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Climate-Smart Business:

# INVESTMENT POTENTIAL in EMENA

Mapping investment potential in renewable energy, resource efficiency, and water in Emerging Europe, Central Asia, and the Middle East and North Africa



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# Executive summary

In this report we present our assessment of climate-smart investment opportunities in a vast region that is both contributor to and victim of climate change: Europe, Central Asia, and the Middle East and North Africa (EMENA). Geographically varied, EMENA spans 49 countries and has of late seen unprecedented increases in energy demand, population growth, and urbanization, as well as an acute need for improved infrastructure for more efficient industry, transport, and utilities.

Our report differs from others in that we sought out, pragmatically and specifically, private sector investment opportunities related to climate change mitigation and adaptation. Where are these opportunities, and will they deliver healthy returns? These are important questions, not least because in the wake of the global financial crisis, overstretched governments often need private sector help to meet climate business goals.

Our proprietary analysis of climate-smart investment opportunities in EMENA, in collaboration with A.T. Kearney, the global management consulting firm, and Eco Ltd, sustainable energy sector specialists, estimates a conservative investment potential of **\$640 billion** up to 2020 distributed across the region in the following sectors:

- **\$270 billion in renewable energy generation, rehabilitation of power infrastructure, and improved**

**transmission and distribution.**

- **\$240 billion in energy efficiency in the commercial and consumer sectors, via building insulation, appliance upgrades, lighting, and water and space heating.**<sup>1</sup>
- **At least \$60 billion in cement, metals, and manufacturing, via improved industrial processes and equipment upgrades.**
- **About \$70 billion in improved water usage, including for power.**<sup>2</sup>

Smart investors are already seizing the opportunities. In the Middle East and North Africa (MENA), renewable energy investments reached \$2.9 billion in 2012, up 40 percent from the previous year. Investments in the Russian and Kazakh power and industrial sectors are at an all-time high. And across the Balkans and Eastern Europe, annual growth rates in the renewable energy sector have exceeded 100 percent in recent years. Given these positive developments, we also produced a less conservative estimate for climate-smart investments of almost **\$1 trillion** by 2020, which assumes greater reductions in energy-related subsidies and ambitious and consistent public incentive schemes, including funds, tax exemptions, feed-in tariffs, and mandatory efficiency standards.

Climate change is real. Fortunately, it's also creating very real private sector investment opportunities across EMENA.

## Emerging Europe looks West

- Renewable energy is a \$76 billion investment opportunity, including \$35 billion for wind energy
- The building sector accounts for an investment opportunity of \$60 billion
- Industrial efficiency accounts for a \$12 billion investment opportunity

## Morocco

- Investment potential of \$13.4 billion in renewable energy
- 42% renewable energy target by 2020
- Potential of \$2.3 billion in wastewater treatment and \$0.7 billion in agricultural irrigation

## Green boom in MENA

- Climate smart investment potential in selected industrial upgrades exceeds \$18 billion
- Renewable energy is a \$45 billion investment opportunity up to 2020
- In North Africa, building-scale solar water heaters for buildings have low market penetration
- More than 1,350 green construction projects are underway in the Arabian Peninsula

## Ukraine

- Heavy industries have investment potential of \$2.1 billion
- Power sector modernization is a \$3.9 billion investment opportunity
- Biomass opportunities estimated at over \$6 billion

## Modernizing the CIS

- \$48 billion of investment potential in electricity transmission, infrastructure modernization
- Over \$8 billion in cement industries and \$12 billion in metal industries in Kazakhstan, Russia, and Ukraine
- 43 billion cubic metres of associated petroleum gas awaiting commercialization

## Russia

- \$31 billion of investment potential in heavy industries
- Important legislative changes in the buildings sector
- Energy generation, transmission and distribution have investment potential of over \$48 billion

## MENA's water-energy nexus

- In the GCC, independent water and power projects present \$14 billion of investment potential
- Water treatment and reuse is a \$16 billion investment opportunity
- \$30 billion of investment potential in water efficiency in agriculture

## Pakistan

- Wastewater treatment is a \$13.8 billion opportunity
- \$2.3 billion investment opportunity in biomass energy
- Wind and solar power increasingly attractive

## Turkey

- Investment potential in energy generation accounts for almost \$42 billion, of which \$22 billion is in renewables
- Industrial and consumer energy efficiency are estimated at \$4.5 billion and \$30 billion, respectively

<sup>1</sup> In terms of energy efficiency investments, our analysis considered only the low-hanging fruit and big ticket items, such as building insulation, lighting, and major industries like cement. In reality, opportunities exist in practically every sector and across all technologies and processes. Our energy efficiency estimates should thus be seen as a lower boundary.

<sup>2</sup> This report largely discusses water as a proxy for climate change adaptation. The topic is much broader, and the investment opportunities likely greater, yet the possibilities remain somewhat unclear for the private sector. Thus, we have taken water as a starting point, and focused only on a few applications, like wastewater treatment and improvements in soil management and water efficiency.

# Introduction

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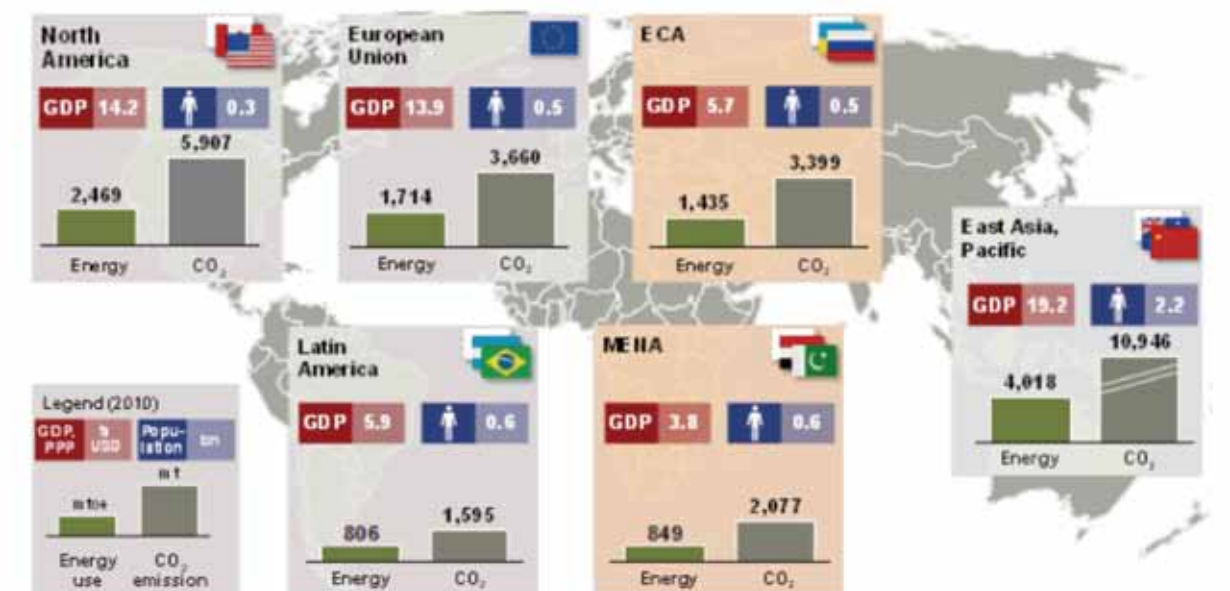


As global temperatures rise, weather patterns shift, and another devastating storm dominates the headlines, the demand for climate-smart investments grows. Released in September, the IPCC's Fifth Assessment Report<sup>3</sup> states with 95 percent confidence that humans are the main cause of global warming. A world in which warming reaches four degrees Celsius above preindustrial levels is likely to see unprecedented heat waves, severe drought, and major floods, disrupting regions and economies.<sup>4</sup> Now more than ever, major investment is needed to help countries, businesses, and consumers mitigate and adapt to climate change. According to the United Nations, 80 percent of that capital will need to come from the private sector.<sup>5</sup> Climate change has become a priority for officials and policymakers across the globe – and private sector involvement is not merely welcome, but critical to this effort.

In this report, we present our assessment of significant climate-smart investment opportuni-

ties up to 2020 in a region that is both a contributor to and a victim of climate change: Europe, Central Asia, and the Middle East and North Africa (EMENA). A geographically varied region, EMENA spans 49 countries and holds more than half the world's oil and three-quarters of its gas. It is also home to hydrocarbon-poor energy importers. The region's CO<sub>2</sub> emissions and energy use are similar to those of North America, but a 35 percent lower GDP makes it the world's most energy inefficient region. At the same time, EMENA is facing unprecedented increases in energy demand, population growth, and urbanization, and an acute need for improved infrastructure for more efficient industry, transport, and utilities. What's more, the likely impacts of climate change – in particular land surface change and water scarcity – will be strongly felt across the region, albeit in a geographically uneven manner.

Our report builds on existing research on climate change that places low carbon and climate resilient technologies at the center of responses to climate



1. Excluding India and Sub-saharan Africa  
Source: World Bank, International Energy Agency

change and identifies key investment needs. For instance, HSBC Global Research<sup>6</sup> has estimated that building the low-carbon energy market will require \$10 trillion of investment by 2020. In *Sustainable Energy for All Global Tracking Framework*, a report released in May 2013, the World Bank Group esti-

mated that total investment in renewable energy may need to triple by 2030, from an annual \$400 billion to \$1.2 trillion, in order to double global renewable energy capacity. The International Energy Agency's *Energy Efficiency Market Report 2013*, published in October 2013, puts current annual

<sup>3</sup> IPCC, 2013, *Climate Change 2013: The Physical Science Basis. Working Group I Contribution to the Fifth Assessment Report of the Intergovernmental Panel*

on Climate Change.

<sup>4</sup> World Bank, 2012, *Turn down the heat: why a 4° warmer world must be avoided*, Washington DC.

<sup>5</sup> UNDP, *Catalyzing Climate Finance*, 2011.

<sup>6</sup> *Sizing the Climate Economy*, HSBC Global Research, 2010.



energy efficiency investments at up to \$300 billion globally and predicts significant growth, principally driven by price and policy.

But our report differs from existing research on climate change in that we ask, pragmatically and specifically, where are the attractive private sector climate-smart investment opportunities, and will they deliver healthy returns? These are important questions, not least because in the wake of the global financial crisis, over-stretched governments often need help from the private sector to meet climate business goals.

We set out to answer these questions with a proprietary analysis of climate-smart investment opportunities (see box on Methodology) in EMENA, in collaboration with A.T. Kearney, the global management consulting firm, and Eco Ltd, sustainable energy market specialists. The study is based on three major pillars: existing reports and databases (World Bank Group and other leading databases, market reports, and research by various associations and international organizations), expert interviews, and a bottom-up analysis of 44 business cases. Our regional analysis constitutes an ambitious attempt at locating growth opportunities arising from efforts to mitigate and adapt to climate change for the private

sector. It is thus a starting point for investors, one we hope will generate follow-up analyses.

As we explore throughout this report, opportunities for climate-smart investors are not hard to find in the EMENA region. We estimate an investment potential of **\$640 billion** distributed across the region in the following sectors:

