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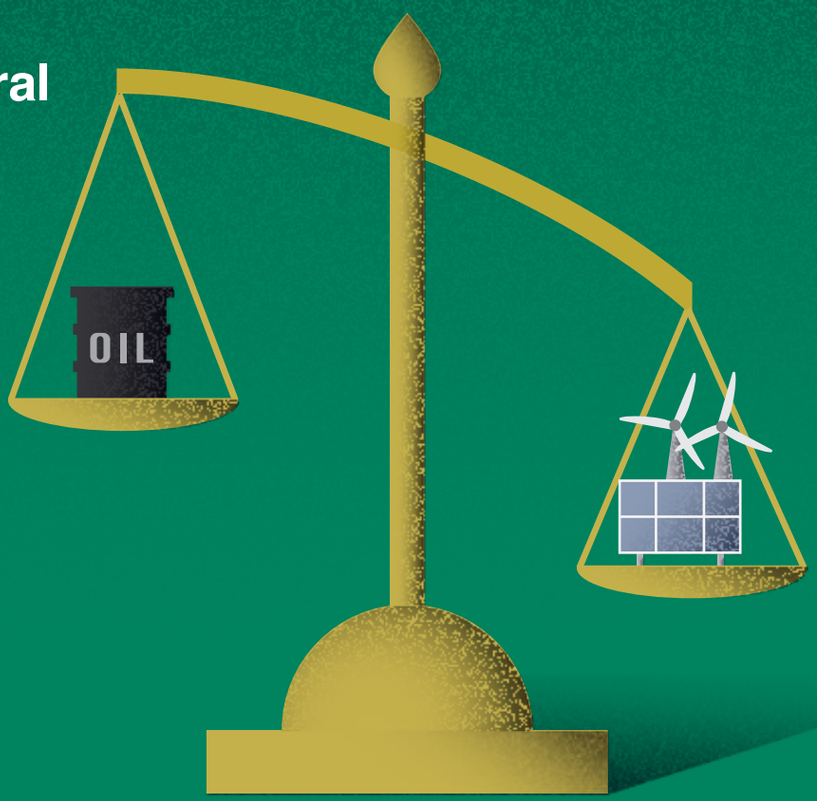
Energy Journal

Interviews with:

Bahrain's Minister of Electricity and Water Affairs

Director-General of IRENA



Shifting Balance: Gulf Countries and the Energy Transition

A magazine about energy and more by CESI

Energy Journal
CESI's house organ

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Editorial

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Today there is no country, no continent that isn't forced to grapple with environmental and energy challenges. All over the world, in every nation, these challenges manifest specific characteristics that translate into different decisions.

In recent issues of EJ, we explored what dealing with these challenges means for African countries, for Europe and for the United States. In this issue, we are bringing our global voyage through the effects and perspectives generated by the energy transition to a close, focusing on the Middle East, and the Gulf countries, considered one of the most interesting and fast-changing areas in the world.

These countries have always been key players in the traditional, fossil fuel-based energy scenario. Today they are determined to remain world leaders in the new energy horizon that is dawning before our eyes. Therefore, they've chosen to face down the challenges of diversification and sustainability in a radical manner. The force driving them in this direction is unquestionably climate change, but it's not the only reason. As we explain in more detail in the article "Life After Oil in the Gulf Region," the theme of rising and falling oil prices; an exponential increase in electric energy consumption (driven by residential consumption); and the need to diversify domestic industrial production have all inspired leaders to profoundly rethink economic structures and objectives across the area.

The strategic plans approved by different countries in the Gulf are designed to take fuller, more efficient use of the region's enormous renewable energy potential. Just look at the green energy generation targets set by two countries of reference: 50% by 2050 for the Arab Emirates; 30% by 2030 for Saudi Arabia.

This is also why we've focused on things like Saudi Arabia's Vision 2030 plan (in the article "Future Vision"); on Oman's Country Value Program and on Bahrain's Economic Vision 2030 plan. About the latter, we have had the opportunity to interview the Bahrain's Minister of Electricity and Water, Dr. Mirza. All these countries are creating a sustainable, localized and high-quality industrial context to stimulate local employment growth and emancipate the region from the fossil fuel business. Mr. La Camera, the IRENA's General Director, is of the same opinion. In our interview, he stated the GCC's energy mix in 2030 will be much more diversified than it is today with a significant renewable energy component.

To achieve this goal, the Gulf Countries' first challenge is to adapt grids to an even more intense use of renewable sources. And another strategic challenge involves interconnections. In this respect, the regional interconnection project for the Gulf region dates back to 2009. Current capacity remains relatively low: 2.4 GW. Given new developing scenarios, the Gulf will need a competitive market if it is to take full advantage of electric interconnection, and therefore of renewable energy production.

It is a strategic challenge, one that will have an enormous impact on a global level, and one for which CESI has chosen to stand alongside countries committed to this radical transformation of their own energy systems, already putting the company's skills and know-how at their disposal a dozen years ago. CESI has handled many different projects and interventions in this region over the past decade: in "Networks and Renewables: The Challenges Gulf Nations Face," we take a look at some of these; and at the collaboration underway with the GCC Interconnection Authority in particular, which confirms developing modern regulations along with increasing transportation capacities in regional networks remain absolute priorities. It's the only way the Gulf region's energy system will be able to achieve the targets set by each individual country, expanding the horizon of energy exchanges all the way to Egypt and Yemen, generating new commercial opportunities for everyone.

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"We should not cling to crude down to the last drop, we should leave oil before it leaves us. That means new approaches must be found soon"

Fatih Birol, Executive Director, IEA

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The Latest from CESI

CESI selected for Central and South Asia's largest energy project

CESI has won an international tender to provide Owner's Engineer services related to construction of two high-voltage direct current (HVDC) converter stations in Tajikistan and Pakistan, as well as an HVDC transmission line connecting them. This is a crucial part of implementation of the CASA-1000 project, which aims to enable electricity transmission from hydro-generation plants in the Kyrgyz Republic and Tajikistan to end consumers in Pakistan, via Afghanistan.

The company will supervise construction of the HVDC power connection, including two HVDC converter stations and the 800 km DC line crossing Tajikistan, Afghanistan and Pakistan, with an export capacity of up to 1,300 megawatts of electricity. CESI will also support the CASA-1000 Secretariat in identifying the most suitable operational strategy for the interconnector.

The CASA-1000 Project represents a key cornerstone of Pakistan's strategy to cope with increasing domestic electricity consumption. The project will also allow the Kyrgyz Republic and Tajikistan to better utilize energy generated in their hydropower plants.

> "The biggest order CESI has ever been awarded in Asia"

Grid modernization strategy for 100% renewable energy generation

EnerNex, a CESI US company, signed a contract with Hawaiian Electric to help the utility establish a scenario-based, comprehensive grid modernization strategy. Hawaii aims to achieve 100% renewable energy generation by 2045.

Leveraging its recognized know-how in grid modernization, EnerNex drafted a document that has now been approved for implementation. The document prioritizes grid-facing, customer-facing and communications investments to simultaneously improve grid operations in the short-term and build toward future investments.

The final strategy includes a cost-effective framework for allocating costs and utility cost recovery according to compliance, customer-specific investments, and/or net beneficial investments. It was shaped with input from both stakeholders and the public, both of whom were influential in shaping the overall direction from the outset.

> "Prioritization of grid-facing, customer-facing and communications investments"

Italy

Innovative strategies to cope with climate change

CESI will be publishing a contribution to the World Road Association's (PIARC) report focused on climate change adaptation for road infrastructure. In it CESI focuses on resilience strategies designed to cope with climate change hazards. The paper describes the importance of innovation in monitoring systems, applied both to road structures and to the environment (i.e.: landslides, river floods, wind and snowstorms) as a way to forecast danger events and develop asset management plans for an infrastructure resilient to climate changes. The final report – "The Roads of the Future: safe, monitored, connected and sustainable" – was presented at the XXVIII PIARC C.N.I. National Congress, held in Rome on May 14-16, 2019 and sponsored by Italy's Ministry of Infrastructure and Transport, the national transportation company Anas S.p.A., and the OICE (an engineering and consultancy organization).

> "Forecasting danger events for an infrastructure resilient to climate change"

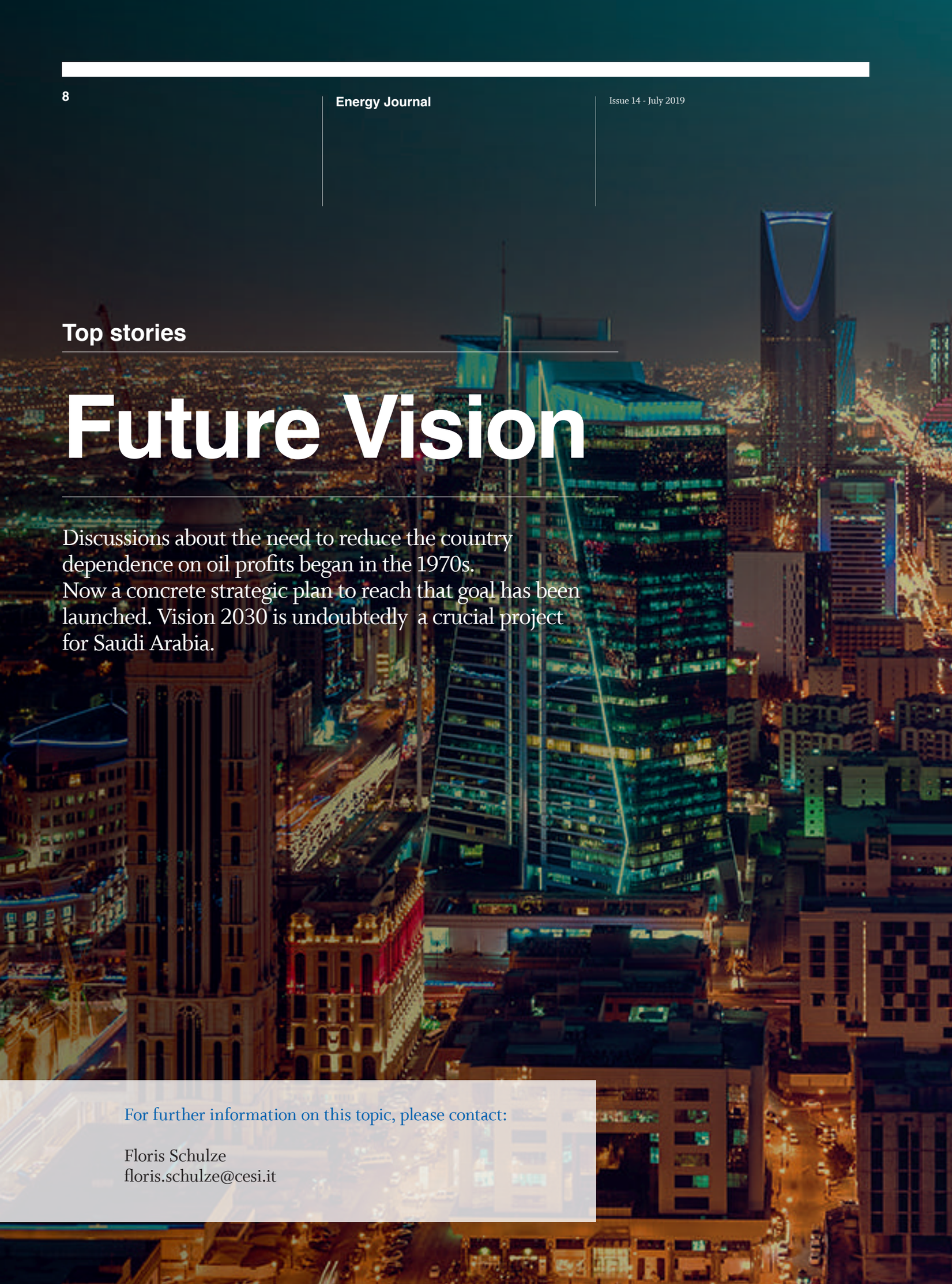
The Philippines

Unifying the Philippines' Power Transmission Network

CESI won a contract to support the National Grid Corporation of the Philippines (NGCP) in implementing the Mindanao-Visayas Interconnection Project (MVIP). CESI will help NGCP conduct system studies, engineering, design verifications, testing, installation and commissioning of all the equipment, material and services required to render the HVDC converter stations at Dumanjug in Visayas and Lala in Mindanao completely operational, including electrode stations in Cebu and Mindanao, as well as HVDC and optical communication cables.

