remarkable about the project that it was supported across the entire political spectrum in Finland, even by the Greens, who are not in favour of nuclear power, says Muranen. Government and industry have worked on building trust among the

IAEA delegation visits nuclear waste repository at Posiva. Photo IAEA

public. "The local municipalities were completely free to decide whether they wanted to allow this on their territory."

Posiva is now selling its expertise abroad, adds Muranen. But he does not expect that Finland will start importing spent nuclear fuel from other countries. "Both imports and exports of radioactive waste are banned by law. Countries that want to develop nuclear power will, for now, have to find their own solutions."

LOW-CARBON MIX

For Finland, nuclear power is an essential part of an increasingly low-carbon energy mix. Currently, the four existing nuclear power plants account for 1/3 of Finnish electricity generation. Renewables (mainly biomass and hydro) account for another 1/3, fossil fuels (gas and coal) for the rest. In addition, Finland imports a quarter of its electricity supply, mainly from other Nordic countries. In the total energy mix, nuclear is good for some 29%, renewables 38%, fossil fuels 33%.

Two new nuclear plants are currently being built in Finland – one by Rosatom for Fennovoima, a joint-venture of energy-intensive companies, which just got started, and the much-delayed EPR-3 by Areva for TVO, a consortium of power producers and users, which is now expected to be operational by 2018. These two new plants will lift nuclear to 40-50% of the electricity mix.

Finland also has a non-binding national target to raise renewable energy to 50% of the energy mix and halve the consumption of mineral oil by 2030, "which is a very tough target", Muranen notes. The Finns hope to partially decarbonise transport with electric vehicles, but also with biofuels. "Experts agree that we will continue to need liquid fuels, especially for heavy transport and aviation. We simply can't afford to ignore biofuels."

Muranen believes that production of biofuels should not replace food production. But Finland is very active in developing so-called "second-generation" biofuels (made from non-food resources such as forest residues). Three major producers are active in this field: UPM, ST1 and Neste, the largest biofuel company in the world.

INNOVATION IN HEATING SECTOR

Muranen notes that the heating sector often gets less attention than electricity, while it is at least as important in terms of greenhouse gas emissions. "A lot of innovation is going on in our heating sector", he notes.

He mentions two examples of innovative projects. Some large new data centres, which use a lot of power but also produce a lot of heat, are supplying their excess heat to the extensive district heating systems that the country has. "A very ingenious concept". And near Helsinki a very special geothermal project has been set up. Here water is taken to a depth of 7 kilometres, where it is heated

to 120 degrees and pumped back out to go into the district heating system. "I think these are very interesting showcases for other cities and countries that are looking to decarbonise their heating sector."

The greatest worry for the Finnish energy sector at the moment, says Muranen, is the condition of the power market in general. "New market-based investments are becoming impossible to justify and even existing units are barely able to stay afloat." These conditions are partly the result of energy policies, such as the special nuclear tax in Sweden (which the Swedish government has said will now be scrapped) and renewable energy subsidies across the EU that distort the Emission Trading System and have depressed wholesale power prices.

WAY FORWARD

Energy policies have become increasingly important to the energy sector, says Muranen. "The interest in the energy sector has grown dramatically over the last 15 years. Energy policy now has a major impact on profitability and performance of energy companies." This is the reason the Finnish committee of the World Energy Council has expanded its activities recently, growing from 20 members to 30 members in about a year. "And we're hoping to grow to 40 by the end of this year. We want to raise the level of the energy debate in Finland." ●

MEMBER COMMITTEE EVENTS

The prospects of the Chilean energy sector: mamouskas game or labyrinth?**Santiago, Chile****11 July 2016**

This event explores the prospects of the Chilean energy sector in the short, medium and long term and coincides with the official launch of the new World Energy Council Chilean Member Committee. Key speakers include:

Máximo Pacheco, Minister of Energy of Chile; Andrés Romero, Executive Secretary, Chile National Energy Commission; and Ricardo Sanchez, Chief Officer, Natural Resources and Infrastructure, UN Economic Commission for Latin America and the Caribbean.