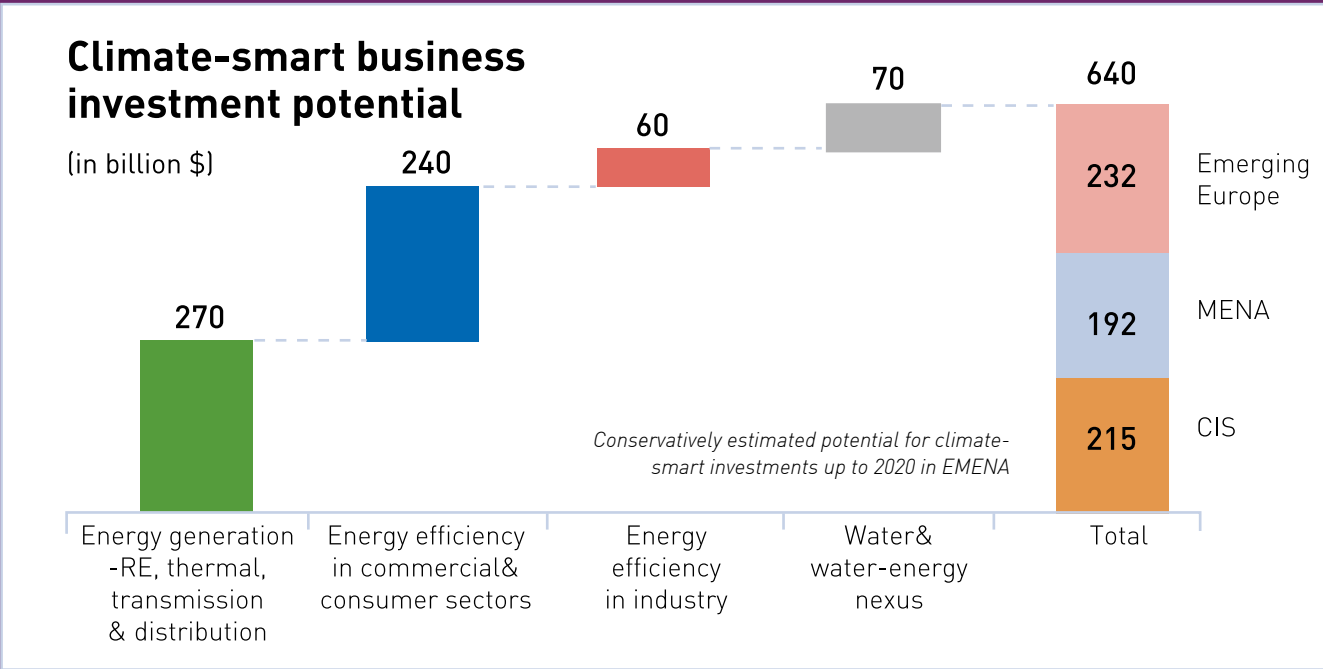
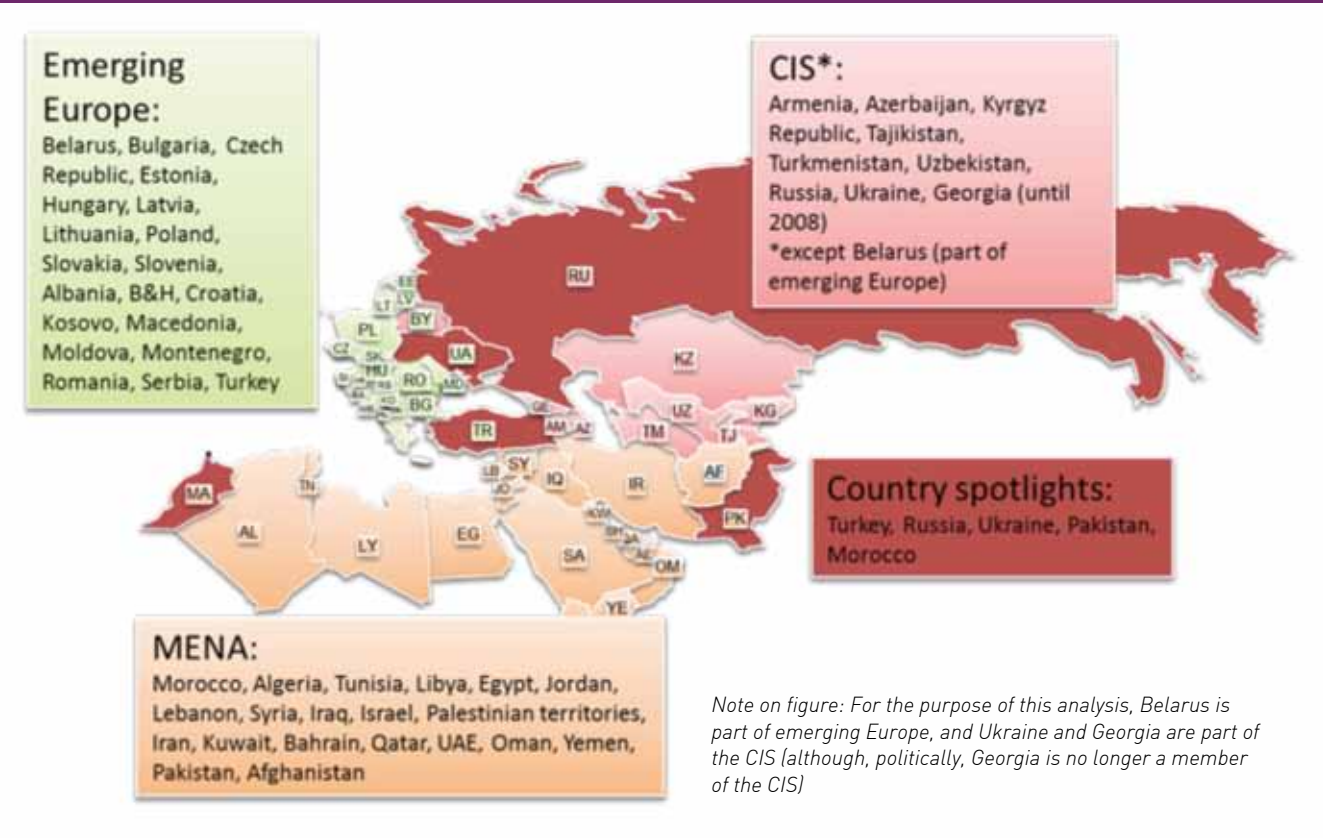
- **\$270 billion worth of potential investments in energy generation.** This includes renewable energy (\$150 billion), reducing energy losses in gas pipelines and electricity grids (\$70 billion), and rehabilitating thermal power infrastructure (\$50 billion).

- **\$240 billion worth of potential investments in energy efficiency in the commercial and consumer sectors,**<sup>7</sup> including considerable potential in LED lighting, appliances, and green buildings.<sup>8</sup>

- **\$60 billion worth of potential investments in cement, metals, and manufacturing** via improved industrial processes and equipment upgrades.

- **\$70 billion worth of potential investments in improving water usage and around the water-energy nexus.**<sup>9</sup>

This is not theoretical potential; smart investors are already seizing the opportunities. In the Middle East and North Africa (MENA), renewable energy investments reached \$2.9 billion in 2012, up 40



<sup>7</sup> In terms of energy efficiency investments, our analysis considered only the low-hanging fruit and big ticket items, such as building insulation, lighting, and major industries like cement. In reality, opportunities exist in practically every sector and across all technologies and processes. Thus, our energy efficiency estimates should be seen as a lower boundary.  
<sup>8</sup> By their nature, many energy efficiency opportunities

are more distributed and less prone to direct project investments. Therefore, the potential business models and investment structures in this market differ substantially, ranging from credit lines by commercial banks to finance small business investments such as solar hot water heaters to a public-private partnership for waste management and street lighting projects.

<sup>9</sup> This report largely discusses water as a proxy for climate change adaptation. The topic is much broader, and the investment opportunities likely greater, yet the possibilities remain unclear for the private sector. Thus, we have taken water as a starting point, and focused only on a few applications, like wastewater treatment and improvements in soil management and water efficiency.

percent from the previous year. Investments in the Russian and Kazakh power and industrial sectors are at an all-time high. And across the Balkans and Eastern Europe, annual growth rates in the renewable energy sector have exceeded 100 percent in recent years. Given these positive developments, we also produced a less conservative estimate for climate-smart investments of almost **\$1 trillion** by 2020, which assumes greater reductions in energy-related subsidies and ambitious and stable public incentive schemes, including funds, tax exemptions, feed-in tariffs, and mandatory efficiency standards.

EMENA is an internationally attractive market to which global players are increasingly flocking - including the Spanish firm ACCIONA, California's Energy Recovery Inc. (ERI), Dow Chemical, the CEZ Group, Turkey-based Zorlu Enerji, and France's Veolia, Bonduelle, and Lafarge. Yet across a region as vast as EMENA, geography matters. Our research linked clusters of private sector investment opportunities to local drivers such as political will, resource endowments and scarcity, and infrastructural and institutional legacies. We present four key regional trends that highlight how climate-smart investment opportunities transcend national borders and individual sectors.

In MENA, climate-smart investment opportuni-

ties exceeding \$190 billion are emerging as governments firm up their commitments to resource and energy efficiency at a time when population growth and rapid urbanization herald sharply rising energy and water demands. While net energy exporting countries increasingly experience the opportunity costs of subsidizing their spiraling consumption, energy importers feel the fiscal pressures that result from unsustainably subsidized energy prices. As MENA greens its infrastructure (see *section Trend 1: Green boom in MENA, page 11*), its governments are focused on the reciprocal relationship between energy and water (see *section Trend 4: MENA's water-energy nexus, page 23*) because water constraints raise serious concerns for the region's agriculture, industry, and people.

Meanwhile, the transition countries of the Commonwealth of Independent States (CIS) are experiencing fiscal pressures at the national and local levels. Across the entire region governments are spending significantly on energy subsidies for industry and for inefficient and ageing buildings. Waste is systemic because economic incentives that would encourage efficiency, such as cost-recovering energy and water prices, are largely absent. As governments push for greater resource efficiency, particularly energy efficiency (see *section Trend*





2: Modernizing the CIS, *page 15*), we estimate the market potential of turning waste into a business opportunity at over \$215 billion.

In the countries of Emerging Europe, a region stretching from the Baltic to the Balkans, we estimate, conservatively, a climate-smart investment potential of about \$232 billion generated by the parallel processes of political and financial integration (see *section Trend 3: Emerging Europe looks west, page 19*). East, Central, and Southeast Europe are CO<sub>2</sub> intensive and moving on from post-1990 economic stagnation and uncertainty. In their bid for EU accession and cooperation, states are increasing their EU alignment and taking cues from the EU when it comes to policy lessons and regulatory issues, with important implications for climate-smart investment opportunities.

In addition to these regional trends, we present five country profiles in which we zoom in on individual countries settings to illustrate EMENA's diverse operating environments. For instance, Turkey is one of EMENA's high growth economies (see Turkey, the Mediterranean Tiger, *page 27*), where hydrocarbon scarcity and rising energy demands coincide with political stability and a strengthening private sector. In contrast, the private sector is less consolidated in the remaining four countries, of which only Morocco

(see Morocco's big, fast green expansion, *page 45*), enters the top 100 of the World Bank's Ease of Doing Business index (along with Turkey). Ranked 110th, Pakistan (a largely agrarian economy like that of Morocco) supports climate-smart business when it aligns with economic development imperatives, in particular access to infrastructure and energy (see Pakistan's climate-resilient growth, *page 41*). Almost as energy hungry as Pakistan, Ukraine has green ambitions comparable to Morocco's, yet its economy is industrialized and energy inefficient and ranks 112nd out of 185 countries in Ease of Doing Business (see Ukraine's growing pains, *page 35*). Its energy rich neighbor, Russia, has an even more inefficient economy and is beginning to unlock its energy saving potential (see Russia's green awakening, *page 31*) owing to lost export revenues.

The country spotlights and key regional trends provide a reminder that climate change is very real. From arid Yemen in the south to the permafrost of Siberia in the north, and from Casablanca in the West to Vladivostok in the Far East, no nation will be immune to its impact. Fortunately, the key finding of our analysis is that energy efficiency emerges as the winning strategy across the region. Climate change is creating legitimate private sector investment opportunities, right now and across EMENA.

## Methodology for estimating climate-smart investment potential in EMENA

The estimates in this report are based on a collaboration between IFC, AT Kearney, and Eco Ltd. The study is based on three major pillars: existing reports and databases (World Bank Group and other leading databases, market reports, and research by various associations and international organizations), expert interviews, and a bottom-up analysis of 44 business cases. The business case analysis was used to determine the overall volume of investment potential for each opportunity as well as its commercial viability in each country and region, e.g. based on countries' energy prices and public incentive schemes.

This quantification was approached by comparing macro-level data with micro-level approximations and involved expert-verified estimations and data extrapolations. Climate-smart business opportunities are defined as economically viable investments that contribute to climate change mitigation and adaption. A conservative approach was used to quantify investment potentials across technologies and regions and only investments expected to materialize as commercially viable by 2020 have been included. The criteria for financial viability differ across technologies and regions, depending on factors such as asset lifetimes and country risk characteristics.

For solar technologies such as PV or CSP, for example, political, technological, and financial factors were taken into consideration in order to translate the region's irradiation levels into a successful commercial investment. Three key determining factors for the commercial viability included 1) installation costs, 2) the cost of competing conventional electricity, and 3) the existence of supportive green energy policies. Solar photovoltaic installation costs are \$2-4 million per MWp, while concentrated solar power costs are \$3-4 million per MWp, resulting in a break-even cost of electricity, in the Arabian Peninsula as an example, of \$0.12-0.20 per kWh. In comparison, the installation cost of an efficient modern coal plant is in the range of \$1-2 million per MW, with the added advantage of capacity factors above 75 percent producing electricity at all times of the day. Non-subsidized fuel prices of \$0.02 to \$0.03 per kWh (coal) result in generation costs (LCOE) below \$0.05 per kWh for coal-based

energy plants. Coal-based electricity in many EMENA countries is heavily subsidized, resulting in electricity costs as low as \$0.01 to \$0.03 per kWh for the end consumer.

Solar technology is entering a commercial ramp up phase, with solar PV leading the field. PV has already experienced a decrease in system costs through its surge in deployment, which in the short period from 2008-2010 experienced a 59 percent increase. If CSP and PV are expanded to more areas with high natural potential and/or high energy resources, declining



technology costs will continue. Through increased adoption and technological efficiency, prices for solar are expected to decline by up to 30 percent from 2010 to 2020. To help close the current price gap, several EMENA countries have instituted policies to incentivize growth in the renewable energy sector. The existence of policies such as capacity targets, feed-in tariffs, investment subsidies, and tax reductions or credits are the most common tools in enhancing the commercial viability of solar technology.

Hence, figures presented throughout this report can be interpreted as a lower bound, with substantially higher potential possible with the implementation of several government initiatives under discussion in many EMENA countries. In particular, energy efficiency potentials stem from an analysis of the largest sectoral opportunities, but given that opportunities exist across the entire economy, we can expect the actual total to be considerably larger.

## Trend 1 Green boom in MENA



As governments across MENA firm up their political commitments to green energy, investments in the renewable energy sector in the region reached \$2.9 billion in 2012.<sup>10</sup> By our estimates, this annual figure - a 40 percent increase from the previous year - will increase dramatically in the years to come. This is because the economies of the region, whether net exporters or importers of energy, are almost entirely reliant on hydrocarbons. At a time when population growth and rapid urbanization across the region herald sharply rising demands for energy, this raises serious questions for net exporters and importers alike.

Our estimates put the commercial climate-smart business investment potential in energy generation in the MENA region at \$192 billion, almost a quarter of which (\$45 billion) is in renewables. The potential in resource efficiency is estimated at over \$73 billion, of which \$18 billion is in industrial energy efficiency.