This HVDC link consists of approximately 220 km overhead lines and 92 km submarine cable, which runs from the Dumanjug converter station in Cebu to the Lala converter station in Mindanao. The link will be able to transfer 900MW at ffl350 kV between Cebu and Mindanao Islands. CESI will support the project with Owner's Engineering services through two separate contracts: one for the HVDC converter and electrode stations; and another related to submarine power and fiber-optic cables. The project is a milestone for the area, and is designed to unify the power transmission network across the Philippines, linking together all major Philippine islands to create one grid and ensure sharing of energy sources across the network.

> "Creation of a single grid that can ensure sharing of energy sources across the entire network"



Top stories

Future Vision

Discussions about the need to reduce the country dependence on oil profits began in the 1970s. Now a concrete strategic plan to reach that goal has been launched. Vision 2030 is undoubtedly a crucial project for Saudi Arabia.

For further information on this topic, please contact:

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Riyadh, Saudi Arabia

People in Saudi Arabia have been talking about the need to reduce the country's dependence on oil profits since as early as the 1970s, when the first international oil crisis struck. At the time these academic discussions did not produce any concrete action. But in recent years, market-driven motivations have expanded to include things like environmental emergencies, increasing pressure on the issue and injecting new energy into the debate. An early attempt by Saudi Arabia to initiate a structural transformation of its energy and economic systems unfolded in 2010, with the establishment of the King Abdullah City for Atomic and Renewable Energy (KACARE) which was designed to implement a renewable and atomic energy development program for the kingdom. But the original plan, aimed at creating 54 GW of "green" energy (including nuclear) by 2032, proved too demanding, and not much of what was included in that initial strategic plan has been implemented.

> "Vision 2030, launched in 2016, is undoubtedly a crucial project"

Vision 2030

The new strategic plan – Vision 2030 – was created with challenging prospects. Launched in 2016, Vision 2030 is undoubtedly a crucial project, distinguished by a number of key elements:

- Economic diversification, helping the country's economy shed its dependence on oil profits;
- Development of human capital through investments in training, starting in school;
- Support for SMEs (Small- and Medium-sized Enterprises), helping them grow into a significant segment of the overall national GDP;
- Diversification in exports in such a way that non-oil exports account for 50% of all goods and services Saudi Arabia exports;
- Maximizing the country's investment capacity through the creation of a public investment fund;
- Privatization of services, from the health system to public transportation and utilities, considered the best way to improve these services;
- Growth in foreign investments.

The final aim is to climb further up the global rankings of economically developed countries, becoming one of top 15 economically successful countries in the world.

Dumat al Jandal

Sakaka Solar

100,000
home energy needs satisfied

1.2 mln
barrels of oil saved per year

↓ CO_2
1 mln
tons of emissions saved per year

+ 2,000
new jobs created

From strategy to action

Launch of the strategic plan was followed by a series of concrete signals, including: transformation of the previous Ministry of Oil and Mineral Resources into the Ministry of Energy, Industry and Natural Resources; the creation of diversified programs like the National Transformation Program; the Strengthening Public Sector Governance Program; the Privatization Program; the Public Investment Restructuring Program; and last but not least, the Saudi Aramco Strategic Transformation Program. According to the Oxford Institute for Energy Studies, which researched and published a targeted paper on this issue titled "Saudi Arabia's Vision 2030, Oil Policy and the Evolution of the Energy Sector," Saudi Arabia's leadership remains unquestioned: even were the plan successfully carried through to completion – as the country absolutely needs, accordingto the Oxford Institute –oil products would continue to play an important role in the country's economy.

New targets and renewable energy projects

At the end of 2017 Saudi Arabia's renewable energy capacity stood at 92 MW, gleaned exclusively from small-scale photovoltaic systems set up for demonstration purposes, for example buildings and parking lots equipped with solar panels. Even today, most of the electric energy used around the country is produced using natural gas and oil. But demand continues to rise, and forecasts call for even greater demand in both residential areas (due primarily to the desire for air conditioning during hot months and water desalinization systems) and in the industrial sector, where diversification plans and projects for industrial growth have further empowered new renewable energy source planning. Launched in 2016, the National Renewable Energy Program sets a clear goal: to create power plants for a total capacity of 3.45 GW by 2020, increasing to 9.5 GW by 2023, in other words to 10% of total capacity nationwide. The plans also call for progressively increasing the share of renewable energy sources in the country's energy mix to a total 30% by 2030.

Today the implementation and timing of these initiatives is overseen by REPDO, Saudi Arabia's Renewable Energy Project Development Office, which has already built two key facilities: Dumat al Jandal, a 400 MW wind park (the largest wind power facility in the Gulf region); and Sakaka Solar, a 300 WM photovoltaic facility. This second facility has already set its first record as well, registering a price of 0.0234 USD / kWh.

These two facilities will help satisfy the energy needs of roughly 100,000 homes. Overall, they have guaranteed savings of approximately 1.2 million barrels of oil per year, reduced CO2 emissions by 1 million tons per year, and created 2,000 new jobs.
The Electricity and Cogeneration Regulatory Authority has also approved a measure ("Small Scale Solar PV Systems Regulations") that will help create small-scale distributed photovoltaic facilities, introducing photovoltaic and smart metering in residential buildings.

Energy efficient thinking

For a society accustomed to abundant energy at low costs, Energy-efficient thinking requires a true change in perspective. Such a shift is challenging, but necessary. The Arab Efficiency

> "Demand continues to rise, and forecasts call for even greater demand in both residential areas and in the industrial sector"

Index, developed in partnership with UNDP (United Nations Development Program) and the Regional Center for Renewable Energy and Energy Efficiency, monitors the progress countries within the MENA (Middle East and North Africa) region make in the sector, supporting the implementation of programs and technologies that aim to render buildings and industrial processes more energy efficient. Today Saudi Arabia stands around the halfway mark in the classification of the twenty countries included in the index, behind nations like Tunisia, Morocco, Jordan, the UAE, Palestine, Egypt, Lebanon, Algeria and Bahrain. But the new policies embraced by the Ministry of Energy, and the National Energy Efficiency Program it adopted in 2016 (which joins the National Renewable Energy Program), leave ample room for further developments. It is important to note that inside these programs, the introduction of tools like the Energy Conservation Law, which defines an entirely new regulatory framework, constitute important steps forward. The goal is to reduce consumption by 30% by 2030.

The program identifies a multiplicity of actions affecting the industrial sector (with the institution of energy audit services), the residential sector (with the definition of efficiency standards for buildings and efficiency codes for mass consumer goods), and residents (through carefully-constructed communications and information campaigns). At the same time, the country has enacted pricing policies that discourage inefficient use of energy. For example in recent years, energy prices have increased by as much as 133% for natural gas. It is an overall efficiency policy that Khaled Abdelshafi, director of the regional department for Arab countries in the UNDP, is quick to define "aggressive, but necessary."

Conclusion

Vision 2030 is an important program that has been designed to concretely affect the kingdom. As we have seen, the general strategic vision it lays out has been followed by intervention programs targeted to specific sectors with a special focus on the energy one. If these programs take off, in 2030 we will be looking at a decidedly different Saudi Arabia: a country that generates a greater share of its energy from solar and wind sources also investing heavily in efficiency technologies, and encouraging international collaboration.

Scenario

Life After Oil for the Gulf Region

In the countries we refer to as major producers, energy transition implies a radical transformation. So, What do changing energy dynamics mean for major oil and gas producers?

For further information on this topic, please contact:

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Saudi Aabia

Transformation of the energy paradigm toward renewables has forced strategic changes, systemic infrastructural interventions and the implementation of new market policies all over the world. In the countries we refer to as "major producers" – in other words countries that base their economy almost entirely on fossil fuel reserves – this transformation implies an even more radical transformation. The response they are capable of providing will exert enormous influence not only on their own futures and the destiny of the geographical areas in which they are located, but on the destiny of our planet.

The issue at the heart of this question is recognized by all international bodies, which are currently drawing up reports and specific studies to address this. In 2018, for example, the International Energy Agency (IEA) published a special report ("Outlook for producers economies 2018. What do changing energy dynamics mean for major oil and gas exporters?") dedicated to major producer countries. As the report emphasizes, this issue is not new, but today it must be addressed head-on. "It is a challenging, complex process that requires significant investment. Choosing not to act or adopting measures that are ineffective for reducing dependence on oil profits will bring risks both for producers and for the global market. The stakes are extremely high."

Factors that have fostered change

An increase in internal electric consumption, the introduction of US-produced shale gas, volatility in gas and oil prices, a lack of internal diversification in industrial production and energy supply, participation in international pacts and the battle against climate change… this mix of contingent factors has driven major producer countries to come to terms with change and focus on new policies that can provide the right answers to these dilemmas, even as they preserve their leadership roles in the world's energy hierarchy.

Since 2014, profits from oil and gas have dropped by an average 40% (Iraq) to 70% (Venezuela). If we bear in mind, for example, that in a country like Kuwait, oil exports represent 90% of total exports, it becomes immediately clear that, taken together, these factors weigh heavily on development and economic solidity. It is a general picture that gathers together countries that are far different from one another, and to which the IEA dedicated the aforementioned study. These countries are Venezuela, Russia, Nigeria, the United Arab Emirates (UAE), Saudi Arabia, Iraq, Turkmenistan, Angola, Kuwait, Oman, Azerbaijan and Iran. Yet within this context, the Gulf countries are characterized by several factors that may prove the key to success in designing new strategies and new identities within the international energy scenario: the enormous potential of renewable resources, solar and wind first and foremost.