The Meeting will highlight the progress of the new energy policy set two years ago as well as the challenges still to be

addressed, through a national, regional and global approach. The main topics for discussion will be climate change, energy efficiency, innovation and energy transition. This conference free of charge, and will be held in Spanish with simultaneous translations into English. Please get in touch as spaces are limited.

Contact: Paula Verholen**E-mail:** direccion@wec-chile.cl**Website:** <http://wec-chile.cl/eventos-locales>**Energy Scenarios Latin America****Rio de Janeiro, Brazil
12-13 July 2016**

This seminar will focus on the main challenges, developments and opportunities highlighted by the World Energy Scenarios 2035 for Latin America and the Caribbean (LAC), which will be launched on the first day. Beyond scenarios, experts will also discuss the oil price, regional integration and raise questions such as “What are the impacts of the low oil price on the energy industry as a whole?”, “How can we achieve a more resilient energy infrastructure?” and “What actions should the energy sector take to address the goals defined by the Paris agreement, and at the same time achieve a balanced Energy Trilemma?”.

The World Energy Council Brazilian member committee organises this conference free of charge, which will be held in English and Spanish.

Contact: Cristina Morales**E-mail:** morales@worldenergy.org**Website:** <http://www.cbcme.org.br/index.php/seminarios>**New energy frontiers and its challenges for Bolivia****Santa Cruz, Bolivia****17-18 August 2016**

International speakers at the 9th Bolivia International Gas & Energy Congress will analyse the global decision on climate change and energy transition and its impact on Bolivia. Bolivian government officials and prominent policymakers and organisations within the oil, gas and energy sectors will convene to discuss issues high on the energy agenda and present their future investment plans.

The Congress is supported by World Energy Council Bolivia and is free of charge for World Energy Council members, and will be held in English and Spanish.

Companies interested in sponsoring the Congress or participating in Expo Bolivia Gas & Energy are welcome to contact eventos@cbhe.org.bo.

For more information on the Congress and registration, please see <http://www.boliviagasenergia.com>
Contact: Raúl Kieffer
E-mail: direccionejecutiva@cbhe.org.bo

SEE MORE COUNCIL EVENTS AT
www.worldenergy.org/events/future

ABOUT THE COUNCIL

The World Energy Council has been at the forefront of the energy debate for nearly a century, guiding thinking and driving action around the world to achieve sustainable and affordable energy for all. It is the UN-accredited energy body and principal impartial network, representing more than 3,000 organisations – public and private – in almost 100 countries.

Independent and inclusive, the Council's work covers all nations and the complete energy spectrum – from fossil fuels to renewable energy sources.

JOIN OUR NETWORK

Join the debate and help influence the energy agenda to promote affordable, stable and environmentally sensitive energy for all. As the world's most influential energy network, the World Energy Council offers you and your organisation the opportunity to participate in the global energy leaders' dialogue.

Find out how you can:

- join a Member Committee;
- become a Project Partner, Patron or Global Partner;
- take part in annual industry surveys, study groups and knowledge networks;

by visiting our website and contacting our team on: <http://www.worldenergy.org/wec-network>

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2016 World Energy Congress
Istanbul, Turkey, 9–13 October 2016

10 Oct 2016 (Mon)	11 Oct 2016 (Tues)	12 Oct 2016 (Weds)	13 Oct 2016 (Thurs)
Vision and Scenarios for the Future	Identifying the Business Opportunities: Resources and Technologies	Policy Solutions to Secure Prosperity: Embracing the Trilemma	Africa: Securing a Sustainable Energy Future
Scene Setting			
Keynote Speeches			

With only 3 months remaining until the 23rd World Energy Congress kicks off in Istanbul under the theme “Embracing New Frontiers”, to date, 250 speakers have confirmed their attendance.

So far, confirmed speakers come from 81 countries and include 42 Ministers

The triennial World Energy Congress has gained recognition since the first event held in 1923 as the premier global forum for leaders and thinkers to debate issues high on the energy agenda. In addition to the discussions, the event provides an

opportunity for executives to demonstrate new technologies, network and explore business opportunities.

Companies interested in sponsoring the Congress are welcome to contact the appointed marketing consultants from ITE Group plc, vivian.linecar@ite-events.com.

For more information on the Congress and registration, visit the official congress website <http://www.wec2016istanbul.org.tr>
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