MENA countries are increasingly pursuing significant energy diversification, mainly by developing renewable energy and boosting energy efficiency. Ex-

### MENA countries are increasingly pursuing significant energy diversification initiatives

porting countries - such as Algeria, Bahrain, Oman, Saudi Arabia, UAE, and Yemen - increasingly experience the costs of spiralling consumption and cast an eye on reaping the benefits of the high export value of hydrocarbons. In contrast, concerns over a secure supply and the fiscal pressures that result from unsustainably subsidized energy prices are strongly felt by energy importers Israel, Jordan, Lebanon, Morocco, Palestine, and Tunisia. In Egypt, public expenditures on energy subsidies are twice as large as those on health and education combined. The MENA region as a whole spends over \$400 billion per year (post-tax) and almost 35 percent of total government revenues (almost 15 percent of GDP, including externalities and tax considerations) on energy subsidies.<sup>11</sup>

These pressures mean that, in some cases, energy efficiency is a priority for governments, even when the

financial incentives for end users are not present. This is the case for Egypt, where energy efficiency targets are in place and a fairly positive regulatory framework has been created. The significant fossil fuel subsidies, however, produce strong disincentives for commercial investment. Morocco and Jordan - both net importers of energy - have relatively high electricity prices with generally low subsidies, increasing the potential for commercial investment. We estimate the energy efficiency investment potential for select industrial sectors in MENA at \$18 billion, with more than \$10 billion in equipment upgrades and more than \$7 billion in commercial industrial lighting (see figure 1).

The region has vast and largely untapped opportunities for climate-smart investment in the renewable sector. From Morocco in the west to Oman in the east, the competitiveness of renewable power is rapidly improving, given the region's strong resource base, declining technology costs and increasing cost of conventional power. Theoretically, MENA could meet the world's power requirements through solar energy alone. However, at a country level, the situation is less favourable. For instance, Oman's solar resources are locked up in an opaque legislative regime, and large concentrating solar power (which could help meet the Sultanate's annual electricity demand using just 0.1

percent of its land mass) is still relatively expensive and faces water scarcity and grid integration issues. Equally as detrimental to investment opportunities is the shadow of political unrest that is cast over, for instance, the Libyan, Egyptian, Algerian, and Iraqi markets. It would seem that the 60-MW wind farm slated for Al-Mokha, Yemen, has been a victim of shifting priorities associated with the Arab Spring, which has focused the attention of governments and the international community on avoiding economic and political collapse.

While challenges to private investment do exist, commercially, the MENA renewables market is attractive and investments have been on the increase in recent years. According to REN 21's MENA Renewables Status Report 2013, non-hydro renewable pow-

### The potential for commercial energy efficiency investments is highest in countries with low energy subsidies such as Morocco and Jordan

er outpaced conventional power generation growth, more than doubling between 2008 and 2011 to almost 3 terawatt-hours (TWh). The more than 100 renewable energy projects in the pipeline in the region in early 2013 (with more than 7.5 GW of new capacity), have benefited from electricity sector liberalization. Ever more independent power producers feed renewable electricity into the grid at fixed tariffs, under quotas, or through power purchase agreements that have been negotiated or tendered for, as in Morocco and Saudi Arabia.

By our estimates, the investment opportunities in

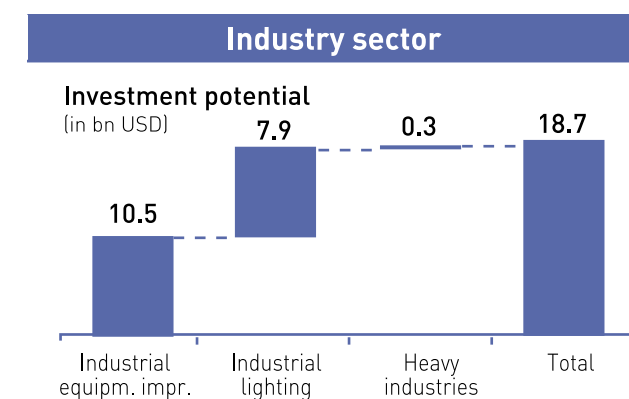


Figure 1: Estimated commercial investment potential in selected industrial sectors in MENA

<sup>10</sup> REN21, 2013, *MENA Renewables Status Report*, REN21, IRENA and UAE Ministry of Foreign Affairs.

<sup>11</sup> IMF, 2013, *Energy subsidy reform: Lessons and implications*.



## Ever more independent power producers are feeding renewable energy into the grid

MENA's renewables exceed \$45 billion, coming mostly from solar (\$29 billion) and wind (\$12 billion) (see figure 2). Indeed, new solar and wind capacities are coming online all the time. Egypt, Tunisia, and Morocco (see section *Country Spotlight 5, page 45*) have expanded their installed wind capacity to, respectively, 550 MW, 291 MW, and 154 MW. Tunisia in particular has experienced strong growth over the last five years, with wind power capacity increasing eight-fold from 2008 to 2012. While lower in absolute capacity, solar photovoltaic (PV) and large concentrating solar power (CSP) have seen faster growth than wind energy. Algeria's first major solar plant of 25 MW, part of the hybrid 150-MW Hassi R'Mel ISCC, was commissioned in 2011 and Abu Dhabi's Shams 1 scheme (100MW) is the world's largest CSP plant since 2012.

Building-scale solar water heating (SWH) is emerging as a strong growth sector in MENA, in particular in North Africa. Greater regulatory measures

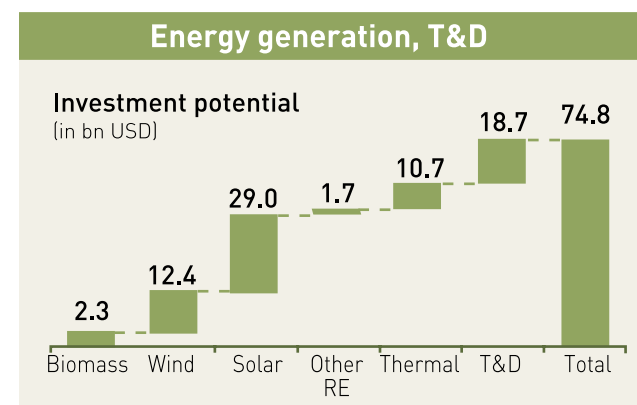


Figure 2: Estimated commercial investment potential in energy generation, thermal power, and transmission and distribution in MENA



## The competitiveness of renewable power is rapidly improving, given the region's strong resource base, declining technology costs and increasing cost of conventional power

ensuring quality control and a higher level of confidence in locally manufactured technologies mean that, increasingly, the lack of access to reliable sources of financing is the main barrier to developing the SWH market in the region. Tunisia is often cited as a regional success story: despite still-high subsidies for liquefied petroleum gas (LPG), it boasts over 500,000 m<sup>2</sup> of installed surface, following ambitious government schemes. With excellent irradiation conditions and reasonable payback periods, Jordan intends to

boost market penetration of SWH to 30 percent by 2020, including through ambitious regulations for new constructions. Market penetration in both commercial and residential segments does not yet exceed 15 percent across the region (with the possible exception of Tunisia), and there are signs that market confidence along the entire supply chain is consolidating. Evidence from more advanced SWH markets - such as Israel, the Palestinian Territories, and Tunisia - suggests a substantial market for SWH applications.

The construction market in the region is growing steadily. The estimated \$4.3 trillion worth of building to be completed by 2020 should provide many opportunities for green construction. Many green building projects have already emerged. Famously, Abu Dhabi's Masdar City is a regional and global pioneer initiative that aims to be the first zero-carbon, zero-waste and car-free city. In general, UAE firms have been early and strong green adopters.<sup>12</sup> The greatest number of green projects are in the institutional sector (schools, hospitals, government office building), with the leadership-by-example effect spilling over

## The growing construction market creates opportunities for green construction, with many new examples in recent years of green building projects

into commercial (office retail, hotel) and community construction projects. While some have not lived up to their green credentials, low energy and resource efficient buildings are now receiving a lot of attention from regulators and project developers due to attractive economic and commercial benefits. There is also increasing interest in building renovation, with reports showing low-cost to no-cost upgrades can reduce building energy consumption in the region by as much as 20 percent, creating plenty of incentive to make small investments in building improvements. Across the Middle East, more than 1,350 green projects are underway. Saudi investment alone in green construction exceeds \$26 billion.<sup>13</sup>

Climate-smart business is growing in the MENA region. Our estimates have identified significant investment potential in renewables as well as in energy efficiency improvements and green buildings, particularly in countries tackling unsustainably subsidized energy prices. Solar energy is the obvious candidate for renewable energy development, but the region also has good wind resources. Although there is variability between countries, in general rising energy demand, policy support, and in some cases a good investment environment have resulted in significant growth of the renewable energy and green building sectors, which is expected to continue in the coming years.

<sup>12</sup> McGraw-Hill Construction, 2013. *World Green Building Trends*.

<sup>13</sup> Sefaira, 2013. *Green Building Booms in the Middle East*. [online].



## Trend 2 Modernizing the CIS



When it comes to infrastructure, most transition countries of the Commonwealth of Independent States (CIS) could use a 21<sup>st</sup> century makeover. Even more so than in Emerging Europe (see section *Country Spotlight 2, page 31*), basic infrastructures - buildings, industry, power generation and transmission equipment - were mainly built before 1990 and are in dire need of modernization and replacement. With such a baseline, investments in upgrades and resource efficiency have the potential to be highly lucrative. However, what should essentially be climate-smart investments with short payback times, high net present values, and high internal rates of return, are frequently thwarted. Waste is endemic in the region, while infrastructure is ageing and inefficient. Yet economic incentives that would encourage efficiency, such as cost-recovering energy and water prices, are largely absent. This places a considerable burden on federal, regional, and municipal budgets. In recognition of all this waste, estimated at over \$112 billion for the Russian Federation alone (see section *Country Spotlight 2, page 31*), the trend across the region is to launch sys-

### Deep, systemic infrastructure modernization programs are being put in place across the CIS

temic infrastructural modernization programs. These programs, often involving ambitious target setting and attempts at institutional and pricing reforms, point toward the emergence of climate-smart business potential that in the past would have been unthinkable.

Overall, our estimates put the commercial climate-smart business investment potential in the CIS (including Ukraine) at over \$214 billion. In the sectors we considered, investment potentials in consumer and industrial energy efficiency are estimated at \$93 billion and \$29 billion, respectively (see figure 3). The rehabilitation of existing power infrastructure offers \$54 billion of potential investment, while renewables account for \$27 billion.

In the power sector, the most obvious climate-smart business opportunity is the reduction of gas flaring (the burning of the gas by-product of oil drilling), which causes emissions of over 400 million

tCO<sub>2</sub> per year globally.<sup>14</sup> Capturing all that flared gas - equivalent to 75 percent of Russia's gas exports - would create a market of some \$68 billion per year. With combined volumes of over 43 billion cubic metres,<sup>15</sup> Russia, Kazakhstan, Uzbekistan, and Azerbaijan, which are among the world's top 20 flaring nations, are exploring the business case of commodifying, rather than squandering, this gas. Central to commercially harnessing flare gas is matching the costly up-front infrastructure investment needed for capture, transmission, and processing in each particular case, with expected payback coming via sales. In Russia, a subsidiary of the OOO Monolit Corporation, ZAO UgraGasProcessing, is capturing flare gas in the Khanty-Mansisk region of Western Siberia for commercial purposes. Converted into fuel, the flare gas will be used to drive power stations at the gas processing plant on the Zapadnoe-Salymskoe oil and gas field, jointly controlled by Royal Dutch Shell and Russia's state-owned OAO Gazpromneft.<sup>16</sup>

Upgrading transmission infrastructure offers another potentially high-yield climate-smart opportunity, particularly where resources are destined for export (and thus generate considerable waste). Our conservative estimate is an investment potential of \$32 billion in electricity transmission infrastructure

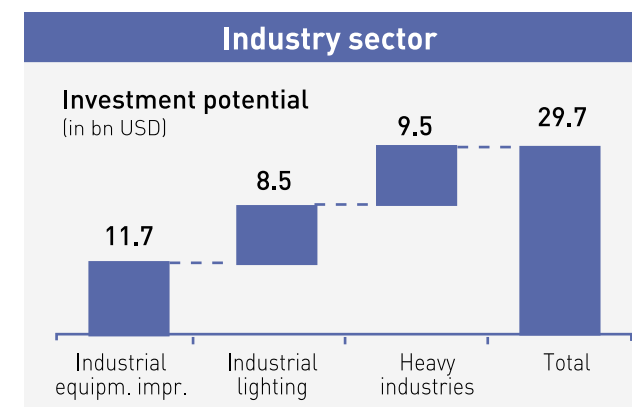


Figure 3: Estimated commercial investment potential in selected industrial sectors in the CIS



### The reduction of gas flaring is the most obvious climate-smart business opportunity

modernization in Russia, Ukraine, the Caucasus, and the Central Asian Republics. The Russian Federal Grid Company of the Unified Energy System, the largest publicly traded electricity transmission company in the world, is investing heavily - \$30 billion through 2014 - in grid repairs, development, and upgrades of 27,079 kilometers of transmission and distribution lines. The company lost 22,121 million kWh of electricity due to inefficient transmission in 2009 (resulting in more than \$477 million spent on electricity to compensate). Under its "intelligent electricity grid"

<sup>14</sup> EBRD, 2013. *Share gas, don't flare it*. [online].

<sup>15</sup> The World Bank, 2011. *Estimated flared volumes from satellite data, 2007-2011*. [online].