> "Today less than 1% of all electric energy consumed in the Gulf region is produced from renewable resources."

The Gulf region: energy consumption

Within the Gulf area, the consumption of electric energy has risen in recent years by an average 5.7% per year, in other words double the global rate. This rise has been driven in particular by residential consumption and building cooling systems, which have tripled since 2000 and continue to grow, so much so that experts estimate the area will achieve 300 TWh of consumption by 2040. But in this corner of the world, electricity generation is still entrusted almost entirely to fossil fuels: natural gas, oil products and, during peak demand, even crude.

While in 2000 a total 900 db/d of oil was required for electric energy production, by 2017 that share had increased to 1.8 mb/d. The difference was made up entirely in "black gold" diverted from exports, during a period in which productivity has been dropping even in the Gulf region, and extraction requires the adoption of innovative and expensive technologies. Today less than 1% of all electric energy consumed there is produced from renewable sources, solar and wind first and foremost.

The Gulf region: renewable resources

According to IEA's Global Atlas, an online platform that outlines the renewable energy potential (solar, wind and geothermal) of every country in the world, the Gulf region can boast excellent solar resources. But it is important to distinguish between Direct Normal Irradiance (DNI), and Global Horizontal Irradiance (GHI). This distinction is important for making the choice of which technology to adopt in order to take best advantage of the available energy potential. High levels of DNI are optimal for the realization of concentrating solar energy plants, while high levels of GHI are important for developing photovoltaic. In reality, in this region dust and humidity have an important effect on the attenuation of solar irradiation. While the level of irradiation useful for photovoltaic technologies is guaranteed, solar energy concentration technologies (which require direct solar irradiation) can be considered optimal only in a few specific areas of Oman and Saudi Arabia.

The quality of wind resources, on the other hand, is determined by wind speeds. According to the Global Atlas, wind speeds in wide areas of central and northern Saudi Arabia, as well as in the southern regions of Oman and western Kuwait, can be considered very

good (7.5 m/s), and in any case superior to those registered, for example, in the Gulf of Suez.

According to data provided by IRENA 2019 relative to the Gulf region, the ability to utilize just 1% of the area's solar potential (using photovoltaic) would mean producing 608 GW of capacity. In the same manner, taking advantage of just 1% of wind potential would produce an additional 26 GW of capacity. Kuwait, Oman, Saudi Arabia and the UAE are undoubtedly the countries that can boast the highest potential.

National targets and strategies

In 2018, out of 146 GW of installed capacity, just 1% was generated by renewable sources (867 MW). 68% of these are concentrated in the UAE; 16% in Saudi Arabia; 9% in Kuwait. Installed capacity is almost entirely made up of photovoltaic and Concentrating Solar Power (CSP) facilities (94%).

Today there are three CSP facilities up and running – Shams Solar Power Station in Abu Dhabi; the Shagaya project in Kuwait; and Waad Al-Shamai in Saudi Arabia – revealing a trend toward industrial projects that are connected to the grid. Even though these numbers remain low, especially with respect to indicated potential, the data nevertheless represents growth equaling four times the installed capacity compared to 2014, and growth forecasts will continue to increase in coming months.

Given the range of development programs for renewables set up in various countries, all of which were evaluated by IRENA in the 2018 report it dedicated to the Gulf region, the goal for 2020 is to achieve 7 GW of newly installed capacity from renewable sources. Once again solar facilities are leading this effort: 91% of the new facilities will employ photovoltaic or CSP technologies; including some specific projects that employ solar power to help with oil extraction or water desalinization.

According to the data, achieving the objectives laid out for renewables by 2030 would permit an overall savings of the equivalent of 354 million barrels of oil emitted on the international market (40% of these savings would be concentrated in Saudi Arabia; 39% in the UAE). It would also reduce CO_2 emissions by 136 million tons, and water consumption (used for energy production) by 11.5 trillion liters. In parallel, the construction of new power facilities would create an additional 220,000 jobs.

Specific strategies for each Gulf country

If we analyze in greater detail the strategic programs in place for different countries, we can see that while the UAE and Saudi Arabia have set the most ambitious targets, each country has focused on policies appropriate to its context, taking advantage of its specific opportunities.

The UAE Energy Plan 2050, for example, aims to achieve a total of 50% in renewables (6% of which nuclear) by 2050. The plan sets intermediate goals and identifies a target of 27% by 2021. Development in the sector is entrusted to DEWA, the same company that created the UAE's first photovoltaic solar facility, the Mohammed bin Rashid Al Maktoum Solar Park. Through different development phases, the project currently boasts an installed capacity of 200 MW, while additional expansion projects already in the works will permit the facility to achieve 800 MW of capacity by 2020.

Saudi Arabia's plan is equally ambitious: its Vision 2030 strategic program, launched in 2016 to achieve targets set for 2030, aims to achieve overall economic diversification and reduce the country's dependence on oil. Saudi Arabia was among the first countries in the Gulf region to move in this direction and considers green tech an important new industrial sector for both development and jobs. The energy goals set by Vision 2030 call for overall energy contributions from renewable sources equal to 3.45 GW by 2020, and 9.5 GW by 2023. The end goal is to achieve 30% of all electric energy production from renewable sources by 2030.

Kuwait, on the other hand, has set its renewables objective at 15% by 2035. Only pilot projects are currently up and running, the most interesting of which is undoubtedly one

> “Given the range of development programs for renewable set up in various countries, the goal for 2020 is to achieve 7 GW of newly installed capacity from renewable sources”

developed together with the Kuwait Institution for Scientific Research, which leverages photovoltaic solar (10 MW), wind (10 MW) and CSP (50 MW) to produce energy. Kuwait also boasts, at the Ratqa oil wells, an Enhanced Oil Recovery (EOR) facility with a total capacity of 100 MW, used to produce vapor for oil extraction and making it possible for Kuwait to reduce natural gas consumption.

Oman, on the other hand, is a pioneer in the use of solar for oil extraction, where these technologies have been up and running since 2007, and where plans are underway for new applications. Approved in 2015, the country's 2040 energy strategy calls for a total 10% quota (2.6 GW) from renewable sources. The Dhofar Wind Project will be the country's first industrial-scale wind power facility, boasting total capacity of 50 MW and capable of satisfying demand from approximately 16,000 homes, reducing overall emissions by 110,000 tons per year.

The World Soccer Championships, scheduled to be held in Qatar in 2022, have prompted the country to focus on new renewable energy projects that will run alongside waste-to-energy projects already established.

Bahrain has approved two specific plans: the National Energy Efficiency Action Plan and the National Renewable Energy Action Plan. Drafted by Bahrain's SEU (Sustainable Energy Unit), and shared with all stakeholders in the sector, these two strategic programs aim to take full advantage of the kingdom's renewable energy potential in order to limit its reliance on importing natural gas to satisfy domestic energy demand. Photovoltaic, concentrating solar power, biogas and wind power are all ways the country expects to achieve the challenging targets it has set for itself. The end goal is to cover 10% of all consumption with renewable power by 2035 (for a total 710 MW of installed capacity). The plan strategically harmonizes distributed generation projects within the urban context (from photovoltaic panels on rooftops to micro-wind projects to biogas) with large-scale, centralized facilities, for example the Askar solar farm. In order to increase energy efficiency, plans call for reducing consumption by 6% by 2025, saving a total of 5,800 Gw/h. This marks an important environmental achievement, one that would allow Bahrain to avoid emitting an additional 3.4 tons of CO2 into the atmosphere.

Developing an electric interconnection network

There has been a regional interconnection project in place in the region since 2009. Current capacity remains relatively low (2.4 GW), given that it was created to respond to energy demand far lower than current levels. In reality, today's network functions as a backup emergency system that makes it possible for different countries across the Gulf region, to transfer energy when and if necessary.

Further development of the network is a necessary step toward achieving ulterior efficiency in the energy system in this corner of the world and would favor additional energy savings. The limits for its specific use can be found in the absence of a true energy market with precise regulations, tariffs and legal negotiating tools. According to the Gulf Cooperation Council Interconnection Authority, regulating the market, together with an increase in network capacity so that higher volumes of electricity can be exchanged, might well make it possible to achieve an energy system in line with the targets set by each individual country. It might also permit expansion of the energy exchange horizon all the way to Egypt and Yemen, generating new commercial opportunities as well.

Conclusion

As the IEA report notes, the stakes are high and there is significant renewable energy potential. Today it may be time to draft a global plan for the entire area, one that extends beyond specific, country-by-country targets to promote an integrated strategy that can encompass a multiplicity of interventions, exactly as happens in more mature markets.

An Organic Strategy for a Successful Energy Transition

Interview with Abdulhussain bin Ali Mirza, Bahrain Ministry of Electricity and Water Affairs

Abdulhussain bin Ali Mirza
Bahrain's Minister of Electricity and Water Affairs

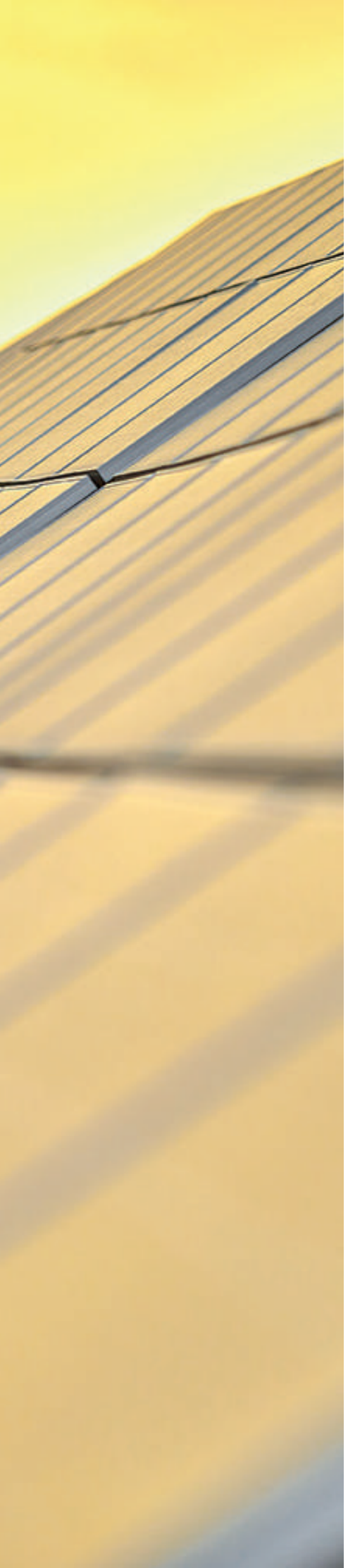
Abdulhussain bin Ali Mirza is the current Minister of Electricity and Water Affairs of Bahrain. Mirza holds a PhD in management change from Middlesex University in London. Mirza was the minister of state, the minister of state for cabinet affairs and also, the chairman of the Tender Board. In 2006, the newly established ministerial portfolio, oil and gas affairs, was given to him. He is also the head of the National Oil and Gas Authority which he has been holding before his ministerial appointment. In 2011 the Electricity and Water Authority was merged with the ministry of oil and gas affairs. Mirza was appointed as the Minister of Energy in January 2015. In June 2016, Mirza was appointed as the Minister of Electricity and Water Affairs.

1. Bahrain's NREAP (National Renewable Energy Action Plan) sets challenging targets for 2035, proposing an organic approach that integrates contributions arriving from different sources (solar, wind, waste-to-energy), different technologies (photovoltaic, concentrating solar power) and diverse approaches (distributed vs. centralized production). In upcoming years, Bahrain's energy profile will be much more articulated than it is today. What are the main elements that will characterize your energy mix?

The future energy mix in the Kingdom of Bahrain will be a blend of conventional and alternative energy sources. Traditional gas-powered turbines will be supplemented by alternatives such as solar and wind farms, both distributed and centralized, and waste-to-energy plants.
The availability of local resources such as skilled labor, optimal solar irradiance levels, suitable areas for collectors to be mounted, winds and areas earmarked for development of wind farms (as demonstrated in the published wind atlas) and waste streams available for waste-to-energy plants will become much more important going forward and are a focus for the government in general and the Sustainable Energy Center in particular. This – coupled with market capacity building and competitive processes to find the best public-private modality for each project – will define the future energy sector in the Kingdom.

2. Within the overall strategy, you have paid particular attention to energy efficiency, a theme that Western countries have also struggled to come up with effective policies to address. What are your main priorities from this point of view? What are the important interventions you are proposing?

Bahrain's National Energy Efficiency Action Plan (NEEAP), endorsed by the Cabinet of Bahrain in January 2017, sets a national energy efficiency improvement target of 6% by 2025. This demonstrates that while some countries have struggled to gather the necessary political will, leadership of the Kingdom of Bahrain is fully committed to improving the energy efficiency. As such, the NEEAP consists of both top-down and bottom-up approaches to implementing energy efficiency policies. The main priority for the Kingdom is to achieve the 6% energy savings target indicated in the 22 initiatives (important interventions) in the NEEAP. These 22 initiatives, 18 of which target the residential & commercial, government, industry, electricity and transport sectors, while four are cross-sectorial and effect all areas of the kingdom, both public and private.



3. Passing from a fossil fuel-based model to a hybrid mix and integrating the potential represented by renewables into the network requires specific skills, extremely high-level technological knowhow, and a lot of experience. What role have international collaborations and partnerships played up to this point, and what role may they play in the future?

The Kingdom has always worked to gather the best-of-breed technologies and techniques in all its endeavors, learning from the expertise and experiences of others and melding them with local knowledge to suit the Kingdom's specific needs. Regarding the energy sector, Cabinet approval for the formation of the Sustainable Energy Unit as a collaboration between the government of Bahrain and the United Nations Development Programme (UNDP) in 2014 enabled the Kingdom to bring international expertise to bear on the Renewable Energy (RE) and Energy Efficiency (EE) sectors. Going forward, international collaboration will feature prominently via different modalities such as tenders for specific power projects, technical expertise via consultants, bilateral agreements with various international bodies and attracting regional and international companies to the Kingdom.

4. Your collaboration with CESI deals primarily with development of your photovoltaic market. Given existing potential, this is a particularly relevant sector for your country. What are the specific goals of this partnership?

CESI's expertise and depth of knowledge, both internationally and regionally, have enabled the rapid development and acceptance of the required legislative and technical frameworks required to launch the Net Metering Policy in the Kingdom as per the NREAP. The ongoing partnership with CESI was focused on developing the regulatory framework for the Net Metering Policy, which was approved by Cabinet Resolution no. 2 of 2017. In addition, the partnership has raised local capacity through training programs such as the Solar PV Systems Installation Training Course. There have been five courses and over 250 candidates have been trained to date, of which over 190 earned certification. CESI has also been used as a reference point when questions arose during implementation of the Net Metering policy and development of the market.

Future & Technology

Renewables for Water Security

Growth rates for energy consumption in Gulf countries are among the highest on the planet. They are driven by activities that are highly energy-dependent, yet fundamental for the territory, like water desalination. The region needs innovative, efficient renewable energy facilities capable of covering an increasingly large portion of energy demand. This need was the driver behind projects like the Rashid Al Maktoum Solar Park, the largest concentrated solar energy facility in the world.

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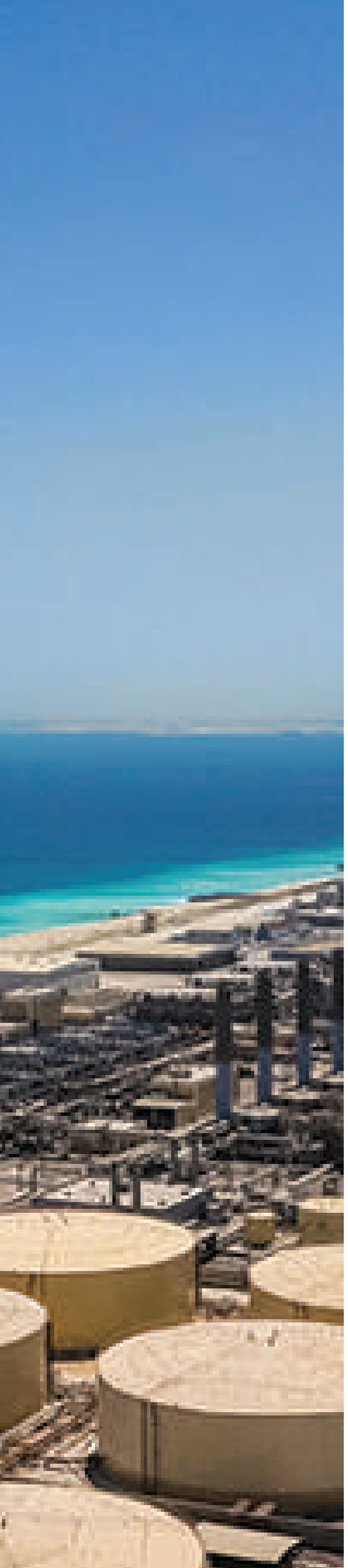
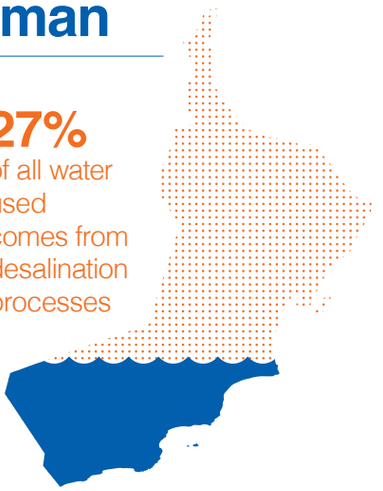


Oman

27%
of all water used comes from desalination processes



Qatar

87%
of all water used comes from desalination processes

Globally, the dearth of drinkable water constitutes one of the primary challenges facing this young millennium. According to analyses conducted by GWI (Global Water Intelligence) based on United Nations data, by 2025 no less than 14% of the world's population will be grappling with this problem. Already today roughly 750 million people – 10% of the world's population – only have access to clean drinking water through seawater desalination plants: between 2008 and 2013 the overall capacity of desalination plants grew by 57% (GWI) at the global level.

For countries in the Gulf region, which registers the lowest pro-capita water availability levels in the world, this challenge is anything but a new. Yet recent social and environmental developments – climate change together with population growth, lifestyle changes and the consequent rise in energy consumption – have radically emphasized the gap between available water resources and demand.

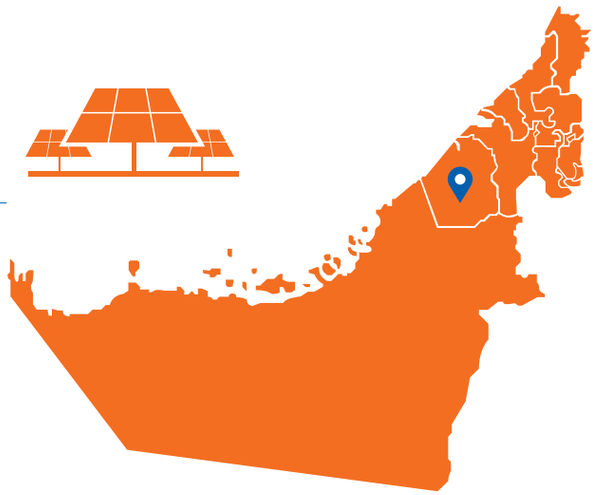
> “According to estimates provided by IRENA, in 2016 a total 5% of all energy consumption across the region was driven by demand linked to seawater desalination processes”

In order to meet this rising demand for water – for domestic use, agriculture, industrial production, etc. – Gulf countries have always turned to seawater desalination plants. Percentages vary significantly from one country to the next, but remain extremely high. For example, in Oman 27% of all water used comes from desalination processes; while in Qatar that percentage rises all the way to 87%. According to estimates provided by IRENA (International Renewable Energy Agency), in 2016 a total 5% of all energy consumption across the region was driven by demand linked to seawater desalination processes, a percentage that climbs even higher in Saudi Arabia, where a total 10% of primary energy consumption is dedicated to the activity.

In this area, the theme of water safety is bound hand and foot to energy and environmental issues. The widespread availability of fossil fuels has clearly conditioned technological and energy decisions taken for desalination processes, to the detriment of efficiency and sustainability: up until just a few years ago, these facilities employed thermal desalination processes, which consume larger amounts of energy than the already widely available inverse osmosis technology. Even more to the point, the daily working operations of these facilities ran on fossil fuels like natural gas, oil derivatives, or even directly on crude oil.

Today this trend is being reversed. The environmental choices made by Gulf countries and formally ratified in Paris commits these countries to identifying innovative, sustainable strategies for operations that are central to peoples' lives in these countries. Over the past ten years, the investment rate in desalination projects that utilize inverse osmosis technologies has increased significantly.

Rashid Al Maktoum Solar Park



largest facility in the world

The main issue from both technological and environmental points of view is the possibility of integrating renewables with this technology for both on-grid and off-grid projects.