<sup>16</sup> EBRD, 2010. *EBRD raises \$87 million to boost utilisation of associated gas in Russia*. [online].



investment program, Federal Grid Company hopes to achieve a 3.6 percent reduction in transmission losses, saving an annual \$92.8 million.<sup>17</sup> Further illustrating the business case, the company invested \$11 billion in 2010 and experienced a return of 11 percent in new invested capital from 2010-2012.

As in the power sector, the region's industrial countries have an eye on the impact of waste on industrial competitiveness. Significantly, Russia (see section *Country Spotlight 2, page 31*), Ukraine (see section *Country Spotlight 3, page 35*), and Kazakhstan announced major modernization programs for their principal industries - including metals, cement, pa-

### Russia, Ukraine, and Kazakhstan have announced major modernization programs for the energy intensive industries

per, plastics and oil and gas. These public initiatives create and enhance the enabling environment to exploit investment opportunities to upgrade industrial equipment and improve resource efficiency. In the cement and metal industries of Kazakhstan, Russia, and Ukraine, the investment potential is estimated at \$5 billion each. There is also substantial commercial investment potential in the oil and gas industries.

Highly noteworthy is the region's combined potential in more generic industrial technologies - electric drives, steam, and compressed air systems - which have energy savings potential of up to 50 percent. We estimate that the investment potential for replacement and optimization (e.g. through insulation and maintenance) of these three systems in Kazakhstan,

Russia, Ukraine, the Caucasus, and the Central Asian economies amounts to at least \$12 billion. Payback times depend on project specifics, but generally small-scale improvement projects (including, for example, energy management systems) will have shorter payback times than more capital-intensive larger-scale projects. In Kazakhstan, for instance, an ISO50001 gap analysis at a KazPhosphate plant identified more than \$1 million in potential annual energy savings, with payback periods of less than three years for all measures. The trend towards achieving ISO standards is also leading to investment opportunities in Ukraine (see section *Country Spotlight 3, page 35*) and across

East and Southeast Europe.<sup>18</sup>

A sector to watch in the medium term is building, where there is a great need for thermal envelope insulation, high efficiency boilers, district heating upgrades, micro-CHP installation, solar thermal water heaters, and geothermal and sewerage heat-pumps. While the energy saving potential is considerable, it has proven tricky to create markets for energy efficiency in the CIS, principally because state-based utility prices in most countries do not reflect the true cost, nor are they consistently metered for individual clients. Yet across the transition countries, the building sector is on a multi-speed track. For instance,

### In the buildings sector the energy saving potential is considerable, but creating markets has proven tricky

owing to Moldova's energy pricing reforms in 2006, Termocom, a district heating company, achieves around 40 percent savings when renovating apartment buildings (including measures such as individual substations, envelope insulation, and heating system retrofitting - including horizontal distribution, heat meters by apartment, thermostatic valves). Yet transition countries lag behind their East and Central European neighbours, which have more mature building energy efficiency markets, based on business concepts such as public-private partnerships and energy service companies (see section *Trend 3: Emerging Europe looks west, page 19*). Provided governments in the transition region move forward on pricing reforms, push for client-level metering, and ease borrowing restrictions (e.g. on municipalities and housing management companies), an investment potential of \$65 billion is not unlikely, across residential, public and commercial buildings, and including measures such as insulation and upgrades of appliances, lighting, and water and space heating. In the meantime, however, progress is slow, even if seemingly inevitable.

There is a pressing need for infrastructure modernization in the CIS. Modernization programs with ambitious targets, coupled with the needed reforms, are leading to the emergence of viable climate investment potential. Our estimates have identified significant investment potential in energy efficiency improvement in all end-use sectors as well as in the power sector. The reduction of gas flaring, transmission infrastructure upgrades, and industry modernization have all been set in motion.

<sup>17</sup> Federal Grid Company of Unified Energy System, 2011. Admission to the Official List and to Trading on the London Stock Exchange of Global Depositary Receipts.

<sup>18</sup> USAID, 2013. Improving energy management in Kazakhstan [online].



## Trend 3 Emerging Europe looks west



In Emerging Europe – a region stretching loosely from the Baltic countries to the Balkans – investment opportunities are strongly shaped by the region's increasing political and regulatory alignment with the European Union. As in the CIS (see section Trend 2: *Modernizing the CIS*, page 15), decades of under investment exacerbate high economy-wide energy intensity, while energy demand is expected to grow by as much as a third by 2035 if current policies remain in place.<sup>19</sup> As the region moves on from post-1990 economic stagnation and uncertainty, East, Central, and Southeast Europe are taking a cue from the European Union when it comes to policy lessons and regulatory issues. As these countries are influenced by policies such as the EU climate and energy package, opportunities for climate-smart investors are emerging across the region.

Overall, our estimates put the commercial climate-smart business investment potential in Emerging Europe (including Turkey) at over \$232 billion.

About a third of the potential identified (\$76 billion) is in renewables, with a bit less in energy efficiency in buildings (\$60 billion). In the sectors we considered, the investment potential in industrial energy efficiency is estimated at over \$12 billion.

Industry players take seriously the implications of EU membership for their operations. Alignment with EU directives on environmental performance

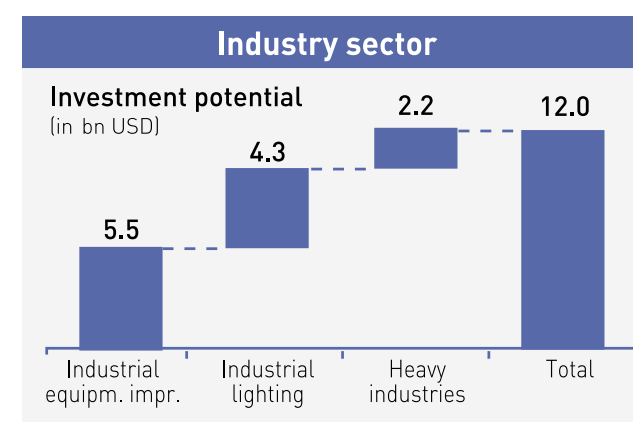


Figure 4: Estimated commercial investment potential in selected industrial sectors in Emerging Europe

<sup>19</sup> International Energy Agency, 2012. *World Energy Outlook Paris*: OECD/IEA.

### The ongoing process of alignment with EU directives on environmental performance has created many investment opportunities in industrial facilities

has been a key theme in recent EU Member States and candidate countries, such as Serbia, Macedonia, Montenegro, and Turkey. For example, in the case of Bonduelle's site in Hungary, new regulations required that the company build a wastewater treatment plant for its food processing factory in Nagykovács. This in turn led to business partner Dalkia converting one of the site's natural-gas-powered boilers to use biogas produced by the wastewater sludge instead of natural gas (see box). There are many other examples of industries investing in improved environmental performance, such as Bulgarian lead and zinc smelter KCM 2000 and Lafarge, which improved its cement plants' performance in Beočin, Serbia, by installing a co-incineration facility for solid municipal and industrial waste and, in Romania, cutting its water footprint by 20 percent through process and equipment improve-

ments (in particular the installation of water shut-off valves). Across Emerging Europe, an estimated investment opportunity of at least \$12 billion is associated with increasing industrial efficiency in the metal and cement industries, as well as generic industrial process improvements in lighting, air pressurized systems, steam systems, and electric drive systems (see figure 4).

As with industry, the power sector of East and Southeast Europe is looking west. The modernization of outdated power generation and transmission infrastructure, in line with EU requirements, offers similarly capital-intensive investment opportunities. For instance, in Slovenia, the Šoštanj thermal power plant, run by HSE, is set to deliver CO<sub>2</sub> emissions reductions of 35 percent using the best available techniques. Estimated as an investment opportunity of at least \$10 billion, up to 30 conventional power plants in Europe's East and Southeast are in line for upgrades in the next five years.<sup>20</sup> Industry players such as Bilfinger Berger, which modernizes lignite power stations in Poland, Romania, and Macedonia, are securing contracts at volumes of \$94-120 million per project. In

<sup>20</sup> Bulk Solids Handling, 2013. *Bilfinger Berger to modernize boilers in power plant in Macedonian* [online].

### Wastewater treatment and renewable energy in Hungary

When new Hungarian regulations required Bonduelle to build a wastewater treatment plant for its food processing factory in Nagykovács, Dalkia, one of the food processor's partners, offered to convert one of the site's natural-gas-powered boilers

to use biogas produced by the wastewater sludge for steam production. The converted boiler now supplies three metric tons of industrial steam using biogas. All of the energy produced on-site from biogas is thus re-used by the Nagykovács plant, for a recovery

rate of 100 percent. This saves the plant almost 350,000 cubic meters of gas annually, thus avoiding the emission of 650 metric tons of CO<sub>2</sub> equivalent each year. The process can reduce energy bills by 17 percent depending on the quantity of biogas produced, while offering an economically efficient solution for treating biogas.

Source: Veolia website

## The modernization of outdated power generation and transmission infrastructure, in line with EU requirements, offers significant capital - intensive investment opportunities, as is illustrated by various recent projects

Poland, the company is modernizing the steam generator at Europe's largest lignite-burning power plant. In Romania, the lignite-burning power plant Isalnita is being equipped with modern flue gas desulfurization systems that will enable it to meet stringent European standards.

Further mirroring EU policy, national targets and supportive frameworks for the development of renewable energy have been instituted across the region. Across Eastern Europe, wind power grew quickly in 2012:<sup>21</sup> 131 percent in Romania, 82 percent in Ukraine, 54 percent in Poland, and 46 percent in Baltic Estonia. In the newest Member State, Croatia, Spanish ACCIONA began operating the 30-MW Jelinak wind farm in early 2013, contributing but a drop to the 1,200-MW target envisioned by Croatia's Energy Strategy. Czech CEZ Group installed the 600-MW Fantanele-Cogealac project in Romania at an investment of \$1.62 billion with the aim of offsetting emissions from dirtier coal-fired power plants it owns in the country. Germany's RWE has 200 MW of onshore capacity operational in Poland, which is one of the energy company's premier markets, with a 2020 market potential as high as 11.5 GW onshore (and 1.5 GW offshore).<sup>22</sup> Across East and Southeast Europe, renewable energy presents a \$76

<sup>21</sup> The World Wind Energy Association, 2012. Annual Report.

<sup>22</sup> European Wind Energy Association, 2013. Poland's true wind energy potential is 13 GW by 2020 [online].

billion investment opportunity, including \$12 billion in biomass, \$18 billion in solar and more than \$35 billion in wind.

The impact of the EU's push for renewable energy is being felt within as well as outside the EU. Similar renewable energy targets have been adopted by Energy Community members, ranging from Ukraine's 11 percent to Bosnia and Herzegovina's 40 percent. Reaching these targets will require significant investment from the private sector. Associated supportive policies, in particular feed-in tariffs and tax incentives, have had substantial impact in the solar and biomass sectors, as in Ukraine (see section *Country Spotlight 3*, page 35). While the feed-in tariff market is reaching a point at which many governments are reviewing support schemes, the consequences of regional energy integration have been remarkable for cross-border renewable energy trade. The Balkan states – Montenegro, Serbia, Bosnia-Herzegovina, and Albania – are looking forward to cross-border electricity trade with

## Initiatives at the municipal level seek to unlock the investment opportunities that exist in the building sector

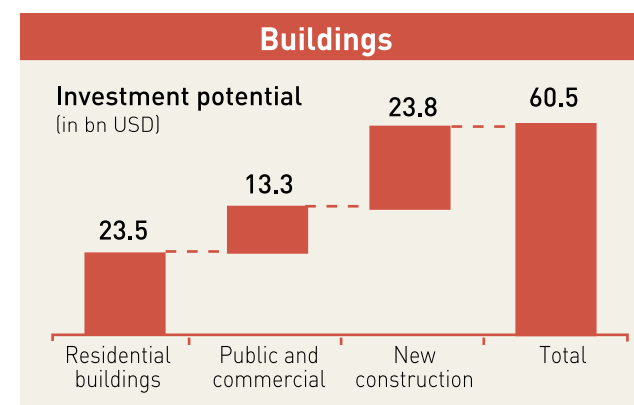


Figure 5: Estimated commercial investment potential in the building sector up to 2020 in Emerging Europe

## National targets and supportive frameworks for the development of renewable energy have been instituted across the region and are leading to high growth rates in the sector

the EU, and with each other through regional energy markets. While this may require the facilitation of multilateral bodies such as the World Bank, regional markets will lead to optimization of resources, lower environmental impacts, and lower electricity prices, and will provide many commercial investment opportunities. The \$1 billion 390-km Tivat-Pescara cable, supposed to connect Montenegro with Italy by 2015, would run under the Adriatic Sea and save Italy \$300 million a year and help the country meet its EU renewable energy consumption targets.