For on-grid projects, the challenge lies in increasing renewable generation tout court and integrating energy produced into the network. There are a number of prestigious, highly technologically projects moving in this direction, for example the Rashid Al Maktoum Solar Park, the largest facility in the world to use concentrated solar power technology. Created 50 km outside Dubai and inaugurated in 2013, the facility has been progressively augmented since its inception: a new expansion project will cover a total surface area of 3,750 hectares, equal to 4,500 soccer fields, and will boast a total capacity of 5,000 MW. Work for the new, three billion dollar expansion project has been entrusted to a Saudi-Chinese consortium and is scheduled to begin in 2020. A 260m solar tower will rise up at the center of the facility. And while the tower will be the project's centerpiece, its technological aspects constitute the most interesting element of the endeavor. A system of lenses and mirrors will concentrate sunlight on the tower, which is filled with a thermal-vector fluid appropriate for storing and transporting heat. Once heated, the fluid is used to produce vapor, which in turn drives a turbine and generates electric energy. The system is also equipped with a field of troughs that make it possible to store heat, guaranteeing the ability to produce renewable energy from sunlight at any time during the day, even when weather conditions are not optimal, thereby sidestepping the well-known difficulties of intermittent renewable energy production. Inside the Mohammed bin Rashid Al Maktoum Solar Park, a water desalination unit is powered by a photovoltaic array and employs reverse osmosis technology to produce 50 cubic meters of drinking water per day. Rashid Al Maktoum will also make it possible to produce renewable energy at competitive prices: an estimated cost of 7.3 cents per kw/h.

Today many desalination plants call for the realization of renewable electric generation facilities – first and foremost photovoltaic and wind – that are at once off-grid and entirely dedicated. PAEW (Public Authority for Electricity & Water) in Oman is conducting an extremely interesting experiment in Sharquiyah: a facility currently under construction in that area will adopt an inverse osmosis technology capable of purifying up to 80,000 m^3 of water per day, and will be partially powered by a solar plant dedicated entirely to water purification. In Saudi Arabia KAEC (King Abdullah Economic City) has decided to build a desalination facility in Metito that will also be powered by photovoltaic solar panels, and will boast an overall water production capacity of 30,000 m^3 per day.

Several critical elements are required to make the desalination/renewable partnership a truly effective reality. First, it will be important to avoid the volatility of renewable energy production, which would cause the desalination process to be interrupted and compromise membrane functionality, which in turn risks blocking the process due to excessive salt accumulation. This means it will be necessary to design systems capable of balancing temporary gaps in electricity production with batteries; or through the creation of hybrid on- and off-grid systems.

> “The main issue from both technological and environmental pints of view is the possibility of integrating renewables with desalination technology for both on-grid and off-grid projects”

Mohammed bin Rashid Al Maktoum Solar Park

In this sense, integration of a facility like the Rashid Al Maktoum into the network could prove a fresh force, even for this kind of production, providing stability and continuity to renewable energy production.

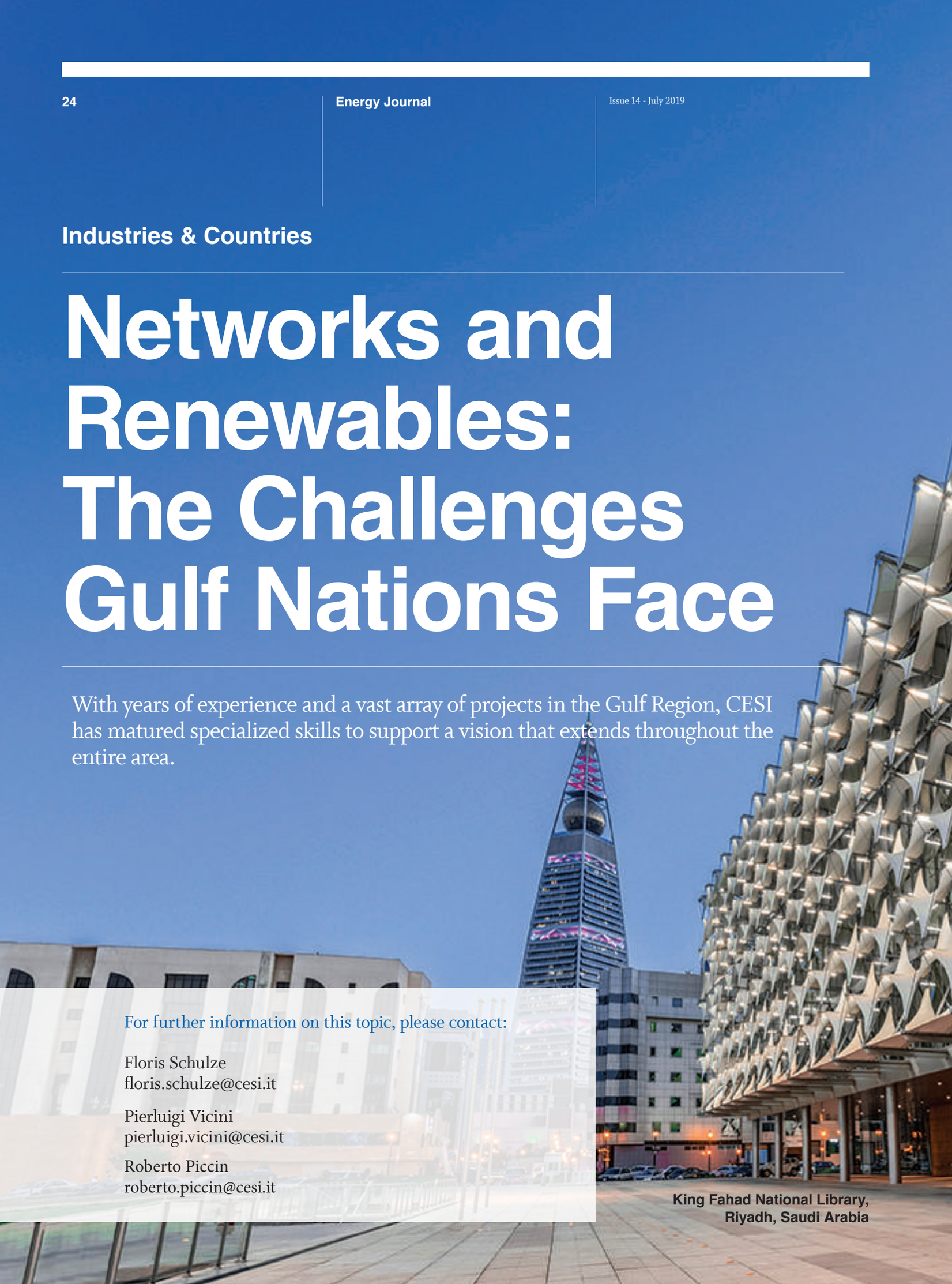
Another interesting example can be found in the facility realized in Saudi Arabia in 2018 by AWT (Advanced Water Technology), a subsidiary of TAQNIA, the commercial branch of KACST (King Abdulaziz City for Science & Technology). The inverse osmosis desalination facility boasts an overall capacity of 60,000 m^3 per day, and is powered by a 15 MW photovoltaic solar array. It is equipped with a smart control system that balances the facility's energy needs against energy production volubility.

But from an environmental point of view there is yet another theme that needs to be addressed: how to use the salt recovered through these processes. Today roughly three million tons of salt a day are being dumped back into the sea, significantly increasing marine salinity and unbalancing the natural local equilibriums. Current uses for this salt – for example in the production of sodium hydroxide or sodium bicarbonate – are not sufficient to reutilize the massive volumes of salt desalination produces. And this aspect of the problem is precisely the new frontier of research. If the Gulf countries prove themselves passionate innovators in this area the way they have in the energy sector, the environment will be the first to benefit.

Industries & Countries

Networks and Renewables: The Challenges Gulf Nations Face

With years of experience and a vast array of projects in the Gulf Region, CESI has matured specialized skills to support a vision that extends throughout the entire area.



King Fahad National Library, Riyadh, Saudi Arabia

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Outside observers consider the Middle East an international energy market of strategic importance for the development of a new energy paradigm, one centered around renewable energy sources. So, it was not by chance that about ten years ago CESI chose to pay attention to this region, and to Gulf nations in particular.

Following the launch of initial projects and collaboration efforts organized with governments, agencies, research institutes and other primary players in the energy sector in various Gulf countries (from GCCIA to SEC, from DEWA to ADWEA, from ASFED, SEU to NAMA), the company created a dedicated subsidiary: CESI Middle East.
This subsidiary established a solid foundation for CESI's expansion in the area. That was 2012. Today, seven years later, the projects CESI has helped develop across the Middle East account for 10% of the company's overall business.

CESI in the Gulf region: constant, continuous growth

In 2014, working for the Arab Fund For Economic and Social Development, CESI led a feasibility study for electric and energy commerce interconnections among the 20 countries that are members of the Arab League. The goal of the study was to define the strategy and master plan for the development of a regional energy market. In 2015, the company completed the study, as well as the design of a major electric network between Riyadh and Mecca: a 800-km line using the most modern continuous current transmission (HVDC) technology, which will produce a drastic reduction in energy loss. In 2017, CESI was selected by the government of Bahrain to support integration of energy produced from renewable sources – photovoltaic solar power in particular – into the existing energy network. In Saudi Arabia, on the other hand, CESI's consultancy efforts dealt with integration of distributed energy production into the network, and called for integration of rooftop solar energy panels, as well as construction of the smart grid.CESI established another key collaboration effort in 2017, this time with Nama Group, the holding company of the distribution utilities in Oman, aimed to introduce smart metering. In a country like Oman, where the GDP grows roughly 5% annually and electric energy consumption is increasing at an even higher rate (as high as 9% per year), it was important to introduce an effective method for controlling consumption, one that would guarantee he highest possible levels of efficiency.
This is precisely the goal CESI sought through this project of introducing smart metering in Oman, which began with a study phase and expanded into a concrete, effective action plan over the course of 2017.

A strategic vision for the Gulf Cooperation Council Countries' future

The experience that the company has acquired through projects across almost every country in the Gulf region (Oman, Bahrain, Kuwait, Saudi Arabia, United Arab Emirates) has made it possible for CESI to mature skills that extend beyond the temporal horizon of any one individual project or technology, providing a long-term vision encompassing the entire area. That is the direction for several of the most interesting projects and studies CESI is conducting in this area. Examples include energy security, super-regional interconnections and the development of electric cars as the key element of programs dedicated to developing renewable energy sources.