While governments negotiate in Brussels and at the UNFCCC, the cities of Emerging Europe are taking the lead in climate action. Initiatives such as the EU's Covenant of Mayors (including its recent Eastern extension) and Energy Cities seek to unlock the climate-smart investment opportunities lying dormant in one of Europe's key energy consumers: the public, residential, and commercial building sector. There is a lot of potential in the region for significant energy savings at low cost. By our estimates, the building sector constitutes, at the very least, an investment opportunity of \$36 billion (see figure 5). This includes measures such as building insulation, appliance upgrades, lighting, and water and space heating across residential (\$23 billion) and public and commercial buildings (\$13 billion). Meanwhile, new green building construction could account for over \$11 billion in East Europe, \$9 billion in Turkey, and \$3.7 billion in Southeast Europe, exceeding \$23 billion for the region. Within these



broad figures, specific opportunities are situated across EU Member States and their neighbours. In Romania, for example, the national market for Energy Services Companies (ESCOs), which undertake building renovations, has been estimated at \$67.5 million, with extremely high growth potential possibly reaching \$200 million by 2020.<sup>23</sup>

In Emerging Europe, political and financial integration go hand in hand. The increasingly tight integration between Emerging Europe and its Western counterparts can be a double-edged sword, with the economic woes of the Eurozone effecting neighbouring economies. However, the closer relationship has brought an overall trend of greater openness to foreign direct investment and louder whistleblowing when irregularities occur. While the countries of Emerging Europe target EU markets, their own economies are beginning to look better than those of Western Europe. Still-high energy intensities, together with growing energy demand and the ongoing process of alignment with EU directives, have led to the growth of climate-smart investment opportunities in this region.

<sup>23</sup> Marino, A. et al., 2010. Energy service companies market in Europe - Status report 2010. Luxembourg: Publications Office of the European Union.



## Trend 4 MENA's water-energy nexus



Wherever water and energy meet, important climate-smart business opportunities arise. Globally, the water-energy nexus is one of the four investment “megatrends” to watch, according to the U.S. National Intelligence Council’s Global Trends 2030. Nowhere is this truer than in the Middle East and North Africa (MENA), the world’s most water-scarce region (see figure 6),<sup>24</sup> where climate change is likely to exacerbate existing water patterns. Yet water is almost universally subsidized across MENA, often making direct financial benefits from water efficiency measures too small to justify investment.

However, amidst earmarked government spending on water infrastructure, there are also substantial investment shortfalls across the region, with estimates ranging from about \$100 billion to \$400 billion annually by the World Bank.<sup>25</sup> In addition, where water is pumped from deep underground aquifers or is unavailable in sufficient quantities, it has a much greater economic value than the nominal price of piped water

<sup>24</sup> World Bank, 2012. *Renewable energy desalination: An emerging solution to close the water gap in the Middle East and North Africa*. Washington, DC: World Bank.

<sup>25</sup> The higher range represents a future in which no demand management options are adopted.

### Globally, the water-energy nexus is one of the four investment megatrends to watch

would imply. In these cases, water efficiency measures can have significant economic benefits – and imply that there are substantial opportunities for providers of environmental services and technology as well as climate-smart investors. Climate change is also leading to a greater focus on the reciprocal relationship between energy and water. As a result, emerging investment opportunities related to the water-energy nexus include desalination, wastewater treatment and reuse, and improved water-use efficiency.

The Gulf Cooperation Council (GCC) countries represent the fastest growing investment opportunity in the region. Independent water and power projects (IWPP) are on the rise in these countries, with 15 projects in Saudi Arabia worth \$8.8 billion, 19 projects in Kuwait worth \$4.2 billion, and 10 projects in the UAE worth \$1.5 billion. Saudi Arabia, referred to regionally as the “desalination nation,” is said to have earmarked around \$66 billion over the next decade

for new hybrid and solar desalination capacity along its Red Sea and Arabian Gulf coastlines.<sup>26</sup> Japanese firms and government agencies have jumped on this opportunity, helping design models that combine solar- and fuel-powered units to reduce the cost of fuel used in desalination plants by 65 percent. In a bid to move away from the otherwise dominant and far more energy intensive thermal desalination process, Saudi Arabia is developing multiple-effect distillation systems (which can cut fuel use by 40 percent) and has partnered with Japanese membrane manufacturer Toyobo and factory builder Itochu to develop reverse osmosis membrane elements near Jeddah. The solar desalination sector stands out for its highly competitive bidding process, with contracts being fought over by the sector’s giants, including Spanish firm ACCIO-NA Agua, California-based Energy Recovery Inc. (ERI), Dow Chemical Company and French Veolia.

MENA is also looking further downstream in the water cycle, where wastewater treatment and reuse is emerging as a strong growth sector, with investment opportunities estimated at over \$16 billion, partially through public-private partnerships (see boxes on pages 24-25). Tunisian authorities are also keen to improve domestic and industrial wastewater recycling for agricultural use from the current 20-30 percent. Remarkable for the region is the Tunisian government’s water pricing policy, which saw the price of irrigation water increase by a factor of four from 1998 to 2008. This has made the \$44 million<sup>27</sup> water treatment infrastructure rehabilitation project undertaken by local industry player WABAG commercially viable. Emerging more gradually, yet consistently, Morocco

<sup>26</sup> Oxford Business Group, 2013. *Economic update Saudi Arabia : Water demands continue to rise* [online].

<sup>27</sup> African Development Bank, 2012. *AfDB loans \$32.5m to Tunisia to boost flow of irrigation water to country’s farms* [online].

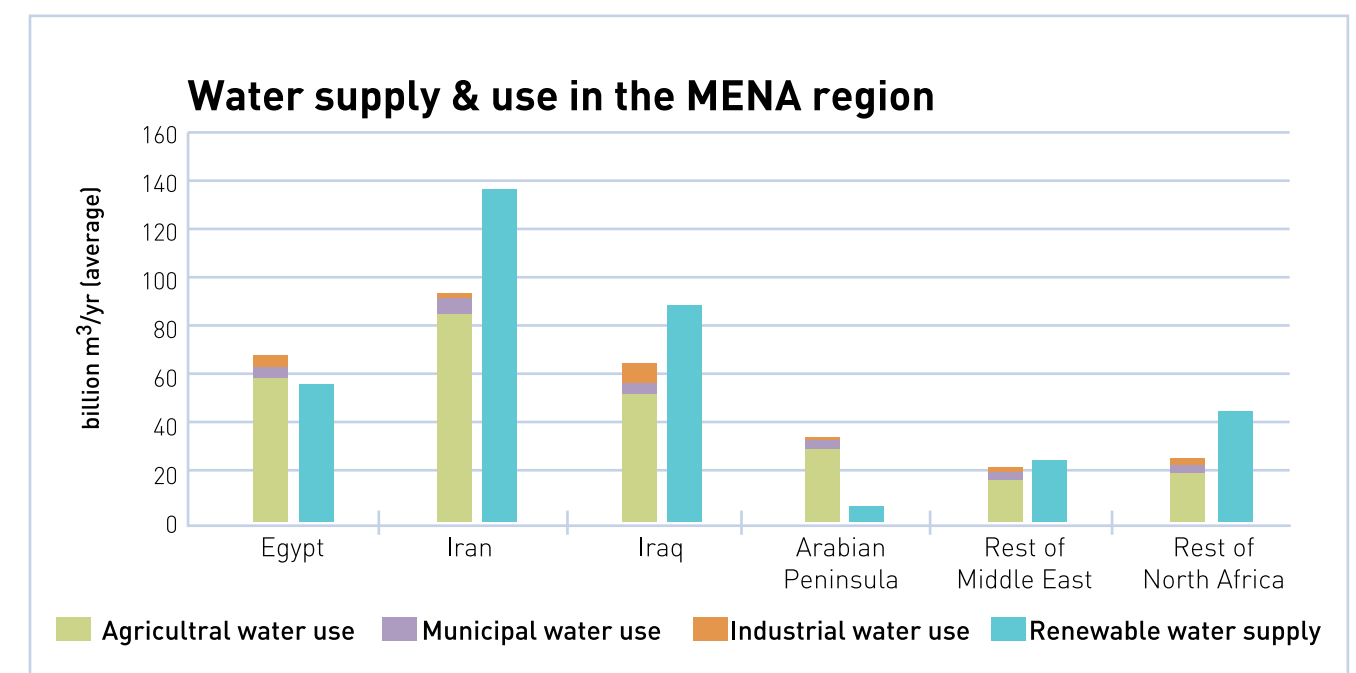


Figure 6: Water resource availability and use in MENA countries showing agricultural, municipal and industrial water use against total renewable water supply (Based on data from Aquastat).

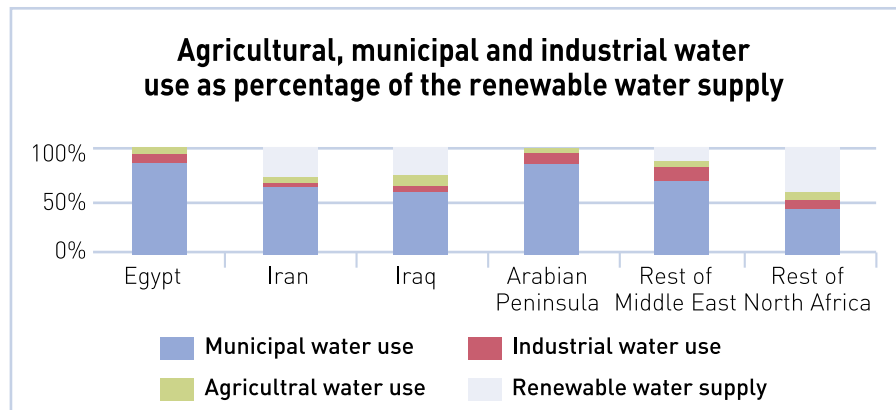


Figure 7: Agricultural, municipal and industrial water use as percentage of the renewable water supply

## New Cairo wastewater treatment plant

New Cairo, a satellite city outside Cairo, Egypt, is expected to grow from 550,000 people to 3 million over the next 15 years. This explosive growth is sure to threaten the delivery of adequate sanitation and other municipal services, particularly in one of the world's fastest growing regions, in the world's most water-scarce region.

Enter Orasqualia, a joint consortium of Egypt's Orascom Construction and Spain's Aqualia, which recently completed a new wastewater plant in New Cairo with a processing capacity of 250 million liters of water per day. The new facility will significantly boost sanitation and services in the booming satellite town.

The \$150 million project was the country's first major public-private partnership (PPP). Orasqualia will run the plant for 20 years before handing it over to the Egyptian government, expecting \$485 million in revenue over that period.

Source: IFC

**Improved soil management and water efficiency in agriculture can lead to significant crop yield increases, which can make it an attractive investment**

is pursuing a \$5 billion investment plan for improving its wastewater infrastructure,<sup>28</sup> having inaugurated the country's (and North Africa's) first membrane wastewater treatment plant in mid-2013, producing high quality reusable effluents at Médiouna.

Significantly, increasing water use efficiency will have a positive impact on the agriculture sector, which accounts for around 85 percent of all water used in MENA, though at a sector-wide efficiency of less than 50 percent (see figure 7). However, at least for now, agricultural water management is mainly conducted through tariff policies, subsidies for water-saving equipment and integrated water resource planning, and continues to constitute a challenging climate-smart investment opportunity.

As the world's most water-scarce region, MENA offers investment opportunities of around \$30 billion in water conservation alone. Improving soil management and water efficiency in agriculture (via no-tillage, drip irrigation, furrow contouring, and more) can lead to significant crop yield increases, in addition to water savings, and is thus an attractive investment. Yet such practices are only in use on two percent of the region's farmland, which is half the global average.

<sup>28</sup> Global Water Intelligence, 2010. Morocco catches up on wastewater treatment [online].

<sup>29</sup> National Intelligence Council, 2012. Global trends 2030: Alternative worlds.



While the most valuable drop of water is the one that is not wasted, capital-intensive water purification and treatment schemes continue to dominate investment opportunities at the water-energy nexus in MENA. Investments in independent water and power projects (IWPPs), producing both desalinated water and power, are concentrated mainly in GCC countries. On the other hand, wastewater treatment and reuse is an important investment opportunity across the region, but mostly in those countries in which water prices are closer to reflecting its true cost. As is the case with energy in the CIS (see section *Trend 2: Modernizing the CIS*, page 15), it is difficult to locate the business case when resources are priced below their economic value. Across the region, deregulating the price of water, which could incentivize investment, remains a sensitive political issue, as does better management.<sup>29</sup>

**In the Gulf Cooperation Council countries the number of independent water and power projects producing both desalinated water and power, is growing**

Given sufficient water prices, sizable investment opportunities in water-use efficiency are likely to emerge, particularly in agriculture, where the main advantage of better water management is increased crop yields. In the meantime, MENA's broader water sector, with its large number of orders and transaction sizes, is one to watch.

## Water recovery and recycling: Modern Karton

Looking to expand production and take advantage of a boom in regional container demand, Modern Karton, one of Turkey's leading producers of paper-based containers, first needed access to a significant supply of water, a key ingredient for paper production.

But 100 kilometers west of Istanbul, where Modern Karton operates, water is increasingly hard to come by. As part of its first-ever climate adaptation project, IFC helped assess Modern Karton's water needs and provided an \$8 million loan for the installation of the most sophisticated water recovery and recycling system in Turkey's paper industry. Modern Karton is now able to reduce the risks related to limited groundwater availability and expand production by 50 percent without increasing water use.

"Due to rapid industrial development and the effects of climate change, access to sustainable water has been a real issue," said Ahmet Eren, Chairman of Eren Group, the parent company of Modern Karton. "The government of Turkey is encouraging water conservation and industrial customers face limitations on water consumption."

Source: IFC





## Country spotlight 1

## Turkey, the Mediterranean tiger



Dubbed the “Tiger of the Mediterranean,” Turkey has benefited from political stability, falling inflation, and the strengthening of the private sector. Despite recent turbulence, the country is still projected to grow healthily: 4 percent in 2013, according to the IMF (compared to 0.2 percent for the Eurozone). However, Turkey’s economy is experiencing pressure due to the country’s large current account deficit, which can be explained almost entirely by necessary energy imports of oil and gas. This is a key driver for the country to push for domestic energy (renewables, but also coal and nuclear) and energy efficiency, and this fact moves these strategic sectors towards the centre stage of Turkey’s economic policy.