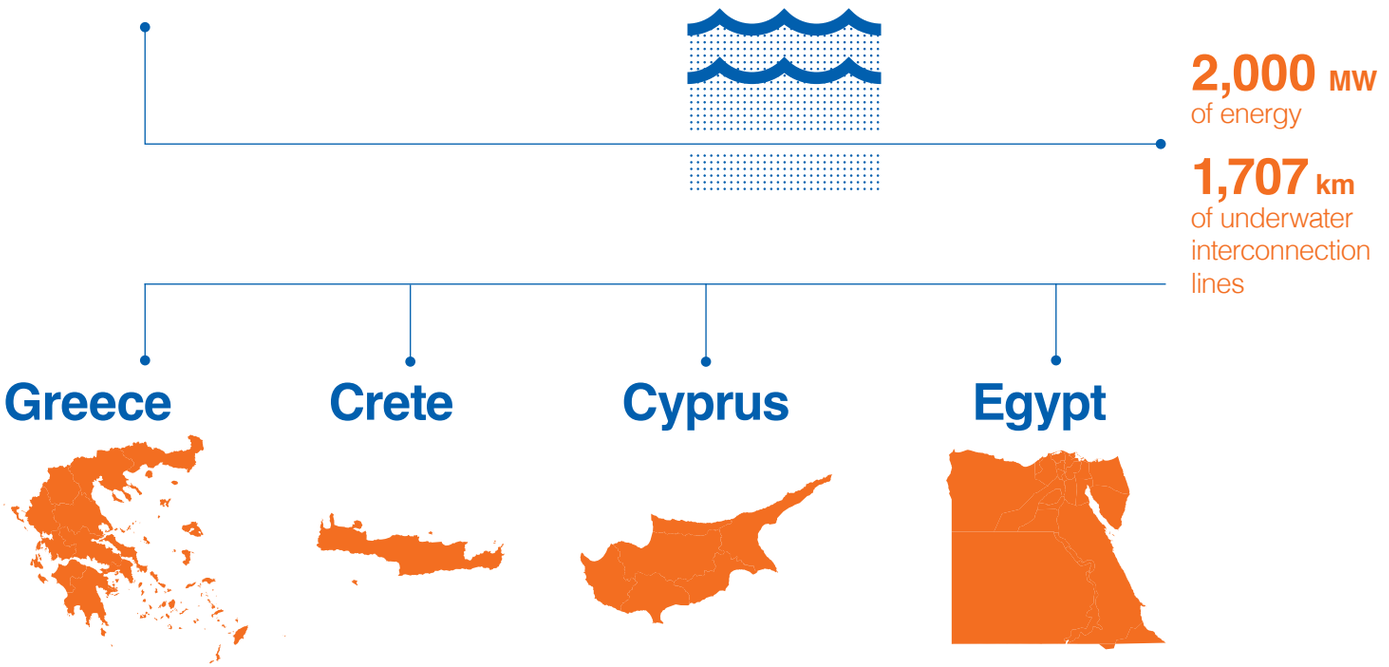
In this respect, CESI was contracted by DEWA (Dubai Electricity and Water Authority) to provide consultancy services related to connecting renewable energy generators to the DEWA grid, to further stabilize Dubai's energy supply. Moreover, CESI carried on a project for SEC (Saudi Electricity Company) regarding rooftop solar PV systems, aiming to increase solar generation in the area.

Interconnecting Europe and the Middle East: a global energy security project

The HVDC line between Riyadh and Mecca constitutes an infrastructure that affects the energy transmission system of the entire area, radically improving efficiency and security. At the same time, it is a project that is part of a momentous infrastructural transformation.

A much more articulated and complex design is on the horizon, one that, through two main steps, may well provide complete and total interconnection between the European Continent and the Middle East. The first step is

EuroAfrica interconnection



the so-called "EuroAfrica" interconnection. This is a submarine interconnection 1,707 km long and capable of conveying 2,000 MW of energy. It will connect Greece, Crete and Cyprus up to Egypt by 2022. CESI has been involved in its cost-benefit analysis by evaluating the expected benefits from a socio-economic point of view. In addition, CESI has already been contacted by GCCIA (Gulf Cooperation Council Interconnection Authority) for the second step: an electric corridor from the Gulf to the Nile Delta, via Saudi Arabia and Jordan. This would be a HVDC corridor of 2,000 MW of capacity, about 2,000 km long. CESI is working on the cost-benefit analysis to assess the economic convenience of such an infrastructure.

These two interconnections would create an enormous geographical area that is fully interconnected and capable of taking advantage of a renewable energy potential stretching from the North Seas to the Gulf and beyond. These projects leverage the most advanced technologies available. For the first section of the project, considered a "European Project of Shared Interest," CESI has been involved also in the environmental impact segment of the feasibility study, which has already been completed. Thanks to infrastructures of this nature, the interconnection of the European and Middle Eastern energy markets would become entirely achievable. It is an objective that would allow for enormous savings in terms of emissions and provide novel guarantees from a security standpoint. It also represents a challenge from both a technological and governance standpoint.

Tests necessary to face the challenge

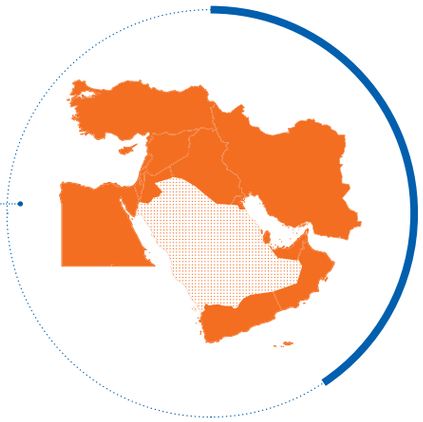
An important project is underway in Saudi Arabia to deal with the technological aspects of this and other analogous challenges. Once again, the leaders of this challenge are CESI and GCC ETL, who have signed an agreement for a thirty-year partnership for the realization and management of the most advanced testing laboratory in the Middle East. The laboratory, which will be built in Dammam with potential satellite facilities in other Gulf countries, will constitute a strategic infrastructure for the entire Middle East; a platform that will make it possible to test and certify (according to international standards) any component of the electric transmission and distribution network: large disconnectors, panels, transformers, cables and more. Currently in its beginning stage, the laboratory – which is owned by GCC ETL but built with design and engineering support from CESI – will be operational by 2020 and provide jobs for roughly ten specialized engineers and technicians, up to over hundred when fully operational by 2024. Today the laboratory stands as a key element for Vision 2030, Saudi Arabia's energy and economic strategy, which aims not only to take advantage of the area's vast renewable energy potential, but also to create a new economic production system, one marked by highly-specialized professional roles.

Supporting e-mobility and the development of renewables

The issue of electric mobility only recently entered into energy companies in developed countries, and today is undoubtedly experiencing a mature phase of the electric market. In Gulf countries, however, the theme of electric cars rose to the forefront at the same time as the strategic design phase of new smart electric systems, and therefore supports a development program for renewable energy sources right from its onset. With focusing on those strategies that are best equipped to integrate e-mobility within the different GCC Countries electric systems and entirely to the benefit of its efficiency and security, CESI conducted a profound analysis of the international market, exploring all its aspects and implications (economic,

Saudi Arabia

The number of cars sold across Saudi Arabia accounts for **40%** of the **Middle East's overall market.**



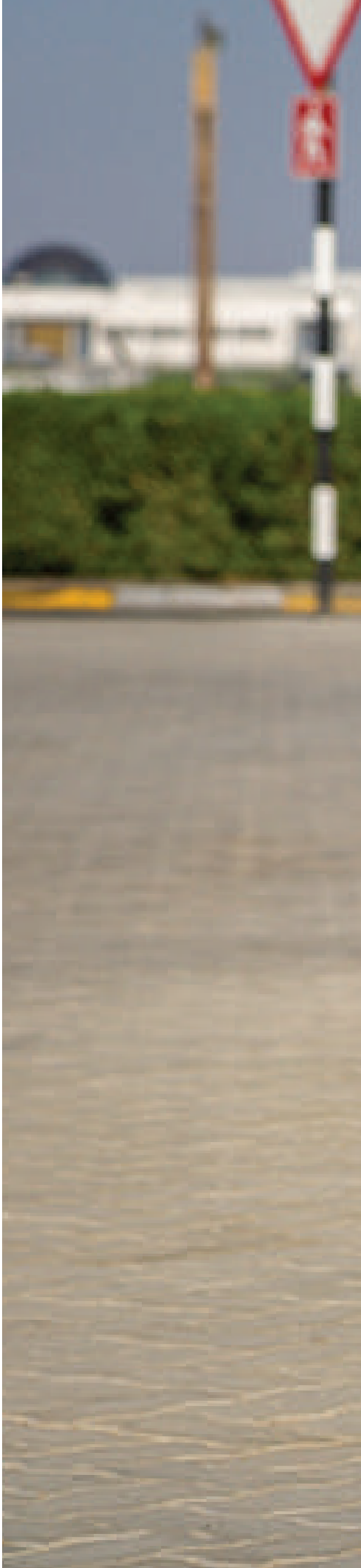
technological, governance, etc.). The analysis took a particularly close look at European best practices. The study titled: "Electric Mobility in Europe: Lessons learned and best practices for the benefit of several GCC countries like the Kingdom of Saudi Arabia and Sultanate of Oman," was presented during the 8th edition of the Saudi Arabia Smart Grid Conference held in December 2018 and Oman Power and Water held in April 2019.

The case of Saudi Arabia, a country that is indicative of technological development trends throughout the surrounding area, is paradigmatic. Every day roughly 10 million cars are on the move across Saudi Arabia: the number of cars sold in the country represents 40% of the Middle East's overall car market. For this reason, the country is 13th overall in the international classification of CO2 emission levels per capita.

The limits inhibiting growth in the market are no longer technological: today we know that a BEV-powered car can run for 300 miles on a "full tank," and that grid parity is an achievable goal. But in order to help this scenario evolve, it will be fundamental to identify a coherent incentives model and advance widespread dissemination of recharging stations. For these reasons Saudi Arabia could study the overall potential of the EV market, including its potential impact on the network, in order to build on a national strategy that will favor the development of the electric car market, defining targets in terms of number of vehicles and impact on emissions. This could lead to the construction of a regulatory framework defining relationships between all stakeholders involved.

Conclusions

CESI's adventure and unparalleled advancements in the Gulf region have proved extremely rewarding thus far. Bringing the company's best skills to bear and developing an increasingly advanced level of know-how to the sector, is paving the way for innovative solutions to address complex energy challenges not only in the Gulf region, but in territories and countries around the world.



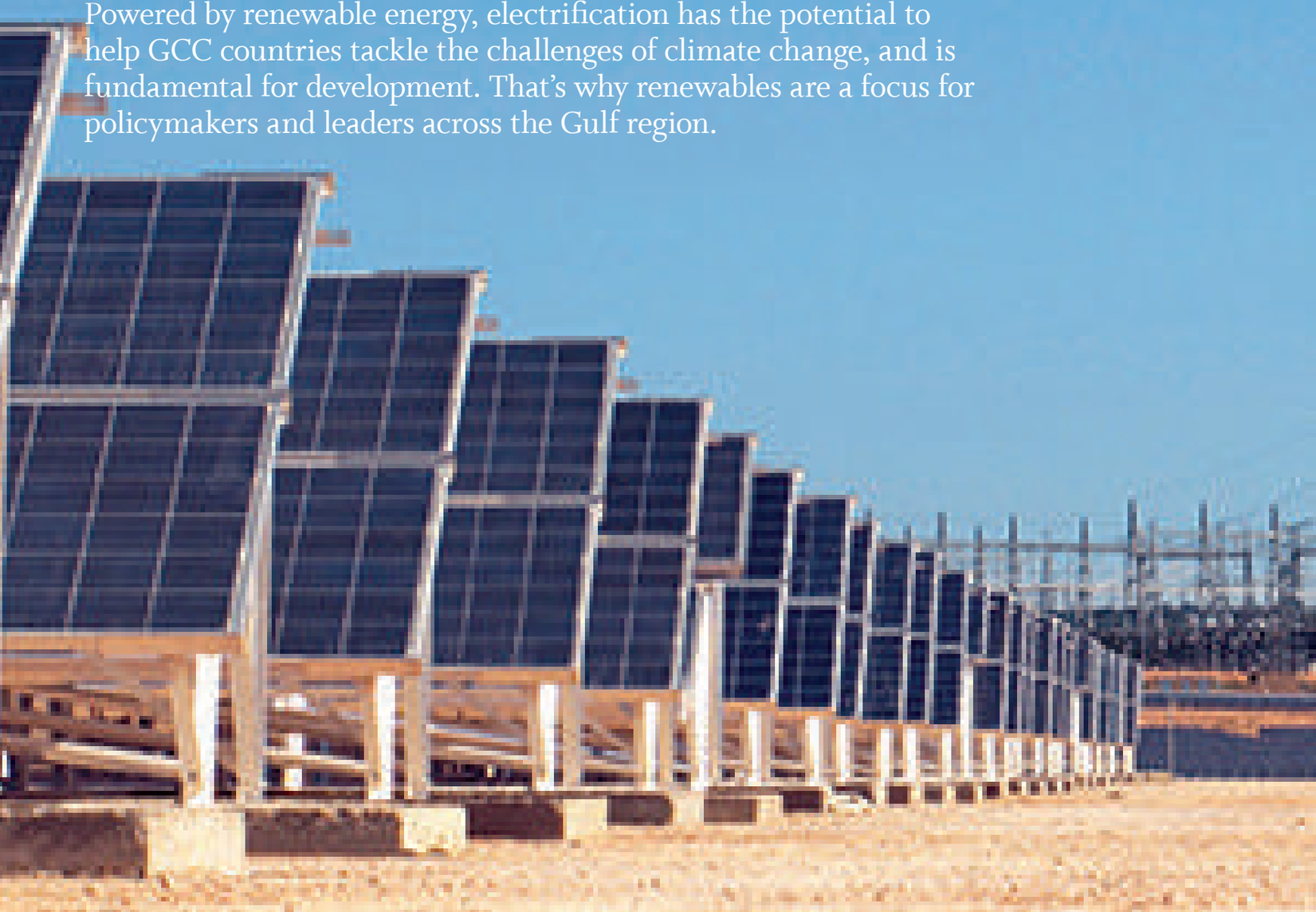
Masdar City, Abu Dhabi

Interview

Step Up for Energy Transition

Interview with Francesco La Camera, Director-General, IRENA

Powered by renewable energy, electrification has the potential to help GCC countries tackle the challenges of climate change, and is fundamental for development. That's why renewables are a focus for policymakers and leaders across the Gulf region.



Francesco La Camera

Director-General, IRENA

Francesco La Camera is the Director-General of the International Renewable Energy Agency (IRENA).
Mr. La Camera formerly served as Director-General of Sustainable Development, Environmental Damage, EU and International Affairs at the Italian Ministry of Environment, Land & Sea since 2014.
As the national coordinator for climate, environment, resource efficiency and circular economy, he led the Italian delegation to UNFCCC's COPs 21 to 24 and the EU delegation to COP 20. He was responsible for the organisation of Italy's G7 Environment Presidency in 2017. He also led the Italian delegation to the G7 Environment meetings in 2016 and 2018.

He served as co-chair of the Africa Centre for Climate and Sustainable Development established in Rome in partnership with FAO and UNDP, and co-chaired the Financial Platform for Climate and Sustainable Development in partnership with the Italian Development Bank Cassa Depositi e Prestiti.

Mr. La Camera was instrumental to the support provided by Italy to several renewable energy initiatives such as the Africa Renewable Energy Initiative (AREI), the Initiative for Renewable Island Energy (IRIE) and the Global Geothermal Alliance (GGA), coordinated by the International Renewable Energy Agency (IRENA).

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1. If we look at the programs launched in the Gulf countries, such as ' Vision 2030', launched by Saudi Arabia, for example, it is clear that the energy transition in this area, in addition to the energy structure, comes to touch economic and productive in the foundations. In fact there is not only the use of renewable sources for energy generation, but also the reduction of dependence of the economy from the export of petroleum products. Are we facing a 360° revolution? In your opinion, what do the Gulf countries face in 2030 from this point of view?

Renewable energy has become central to energy policy in the Gulf for several reasons. Carbon emission reductions, economic diversification and reduced domestic consumption of export resources are the primary drivers. There is no doubt however, that for the Gulf region renewable energy represents a path to stable long-term economic growth and economic resilience.

Regional ambition has been made possible by the falling cost of renewable energy. Today, it is the cheapest way to generate new electricity in most Gulf countries despite their access to fossil-fuel resources. Reliable, cheap power underpins development and therefore renewables present an undeniable case for to policy makers and leaders.

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2. The renewable generation targets that the various countries of the Gulf have set are very ambitious and aim to exploit all renewable resources in a diversified way. In the center, there are obviously solar technologies, both photovoltaic and solar in concentration, but also wind is emerging as a resource with great potential. How do you foresee the renewable mix in this area be comprised?

Solar is the dominant renewable energy technology in the region and it will remain the primary driver of energy transformation given the abundance of strong solar resources that exist in the GCC.

Despite this dominance, the region does possess wind energy potential – particularly Oman and Saudi Arabia which are promising markets. Oman's 50 megawatt Dhofar project, set for completion by the end of 2019, is the first utility scale wind project in the region and it will supply electricity to around 16,000 homes, equivalent to 7 percent of the Dhofar Governorate's power demand.

Saudi Arabia's first wind energy tender, the 400-megawatt Dumat Al Jandal, secured a winning bid at a little over 2 cents per kilowatt hour last year demonstrating significant investor confidence both in the country and in the quality of its wind energy potential. Beyond solar and wind energy, research is ongoing with regards to the feasibility of other forms of renewable energy in the Gulf, including geothermal and bioenergy. During Abu Dhabi Sustainability Week earlier this year, following our Assembly, a new biofuels initiative powered a test flight using a 50-50 mix with traditional fuel. This is a particularly interesting development and points to the commitment made by regional governments towards the new energy economy.

Given the many renewable energy projects in the pipeline in the region, there is no doubt that the GCC's energy mix in 2030 will be much more diversified than it is today with a significant renewable energy component.

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3. These changes are destined to have an important impact on the international energy scenario: the markets are already on the alert today regarding the consequences they can also have on the price trends of petroleum products. How will the role of the Gulf countries in light of the global energy spectrum change over the next few years?

GCC nations are showing their commitment to renewable energy as a cost-effective source of power generation domestically and this is positive. As an organisation, we do not have a view on the impact of diversified energy policies on traditional energy exports.

As the energy transition deepens however, we may see Gulf countries emerge as renewable power exporters, not only to regional neighbours but also further afield. There is already an ongoing interconnection project between Saudi Arabia and Egypt and discussions for an interconnection with Ethiopia to export electricity to Africa. There are also plans to export electricity to Europe. Moreover, countries across the Arab region are cooperating on renewable energy development, which includes the development of regional grid infrastructure capable of transporting power across markets. In this regard, IRENA is engaged in the Pan Arab Clean Energy Initiative which serves as one such platform to advance these programmes.

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4. In the redefinition of the energy structure and considering the demand rate of electricity is continuous with very strong growth, especially due to residential consumption, the issue of energy efficiency, which the Gulf countries have so far been little sensitive, it proves central. How is it moving on this front and what needs to be done to promote the spread of a radically new culture in energy consumption?

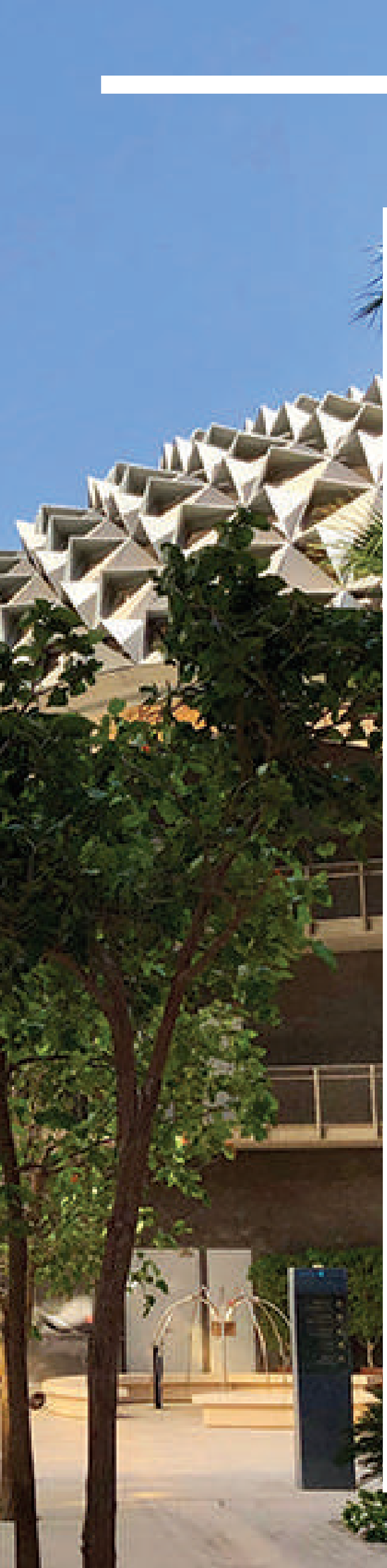
The GCC countries do face unique environmental challenges. It is one of the hottest and driest inhabited regions in the world, placing a tremendous amount of pressure on cooling and desalination infrastructure – both of which are energy intensive.

Like many regions of the world however, behavioral change with regards to responsible energy consumption and the introduction of measures to improve energy efficiency in buildings are important steps, and I believe regional governments are embracing this.

Masdar City is an example of the UAE's desire to establish a blueprint for low-carbon urban development. Moreover, the Emirates Green Building Council (EGBC) was formed in 2006 with the specific objective of improving energy efficiency measures in the UAE.

There are similar efforts all over the region such as the Qatar Green Building Council (QGBC) and the Saudi Green Building Forum. The latter is leading the country's efforts to achieve the officially stated goal of becoming a world leader in green building.

Masdar City, Abu Dhabi



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5. The changes of these development plans also go in the direction of more intense relations with foreign countries, favoring foreign capital investments, and increasing technological partnerships. From this point of view, what are your perspectives on Europe and Italy?

There is no sustainable development without renewable energy. Therefore, I see it as being critical that key national and intergovernmental stakeholders strengthen their cooperation to ensure that renewables and the provision of affordable electricity remain at the centre of development goals.

I see Europe playing a key role in delivering against the 2030 Sustainable Development Goals and Italy as an important contributor to that. In this regard, the existing EU-GCC Clean Energy Technology Network, based in Masdar City, is playing a major role in catalyzing mutually beneficial partnerships for the deployment and development of clean energy technologies in the GCC.