Overall, our estimates put Turkey’s climate-smart business investment potential at over \$89 billion. In the sectors we considered, investment in energy generation accounts for almost \$42 billion, with over half of this (\$22 billion) in renewables. Industrial and consumer energy efficiency are estimated at over \$4.5 billion and \$30 billion, respectively.

By the Turkish Republic’s centennial in 2023, its 55-GW capacity must double to accommodate rising demand.<sup>30</sup> To reduce its exposure to supply and

### By 2023 Turkey’s 55 GW capacity must double, to accommodate rises in demand by 6.3 percent in the next two decades

price fluctuations, which could jeopardize economic growth, Turkey has expressed a desire to reduce fossil fuel imports, which account for 60 percent of power generation.<sup>31</sup> Regarding water, Turkey faces a geographical mismatch between resources, population, and industrial centers that calls for an integrated water resources management approach.

Fortunately, what’s good for Turkey’s economy could also be good for the global environment. If ambitious government targets are met, Turkey’s energy supply will be 30 percent renewable by 2023, despite significant planned investments in coal power. This implies huge investments in the clean energy sector,

<sup>30</sup> Annual 6.3 percent increase over the next two decades: World Bank, 2013, *Wind, Water, and Steam – a Triple Win for Turkey’s Energy Sector*, online feature story, 30 May 2013.

<sup>31</sup> World Bank, 2013, *In Turkey: Power from the Earth*, online feature story, 23 January 2013.

including wind, solar, hydropower, biomass, and geothermal energy. With abundant potential, high spot-market power prices and reasonable feed-in tariffs<sup>32</sup> in place, the renewables sector is ready for growth. Solidly rising demand, a grid that can accommodate further capacity, and favourable policies are focused in particular on nurturing hydropower and wind, the poster children of Turkey’s slowly maturing renewable energy market.

These framework conditions support our estimate of Turkey’s commercial investment potential of almost \$42 billion in energy generation, (see figure 8), with renewables representing \$22 billion of this total. There is also \$16 billion of investment potential in transmission and distribution (T&D) infrastructure upgrade and repair, substantiated through electricity losses of 14 percent running across 46,000 km of lines, with a commercial potential of over \$16 billion.

The fastest growing in the world, Turkey’s wind sector is booming. Right now, wind accounts for about two percent of Turkey’s energy generation, yet only

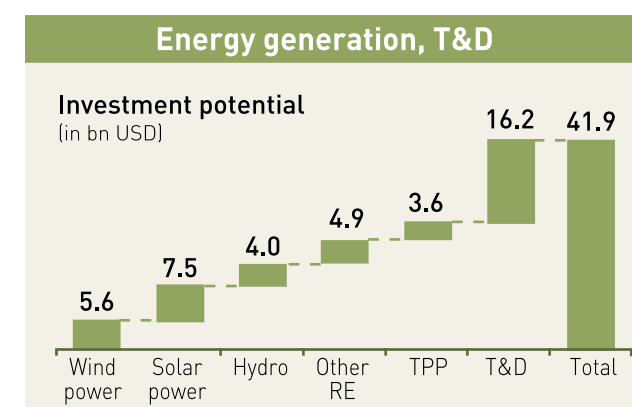


Figure 8: Estimated commercial investment potential in energy generation, transmission and distribution in Turkey

<sup>32</sup> At the time of writing, tariffs are \$0.073 per kWh for wind and small hydro power, plus a local content bonus of between \$0.006 and \$0.037 per kWh (wind), \$0.105 per kWh for geothermal power, plus local content bonus of between \$0.007 and \$0.027 per kWh, and \$0.133 per kWh for solar PV and CSP, and biogas power, with local content bonuses ranging between \$0.004 and \$0.092 per kWh, all for a period of 10 years.

## Country snapshot

Population:	74 million
HDI rank:	90th of 186 countries
GDP (2012):	1,358 billion \$ (PPP)
GDP/capita:	18,348 \$ (PPP)
FDI, net inflows (2012):	12,555 million \$
Investment in energy with private participation (2012):	9,639 million \$
Ease of Doing Business Rank (2013):	69th of 185 countries
Energy use:	105 million toe (a third of Germany’s)
Energy trade:	imports 69 percent of energy used
GDP / energy use:	11.0 \$ PPP/toe (USA: 6.5 \$/toe)
Electricity price, industry:	13.6 \$c per kWh
Electricity price, consumers:	15.6 \$c per kWh
RE Share of total energy use:	14.2percent
GHG emissions:	386 Mt CO2e
Per capita GHG emissions:	5.3 tCO2e per capita
GHG emissions per GDP	422 tCO2e/million \$ GDP PPP

Sources: WDI, ATK, SE4ALL Global Tracking Framework (RE share), WRI (GHG emissions). Unless otherwise specified, all values are in current \$ and are from 2010. GHG emissions exclude LUCF.

five percent of its wind potential – estimated at about 40 GW, onshore<sup>33</sup> – has been harnessed. In early 2013, the sector attracted the turbines of General Electric Co. and Siemens AG for combined orders exceeding 150 MW. GE has announced potential investments into the sector of \$900 million<sup>34</sup> and is operating several projects (the 22.5-MW Sares, 10-MW Karadag, and the 35-MW, 13-turbine Gok Il in Izmir) through joint venture Gama Enerji, along with Gama Holding. Some 20 GW are needed to meet Turkey's 2023 target. The main hurdle may be administrative: the Turkish Energy Market Regulatory Authority (EMRA) has reportedly struggled to keep its project screenings on pace with the rate of project submissions.<sup>35</sup>

Hydropower is also going strong, dominated by local developers such as Enerjisa and SPC Kalehan Enerji Üretim, with capacities ranging between the 236-MW plant on the Coruh River in Arkun and 1100 MW of power on the Murat River. Equipment, engineering, and construction contracts have generally been awarded to international players, such as Alstom, Pöyry, Temelsu, and Andri. While costs vary, it

<sup>33</sup> Nicola S & Sulugiu G, 2013, Turkey Sees 'Huge' Clean-Energy Investment as Demand Bucks Trend, Bloomberg news, 4 February 2013.

<sup>34</sup> Tsagas I, 2013, GE plans \$900 million Turkish investment, Windpower Monthly, 2 October 2013.

<sup>35</sup> 2012, Government Incentives Lead to a Wind energy Boom in Turkey, oilprice.com, 12 August 2012.

## Solar energy in Turkey benefits from FIT scheme

Turkey's new renewable energy policy has already had practical results. Adana Cement Inc., which is part of OYAK, recently built a 499-kW photovoltaic plant. This is the first solar power plant approved by Turkey's distribution grid operator TEDAS, with the bid for the plant having been con-

ducted in July 2012 and operations beginning in May 2013.

The project, with an annual production capacity estimated at 775 MWh, is expected to meet a significant portion of the electricity needs for the administrative functions of Adana Cement. A total of 2088 polycrystalline modules

manufactured by Zhejiang University Sunny Energy and 30 SMA inverter units are used in the plant. The system is connected to the Adana Cement Plant line and the cost of electricity generation is approximately \$0.013/kWh, with a payback estimated at 11 years.

Sources: David Appleyard, Solar Power Surges on Turkish Policy Backing, Renewable Energy World, 2013; Mahmut C. Selekoglu, Tapping the Sun's Potential, World Cement, December 2012

is known that the Cetin storage project for 517 MW of hydropower estimated the required investment at \$680 million. Owned by Statkraft of Norway, this plant is a good example of foreign involvement in the Turkish hydropower sector.

The sun is beginning to boost more than Turkish tourism and agriculture (see box). Assuming the availability of attractive long-term debt financing, which is still scarce, the country's solar power capacity could reach 3,000 MW by 2023. Although there are certain restrictions on land use and minimum radiation levels, license holders may choose either photovoltaic or concentrating solar power technologies. Turkey's first feed-in tariff scheme is starting with a first round of licensing of 600 MW across 27 regions, to be completed in early 2014.

Recent developments have also boosted Turkey's two traditional renewable energy sources, geothermal and bio-energy. The emerging trend is the application of these sources in industrial settings. The first large-scale biogas plants based on energy generation from chicken and cow manure could provide up to 750 MW of electrical power. In the next decade this initiative could result in as many 2000 biogas plants, each with 500-kW of capacity, according to the Turkish R&D organisation Tübitak.

## Energy efficiency is very much seen nationally as a tool for boosting the competitiveness of domestic businesses and companies – with high power prices there is a good foundation for energy efficiency

Geothermal energy, in contrast, is mainly receiving attention for its power generation potential, with explorations underway for 600 MW of geothermal power by 2015. Two plants have been commissioned by Celikler Jeotermal Elektrik Uretim A.S, with four geothermal power trains and a total gross capacity of 80 MW, serving the expansion of power plants near Pamukören and Sultanhisar. Sweden's Atlas Copco and the Italian firm EXERGY are part of the consortium delivering the project, at a half-order value of \$23 million for two trains.

Nationally, energy efficiency is very much seen as a tool for boosting the competitiveness of domestic businesses. Relatively high power prices (industrial tariffs of \$0.136 per kWh and consumer tariffs of \$0.156 per kWh) provide a solid foundation for energy efficiency. In addition, the government has committed to reduce primary intensity 20 percent by 2023. A promising sign of government commitment are the financial incentives made available under Turkey's energy efficiency law and its Energy Market Regulatory Authority, to sanction rises in retail prices for electricity and gas by almost 10 percent in October 2012.<sup>36</sup> The exact implications of these developments have not yet been

<sup>36</sup> E&Y, 2013, Ernst & Young's attractiveness survey Turkey 2013 The shift, the growth and the promise.

<sup>37</sup> FT, 2011, Special Report: Investing in Turkey.

<sup>38</sup> Climate Investment Funds, Portfolio Highlights, Turkey Promotes Energy Conservation, Accessed Oct 2013.

<sup>39</sup> This figure is based on high metals production of 36 million tonnes per annum, addressing less than a third of the facilities, and smaller-scale improvement programs in cement addressing almost half of the current production capacity

estimated, but it's safe to say that many previously unviable investments are likely to become attractive. This would include, for the automotive, white goods manufacturing, and aeronautical components industries,<sup>37</sup> switchovers to new technologies and replacements of motors, compressors and pumps, as well as investments in lighting, insulation, and heating and cooling in commercial, public, and residential buildings.<sup>38</sup> We estimate commercial investment potential in select industrial sectors of \$4.5 billion by 2020, with improvement of industrial equipment leading the way (\$2.1 billion), followed by industrial lighting (\$1.6 billion) and large-scale, capital intensive improvements in heavy industry (\$800 million)<sup>39</sup> (see figure 9).

Perhaps owing to its famed entrepreneurialism and vibrancy, Turkey is starting to embrace climate-smart growth. This, as well as its geographic location and the size of its domestic market, make Turkey an attractive investment destination. Our estimates have identified significant investment potential in traditional energy generation, in renewables – wind, hydro, solar and geothermal – and in industrial and consumer energy efficiency. Turkey's ambition to foster and promote climate-friendly investments derives from a commitment to overturning its status as a net energy importer and reducing the resulting economic stress.

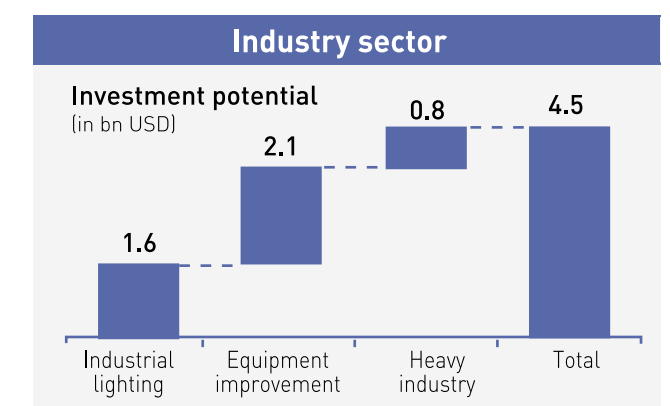


Figure 9: Estimated commercial investment potential in selected industrial sectors in Turkey



## Country spotlight 2

# Russia's green awakening

The sustainable energy giant is stirring, and with good reason. Russia's energy intensity, at over 2.5 times the world average, poses a risk to the country's economic competitiveness and puts undue pressure on federal, regional, and municipal budgets. Russia is losing more than 40 percent of the energy it generates, which is equivalent to the annual primary energy consumption of France.<sup>40</sup> This wasted energy costs Russia \$84 billion to \$112 billion in lost export revenues

tion accounts for more than \$48 billion, with less than a third of this (\$14 billion) in renewables.

Perhaps unsurprisingly, Presidents Dmitry Medvedev and Vladimir Putin have over the past decade emphasized, with unprecedented urgency, the need for energy efficiency. As a result, there has been some progress on energy pricing and legislative frameworks that make related investments more viable. There has been progress too in renewables, illustrated by the al-

**Russia has by far the largest industrial energy efficiency investment potential, estimated at over \$19 billion in EMENA**

location of the country's first wind and solar licenses. Yet Russia is still very much dominated by fossil fuels, and may not fully commit to this effort. Still, despite low energy costs and subsidies in the residential sector, Russia presents many emerging opportunities for climate business.