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6. In March, students all over the world have been struggling to solicit positions and concrete actions by all Governments to tackle climate change in a radical and effective manner. What would you tell them and what can the IRENA agency do to promote this change of pace internationally?

Renewable energy growth has been positive in recent years. Just a few months ago we release our latest capacity report, which tracks new renewable energy installations globally, and we found growth this year to have been as strong as it was last year with additions of 171 gigawatts. Clearly, the global energy transformation is well underway.

Yet, the world is not on track to meet the goals established under the Paris Agreement and that is a grave concern. Globally, energy-related CO2 emissions are rising by around 1% per year and as a consequence, so is the urgency to advance the energy transition. The recent IPCC report on 1.5° Global Warming delivered a stark warning. If we continue as we are, global temperatures will rise to 2.6° or higher by 2050 – with severe consequences. Despite progress, action must step-up - significantly and urgently.

Our view is that electrification powered by renewable energy is a major climate solution. Renewable energy combined with a deep electrification in sectors like transport and heating can deliver more than 75% of the emissions reductions we need. And, combined with energy efficiency, we can reduce energy-related carbon emissions by 90%. IRENA is working closely with members to develop the policy and regulatory frameworks that unlock capital and accelerate renewable energy deployment.

City Portraits

Welcome to Dubai 2021

What will the Dubai of the future look like? DR Aisha Bin Bishr, Director-General of the Smart Dubai Office has a vision: sweeping technological transformation that will turn Dubai into the happiest city in the world.

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Over the course of a single century, Dubai has evolved from a town of just 10,000 inhabitants to a metropolis of 2.7 million. What the city has experienced is the textbook definition of population explosion, and it has brought equally intense growth in consumption and climate-changing emissions.

For these reasons, Dubai has become one of the most sustainable and smart cities in the world, quickly rising in international classifications, leaving more storied Western megalopolises in its wake, one-by-one. According to a report published by the International Entrepreneurship Forum and Exhibition (IEFE) in 2018, Dubai currently stands 60th in the world, and is in 1st place regionally. The city's achievements in the use of ICTs and innovation are even more impressive, bringing Dubai to 4th place worldwide in the general classification.

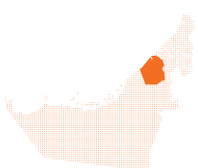
The choice of Dubai as the location for the World Expo 2020 has undoubtedly sped things up from an innovation point of view. The event will bring approximately 45 million people to the city, offering an opportunity for strategic visibility for the country and especially for Dubai, which is dedicated to presenting the best possible version of the city to the world. For this reason, in order to reinforce metropolitan infrastructure so that it can handle the impact of such high demographic inflows, the government has set up investments totaling 2.5 billion USD.

The Dubai Smart City Initiative – a strategic plan created to initiate this phase of radical transformation designed to boost innovation – identifies six macro-areas for interventions, for a total of 100 specific actions to be completed by the end of 2021. Their realization is entrusted to the Smart Dubai Office, while a series of new laws have been approved specifically to reinforce and formalize the legal framework of the Dubai Smart City Initiative. In a very short time, this task force has already completed a number of different initiatives aimed at consolidating the infrastructure on which all the different interventions are built. Last but not least, the government created a dedicated division to evaluate results achieved and monitor the progress of change: the OSCIM, or Office of Smart City Impact Management.

Dubai

60th
(international classification of the world's most sustainable, smart cities, IEFE Report)

4th
(international classification of the world's most innovative cities)



1st
(in the Gulf region)

Dubai 2021: Futuristic and…Fulfilled

Everyone knows that a smart city is a city in which soft and hard infrastructures are interconnected in a secure manner, and we generally imagine them as a sort of collaborative digital ecosystem that can improve the city's environmental, economic and social sustainability, protecting the environment and guaranteeing a high-quality standard of living. But each city, while remaining within this general framework, fine-tunes its own individual profile, which becomes more interesting the more original it gets. From this point of view, what will the Dubai of the future look like?

"The Dubai government differs from others around the world in that it aims to make Dubai the Happiest City on Earth," stated Her Excellency Dr. Aisha Bin Bishr, Director General of the Smart Dubai Office. No one knows if specific targets will be achieved or whether or not the programs will be fully realized, but there is no doubt that Dubai is the first city to put the theme of happiness front and center for its inhabitants and those who visit it. And in Dubai, the route to happiness passes through a powerful technological transformation, thanks to the insertion of ICT systems, integrated with IoTs, which will make it possible to govern several key areas of city life: services, mobility and residential consumption.
From a mobility point of view, this means betting on the quick spread of e-mobility systems. In order to honor targets set as part of the Green Charger Initiative, DEWA (the Dubai Electricity and Water Authority) has already installed 200 recharging stations for electric vehicles around the city. And plans are already pushing the horizon further into the future: the most advanced programs call for large-scale adoption of driverless vehicles.

> "The objective of this technological transformation is to permeate the heart of the city with artificial intelligence"

From a governance point of view, the objective is to permeate the heart of the city – its operating system – with artificial intelligence. Obviously, all services will be managed digitally, but starting in 2021, the Dubai government will be "paperless" and "cashless." This will mean eliminating the roughly one billion pieces of paper used every year for all sorts of communications and transactions. The idea is to create a light, immaterial bureaucracy that will have a decidedly positive impact on the environment, as well as save its citizens a great deal of time.

Sustainable Design

Dubai continues to grow, but its new neighborhoods are being built in keeping with the precepts of sustainability, relying on concepts of passive design and minimizing ecological footprints. The Sustainable City, Desert Rose, The Blue Water Island, Meydan One, Dubai Creek Harbor… These are merely the first among a number of new residential neighborhoods that will develop now through 2021.

On the residential front, in 2014 Dubai approved the first of a series of regulations – the Green Building Regulations & Specifications – that outline minimum efficiency and consumption standards.
The management of water, energy, materials,

waste, emissions and more are all kept rigorously under control, through the adoption of smart meters for energy and water consumption. In order to accomplish this, the city chose a path of increasingly refined and widespread integration of ICT and IoTs.

The sensibility and diversification of sensors designed to collect and share data in real-time will make it possible for individual buildings, and in return the entire city, to pursue a goal of efficiency and resilience with which most avant-garde smart cities in the world need to move toward. The Oasis Eco Resort is an excellent example of this trend: the residence recycles waste water for irrigation, manages all its refuse on site, creates a zero-emission zone and will develop a 157,000 square meter photovoltaic park, set up in part on building rooftops, that has been specifically designed to optimize panel efficiency.
This is the approach Dubai has adopted for all residential areas. There are already 1,145 buildings with photovoltaic panels installed on the rooftops for clean energy generation, all connected to the Smart Dubai network, for a total capacity of 50MW. By blending a new cultural approach with commercial offerings that place demand front and center, Green Dubai is pushing the city toward a culture of intelligent energy and water consumption: the goal is to reduce consumption by 30% by 2030, which cannot be achieved without clear knowledge and awareness among consumers.

To this end, DEWA has promoted installation of 250,000 smart meters in homes, shops and companies around Dubai. Applications for smart phones and other "user friendly" systems will turn energy efficiency into a simple, easy-to-use daily convenience. Citizens and inhabitants of the city are allies in the creation of the ideal sustainable city that Dubai aims to become.

DEWA is one of the leaders of this transformation and is well aware that it implies changing the internal organization as well, redefining the very concept of utility and turning the traditional public utility business on its head.

Regardless of whether the leaders of this endeavor manage to turn Dubai into the happiest city on the planet, the Dubai Smart Initiative undoubtedly offers a futuristic vision of what cities of tomorrow could become: urban realities in which inhabitants are the leaders of a new, sustainable way of life.

News & Events

Upcoming Energy Events

World Energy Congress

Sept. 9-12 — Abu Dhabi, UAE

www.worldenergy.org/events

Under the theme Energy for Prosperity, the program of the 24th World Energy Congress leads delegates through the most live and critical issues facing the energy industry. The format of the four-day program features opening, closing and panel sessions designed to ensure that there is a narrative to the event based on sharing best practice and identifying solutions for the key issues facing the sector.

Microgrid Global Innovation Forum

Sept. 9-11 — London, UK

www.microgridinnovation.com/EMEA

The 10th edition of the Microgrid Global Innovation Forum focuses on microgrid advances, case studies and applications in EMEA, Asia-Pacific, and Latin America. Organized by the Smart Grid Observer, the emphasis is on maximising the effective use of renewable and distributed energy resources.

Off-Grid Experts

Sept. 19-21 — Augsburg, Germany

www.off-grid-experts.com

A three-day program around self-sufficient solar, wind and hydro power systems and the off-grid power supply, which has since firmly established itself in the scene.

UN 2019 Climate Action Summit

Sept. 23 — New York City, US

www.un.org/en/climatechange

The UN 2019 Climate Summit will convene on the theme, 'Climate Action Summit 2019: A Race We Can Win. A Race We Must Win.' It will seek to challenge states, regions, cities, companies, investors and citizens to step up action in six areas: energy transition, climate finance and carbon pricing, industry transition, nature-based solutions, cities and local action, and resilience.

Southern Africa Power Summit

Oct. 29-31 — Cape Town, South Africa

www.ssapower.com

The SSA Power Summit will provide a platform to address some key challenges of improving aging power infrastructure, developing new power infrastructure, renewable power innovations, gas to power technologies, transmission & distribution solutions, more cost effective temporary power solutions and much more.

RENEXPO INTERHYDRO

Nov. 28-29 — Salzburg, Austria

www.renexpo-hydro.eu/en/

The RENEXPO INTERHYDRO highlights the contribution hydropower makes to safe, sustainable, affordable and climate-neutral energy provision.
The 2-day congress attracts the who's who of the hydropower industry. Current issues such as political and legal frameworks, practical experience, energy storage, maintenance and modernization, and ecologically acceptable hydropower plant construction are introduced and discussed by groups of experts.

Shaping a Better Energy Future

CESI is a world-leading technical consulting and engineering company in the field of technology and innovation for the electric power sector. With a legacy of more than 60 years of experience, CESI operates in 40 countries around the world and supports its global clients in meeting the energy transition challenges. CESI also provides testing and certification services to the power equipment industry, as well as civil and environmental engineering services.

The company's key global clients include major utilities, Transmission System Operators (TSOs), Distribution System Operators (DSOs), power generation companies (GenCos), system integrators, financial investors and global electromechanical and electronic manufacturers, as well as governments and regulatory authorities. In addition, CESI works in close cooperation with international financial institutions such as, among others, the World Bank Group, the European Bank for Reconstruction and Development, the European Investment Bank, the Inter-American Development Bank, the Asian Development Bank.

CESI is a fully independent joint-stock company headquartered in Milan and with facilities in Berlin, Mannheim, Dubai, Abu Dhabi, Washington DC, Knoxville, Rio de Janeiro, Santiago de Chile and Bogotá.

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