On aggregate, potential yields are high and payback periods short. This is because energy prices are rising rapidly and investments in energy efficiency are characterized by energy-cost savings inherent to the project. Across all sectors, the annual cost savings for investors and end users could be as high as \$80 billion.<sup>41</sup> Given these estimates of aggregate investment needs and cost savings, average payback times on economy-wide investments are as short as four years.<sup>42</sup> Yet, as always, the devil is in the details, and every sector of the Russian economy presents its own challenges.

Of all energy consuming sectors, residential, commercial, and public buildings possess the largest po-

tential savings. Typically, buildings have inadequate or non-existent regulating and control systems, old and inefficient boilers, inadequate insulation, and draughty windows. Internal infrastructure is old and inefficient, with metering of heat and power not yet ubiquitous, causing significant overconsumption of energy.

Residential buildings account for three-quarters of the building sector's energy consumption. Modernization is urgently needed, with over 80 percent of the housing stock built before 1990. This represents a potential opportunity for technology and material suppliers able to partner with Russian companies to meet this need. While the commercial potential to finance the modernization of residential buildings is constrained by low energy costs, indirect approaches to billing, and complex ownership and management approaches, there have been significant recent changes to legislation on standards for certification of buildings and a "Law on Capital Repairs" was passed in December 2012, creating "capital repairs funds." These developments have potentially improved the bankability of modernization projects, opening the door to commercial investments in the sector.

New energy efficient construction, in contrast, is still in its infancy when compared to parallel developments in the Arab Gulf States (see *section Trend 1: Green boom in MENA, page 11*), which have also been responding to rising prices and export prioritization. This opportunity is demonstrated by the 2011-2015 federal housing program, which expects to create over 370 million square meters of dwelling space, mainly in and around St. Petersburg, Chelyabinsk, and Moscow. Associated developments include efforts to simplify formerly opaque legislation on housing development,

**Recent developments have improved the potential bankability of building modernization projects**

## Country snapshot

Population:	144 million
HDI rank (2012):	55th of 186 countries
GDP (2012):	3,373 billion \$ (PPP)
GDP/capita:	23,501 \$ (PPP)
FDI, net inflows (2012):	51,416 million \$
Investment in energy with private participation (2011):	5,256 million \$
Ease of Doing Business Rank (2013):	92nd of 185 countries
Energy use:	702 million toe (double Germany's)
Energy trade:	exports 46percent of energy produced
GDP / energy use:	4.2 \$ PPP/toe (USA: 6.5 \$/toe)
Electricity price, industry:	6.7 \$c per kWh
Electricity price, consumers:	11.0 \$c per kWh
RE Share of total energy use:	3.3percent
GHG emissions:	2,326 Mt CO2e
Per capita GHG emissions:	16.3 tCO2e per capita
GHG emissions per GDP	1,154 tCO2e/million \$ GDP PPP

Sources: WDI, ATK, SE4ALL Global Tracking Framework (RE share), WRI (GHG emissions). Unless otherwise specified, all values are in current \$ and from 2010. GHG emissions exclude LU emissions.

**Russian leaders have emphasized the urgent need for improved energy efficiency**

and \$3 billion to \$5 billion in federal and municipal spending on energy subsidies. If its energy efficiency potential were fully realized, Russia's CO<sub>2</sub> emissions in 2030 would be approximately 20 percent below its 1990 level.

Overall, we estimate that Russia's commercial climate-smart business investment potential is at least \$134 billion. In the sectors we considered, potential investment totals in consumer and industrial energy efficiency are estimated at \$60 billion and \$19 billion, respectively. Potential investment in energy genera-

<sup>40</sup> IFC, 2011, *Energy Efficiency in Russia, Untapped Reserves*, International Finance Corporation, Russian Country Office, Moscow.

<sup>41</sup> Lychuk T, Evans M, Halverson M & Roshchanka V, 2012, *Analysis of the Russian Market for Building Energy Efficiency*, Pacific Northwest National Laboratory for the US Department of Energy.

<sup>42</sup> Mokveld, K, 2011, *Energy efficiency in Russian Industry*, Agentschap NL, The Netherlands.

## KKS Russia

**KKS Group, an independent district heating utility in Russia, was looking to improve its supply of energy-efficient heating and hot water to customers in the country's Tula and Kemerovo regions. Receiving a \$14 million loan earlier this year, KKS is now able to increase the efficiency of its energy use, cut losses and reduce its greenhouse gas emissions by nearly 38,000 tons of CO2 per year. Ilya Brodsky, a director of Spring, a research and investment group that is the biggest investor in KKS, said the investment would help the firm "improve the quality and efficiency of our services."**

Source: IFC

the issuing of two green building standards and demonstration of sustainable design and construction already underway for the Sochi 2014 Olympics.

Russia has by far the region's largest industrial energy efficiency investment potential, estimated at over \$19 billion in the sectors we considered (see figure 10). Experts estimate the cost of saving one unit of energy through efficiency measures is more than six times lower than the cost of increasing primary energy supply by the same amount.

The country's major energy-intensive industries – ferrous metals, pulp and paper, and cement – make up approximately 53 percent of energy saving potential, with 39 percent concentrated in ferrous metals (less energy intensive industries – e.g. food processing, meat, and bakeries – constitute 42 percent of the potential<sup>43</sup>). Most of the savings can be achieved by improving the efficiency of electricity and heat use at Russia's manufacturing facilities,<sup>44</sup> with \$31 billion in investments required and \$12 billion in associated an-

nual energy cost savings for investors and end-users. The important difference between the Russian Federation and other industrial countries in EMENA – for instance Egypt and Morocco (cement) and Pakistan and Turkey (metals) – is that Russia produces high volumes but with generally more outdated equipment. Significantly, industry experts estimate that at least 50-60 percent of equipment in the cement and metal industries is outdated, offering opportunities for modernization and upgrade programs with an estimated commercially viable investment of approximately \$3 billion in metals production and \$4 billion in the cement industry. Steel industries could reduce their energy consumption by up to 6 percent by using the gases emitted for power and heat production, which would entail switching from open-hearth furnaces to blast oxygen furnaces.

Finally, Russia's potential for climate-smart business investment in energy generation, transmission

**Energy efficient construction of new buildings is supported by new regulations, an opportunity some investors have started to take advantage of**

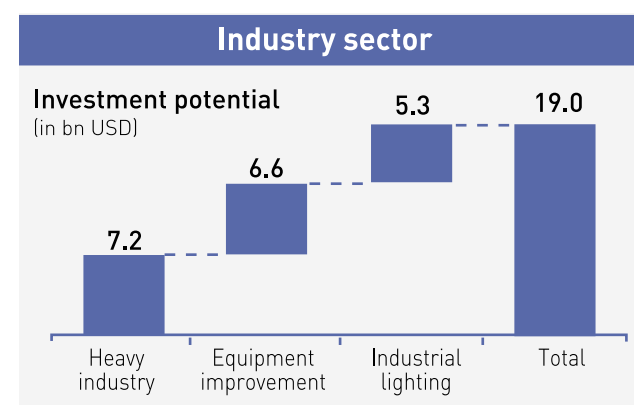


Figure 10: Estimated commercial investment potential in selected industrial sectors in Russia

and distribution has been estimated at over \$48 billion (see figure 11). Commercially viable climate-smart investments in thermal power plants (TPPs), specifically the rehabilitation of TPPs and the expansion and replacement of cogeneration (CHP) capacity, have been estimated at over \$12 billion and \$22 billion, respectively. The commercial renewable energy generation potential consists of predominantly biomass applications (mostly based on forestry and agriculture residues), which exceed \$9 billion (from an estimated total of 12 GW of commercially viable capacity by 2020). An estimated 1.4 GW of additional wind power capacity could be commercially viable by 2020 – with an investment potential of \$ 2.3 billion – based in part on government plans for tenders of 3.6 GW and feed-in tariffs of around \$0.28 c/kWh, but with full implementation not expected by 2020. Russia is planning very strong local content requirements, which will be a significant challenge for the sector, potentially limit-

**The largest renewable energy investment potential is for biomass energy, mostly from forestry and agriculture residues**

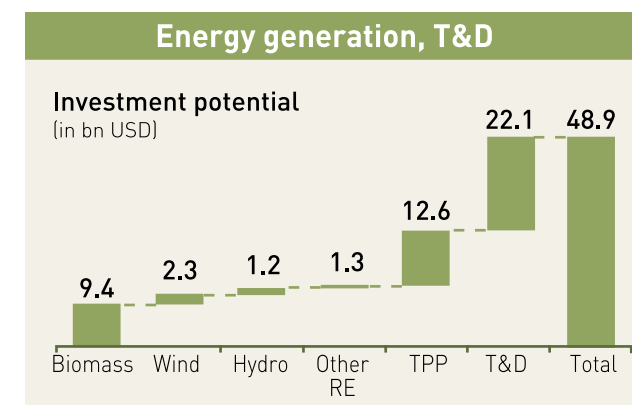


Figure 11: Estimated commercial investment potential in selected energy generation, T&D sectors in Russia

## Bioenergy saves money and solves a waste problem

**UNK Agroprodukt wished to expand from selling and shipping grain and sunflower oil to producing its own sunflower oil. On the one hand, the new oil-producing equipment needed a lot of energy. On the other hand, an inevitable waste product of the production of sunflower oil is sunflower seed husks. The company decided to use the husks as biofuel and thus kill two birds with one stone: reducing energy costs and getting rid of the waste product. With the help of a loan from Center-Invest Bank that was ultimately financed by IFC's Russia Sustainable Energy Finance Program (RSEFP), a \$1.2 million boiler was purchased that saves the company \$1 million in energy costs per year.**

Source: IFC

ing international investment in renewables.

On the whole, the drivers are unequivocal and leading to a slow but sure awakening to the country's energy investment potential. This is good news for private investors and technology suppliers across many sectors. Our estimates have identified significant investment potential in energy generation, particularly in the rehabilitation and efficiency improvement of existing thermal power plants and transmission and distribution infrastructure (see in particular *Trend 2: Modernizing the CIS*, page 14), as well as in industrial and building energy efficiency improvements. In the past, the uptake of energy efficiency measures has been slow due for several reasons, including traditionally low energy prices and low management interest.

Some indications of the increasingly favourable investment climate are Russia's accession to the World Trade Organization in 2012 and the government's drive to lighten regulatory burdens for foreign investors and foster greater consistency and transparency in the application of commercial law.

<sup>43</sup> Mokveld, K, 2011, *Energy efficiency in Russian Industry*, Agentschap NL, The Netherlands.

<sup>44</sup> IFC, 2011, *Energy Efficiency in Russia, Untapped Reserves*, International Finance Corporation, Russian Country Office, Moscow.



## Country spotlight 3

## Ukraine's growing pains



Ukraine is an energy hungry country that has shown an appetite for expanding its renewable energy sector and improving its energy efficiency. The country is dependent on Russian gas supply, yet seeks energy cooperation with the EU. Ukraine's wish to secure its flailing energy sector—by attracting Western investors, for instance—stands in contrast to reports of a perniciously complex tax, legal and regulatory system, and cases of weak enforcement of contract law.

Overall, our estimates put the commercial climate-smart business investment potential in Ukraine at over \$43 billion. In the sectors we considered, potential investment in energy generation, transmission

and distribution accounts for at least \$18 billion, with over half of this (\$10 billion) in renewables. The potentials for consumer and industrial energy efficiency are estimated at more than \$21 billion and \$3 billion, respectively.

**There is a large potential, estimated at over \$6 billion for biomass energy, with Ukraine already a major exporter of biomass pellets for energy generation**

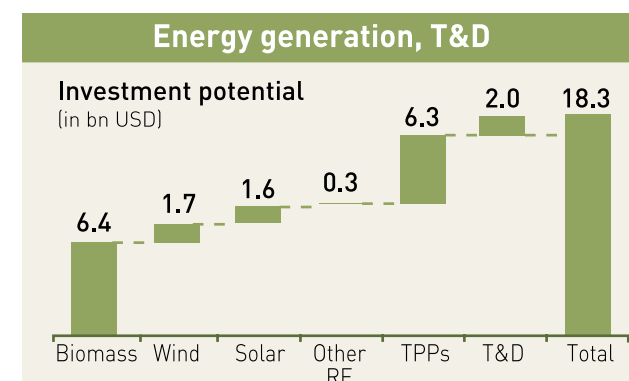


Figure 12: Estimated commercial investment potential in selected energy generation, Transmission & Distribution sectors in Ukraine

## Country snapshot

Population:	46 million
HDI rank (2012):	78th of 186 countries
GDP (2012):	338 billion \$ (PPP)
GDP/capita:	7,421 \$ (PPP)
FDI, net inflows (2011):	7,207 million \$
Investment in energy with private participation (2011):	343 million \$
Ease of Doing Business Rank (2013):	112th of 185 countries
Energy use:	130 million toe (less than half Germany's)
Energy trade:	imports 32 percent of energy used
GDP / energy use:	2.3 \$ PPP/toe (USA: 6.5 \$/toe)
Electricity price, industry:	8.9 \$c per kWh
Electricity price, consumers:	2.9 \$c per kWh
RE Share of total energy use:	2.9 percent
GHG emissions:	390 Mt CO <sub>2</sub> e
Per capita GHG emissions:	8.5 tCO <sub>2</sub> e per capita
GHG emissions per GDP	1,411 tCO <sub>2</sub> e/million \$ GDP PPP

Sources: WDI, ATK, SE4ALL Global Tracking Framework (RE share), WRI (GHG emissions). Unless otherwise specified, all values are in current \$ and from 2010. GHG emissions exclude LU emissions.





Recent developments suggest Ukraine has taken its first steps towards an energy revolution. As part of the harmonization of Ukraine's energy legislation with the EU *acquis communautaire*, legislative and regulatory frameworks have recently been put in place that support renewable energy, including very favourable feed in tariffs – that are linked to the Euro and guaranteed until 2030 – of \$0.46 per kWh for solar power, \$0.15 per kWh for large wind power installations (>2MW), \$0.17 for biomass energy, and at least \$0.16 per kWh for small hydro (all for objects commissioned before 2015<sup>45</sup>). In addition, Ukraine guarantees off-take of the electricity and provides corporate tax benefit until 2021. A recent "local content requirement" of up to 50 percent for wind, solar, biomass, and biogas installations aims to ensure Ukraine's economy benefits alongside foreign investors, yet makes investments more complex. The generous level of the solar feed-in tariff has raised questions about its mid- and

### The renewable energy sector is expected to continue growing at a rapid rate

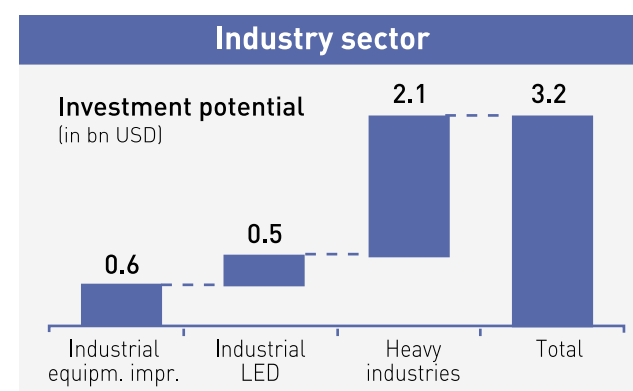
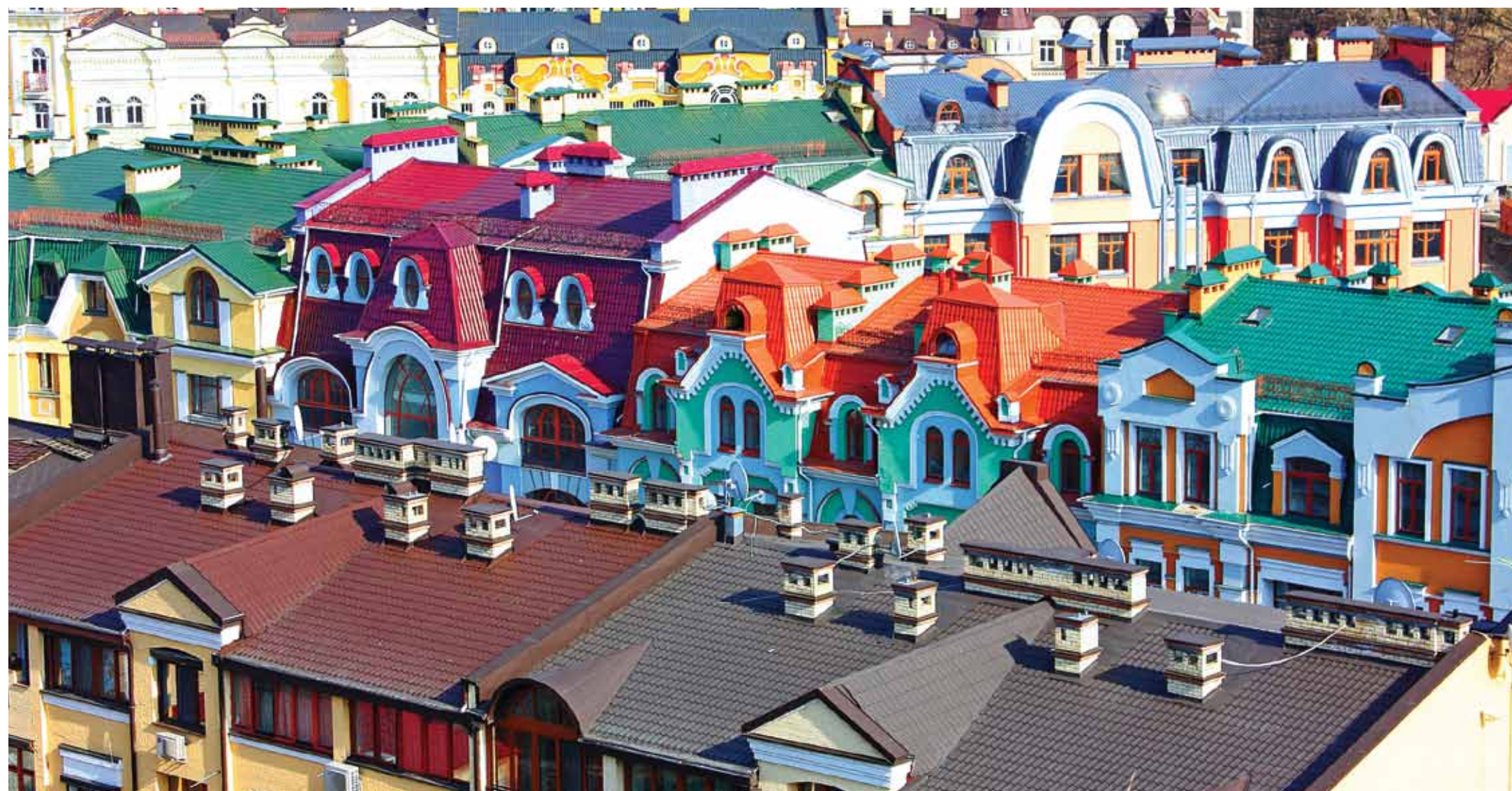


Figure 13: Estimated commercial investment potential in selected industrial sectors in Ukraine

<sup>45</sup> Renewable energy in Ukraine, Clifford Chance briefing note, July 2013.

<sup>46</sup> EBRD, Novoazovskiy Wind Project: summary document, [online.]



long-term sustainability.

Based on major resource potentials (Ukraine has a large agricultural sector), current low penetration, and strong public facilitation, biomass represents more than two-thirds of the total estimated renewable potential, offering opportunities estimated at over \$6 billion. Public support is strong, and, with an attractive feed-in tariff in place, the biomass energy sector is poised for take-off. Ukraine is already a major ex-

porter of pellets (mostly sunflower husk pellets), an attractive and growing trade market driven by demand from Central Europe.

At the moment, however, Ukraine's renewables market remains in its infancy. The first private commercial wind farms in the country – Novoazovskiy, Wind Park Ochakovskiy, and Novrossiyskiy – were commissioned in 2011<sup>46</sup>; in 2012, a deal for the 90-MW, \$126 million Botievo Wind Farm Phase 1 was closed

by DTEK Group. The first solar power plants were also constructed in 2011, with Austria's Activ Solar developing a number of projects, including the 100-MW Perovo project on the Crimean Peninsula, reportedly the largest photovoltaic project in Central and Eastern Europe.

Renewable capacities are still low, on the whole, and mostly a result of recent projects. Wind and solar generation surged by 125.5 percent in the first



half of 2013, with wind capacity up from 50 MW to 350 MW, solar capacity at 470 MW, and small hydropower (which receives the highest hydropower feed-in tariff) up 2.7 MW to 73.5 MW as of summer 2013.

On the horizon, substantial longer-term opportunities are likely to emerge in the traditional power sector, which is trying to cope, on a shoestring, with mounting gas bills. Ukraine made a commitment to further liberalize its electricity market when it joined the Energy Community in 2011. Freeing tariffs as part of this liberalization could turn the modernization of Ukraine's vastly outdated power sector infrastructure into a \$3.9 billion investment opportunity. Investments in the sector from global energy players may in fact

### Investment opportunities of over \$ 3.2 billion in industrial energy efficiency exist across industry sectors

#### West-Crimean Windplant

West-Crimean Windplant LLC has received a construction permit and is building a 250-MW wind farm in the Chernomorske district of the Crimea in Ukraine. The company is 50 percent owned by Güris Construction and Engineering Co., Inc. (Turkey) and 50 percent owned by Greenworx Holding Company, a subdivision of the Saffelberg Investments (Belgium).

The wind turbines will be Gamesa 4.5-MW units. The first phase, of 126 MW, will be funded by loans from IFC and EBRD, making this the first large renewable project in Ukraine developed by foreign owners.

Source: [windplant.crimea.ua](http://windplant.crimea.ua)



outpace reforms if a bilateral agreement with the EU materializes that would position Ukraine as a regional energy hub.

Industrial energy efficiency is also a promising niche. Ukraine is both one of the world's largest energy consumers and one of the most energy intensive economies, with energy intensity in 2010 equal to that of Russia in 1990. Ukraine has a strong industrial sector with approximately 32 percent industry value added to GDP, but low productivity at approximately \$15,000 GDP PPP per worker. Investment opportunities exist across industry sectors for the replacement and ef-

iciency improvement of industrial energy equipment and lighting. Over two-thirds of infrastructure and equipment is outdated due to a lack of modernization since the Soviet era. Investment potential in the metals sector has been estimated at over \$1 billion. Including modernization of the cement industry, the climate business potential is conservatively estimated at over \$2.1 billion (see figure 13) (see case study for an illustration of this potential). Natural gas prices in Ukraine have increased steeply in recent years, making other energy efficiency measures, beyond industry, financially attractive. For instance, the payback

time of changing an old and inefficient boiler to a new efficient one is typically less than two years, and internal rate of return (IRR) can be over 50 percent.

In Ukraine, favorable policy and regulatory developments are creating investment opportunities for both renewable energy and energy efficiency, in particular for biomass energy production and industrial energy efficiency. However, similar to the situation in Russia and the rest of the CIS, any investor in the sector will need to be savvy given Ukraine's broader investment context – including challenges that may arise with licensing, managing pre-investment risk, and delays in land allocation.

#### Upgrade of PJSC Podilsky Cement (JI project)

For a total investment of over \$250 million, the PJSC Podilsky Cement facility was completely modernized over the course of four years. Five inefficient wet-stage production lines were decommissioned and completely replaced by just one new dry process production line at equivalent total output capacity of an annual 3 million tons of cement (production output of 1.4 million tons in 2011, at a market share of 17 percent). Besides the major overhaul, which decreased energy intensity in clinker production by over 50 percent, the project included the implementation of integrated power supply, process control, and automation systems. The total potential energy savings are assessed at 200 thousand tons of oil equivalent (ktoe) per year. While initially energy use was almost double that of similar facilities in Germany, it dropped to about 0.07 toe per ton of clinker after the upgrade, below the German average of 0.08 toe per ton.

Source: A.T.Kearney



## Country spotlight 4

# Pakistan's climate resilient ambitions

Climate-smart investments have a promising future in Pakistan, a country in which environmental objectives could coincide with economic development imperatives – in particular access to infrastructure and energy. On the political agenda, economic development comes first, while attempts are also being made to deal with high population growth, steep urbanization rates, persistent poverty and security concerns, a complex political transition and devastating natural disasters (floods in 2010 and 2011).<sup>47</sup> Pakistan's context poses significant challenges to private sector investors due to corruption problems and the poor state of public finances. It is evident, however, that if Pakistan succeeds in dealing with its many challenges, economic and environmentally sustainable development could support the transition from an agrarian society to one with larger industrial and service sectors.

Overall, our estimates put the commercial climate-smart business investment potential in Pakistan at over \$45 billion. In the sectors we considered, potential investment in energy generation is estimated at more than \$8 billion. Potential investment in the water and agriculture sectors accounts for at least \$20 billion.

Pakistan's power shortage may be its greatest hurdle to economic development. Thought to exceed 6,000 MW, compared to an installed capacity of 22,500 MW, the shortage results in 8-16 hours of load shedding per day. Formerly abundant natural gas is now in short supply. As this shortage takes political center stage, opportunities are emerging in the country's energy landscape.

In the energy sector, the idea of turning waste into wealth underpins one of Pakistan's climate-smart business opportunities: about \$2.8 billion (see figure 14) in cheap and abundantly available biomass fuel sources, namely agricultural residues (e.g. wheat



straw, rice husk and straw, cane trash, bagasse, cotton sticks), animal manure (especially cattle), and municipal solid waste – estimated conservatively to be able to yield at least 50,100 GWh per year combined. Despite risks related to the bankability of fuel supply chains, where these can be secured, commercial opportunities exist. A number of biogas projects are planned or under construction, including a 24-MW

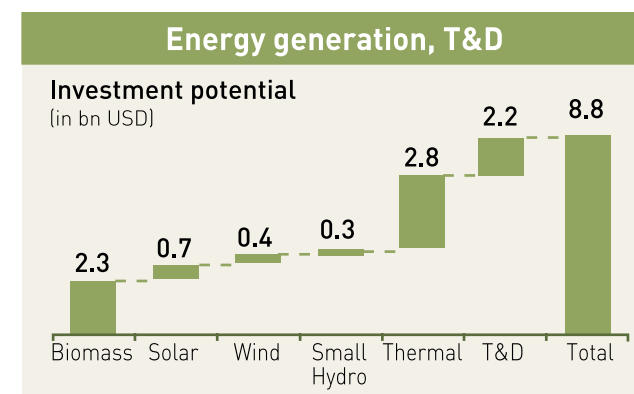


Figure 14: Estimated commercial investment potential in selected energy generation, transmission and distribution sectors

## Pakistan's severe power shortage is leading to the emergence of opportunities in the energy sector

plant near Landhi Cattle Colony in Karachi. This is one of the largest biogas projects in the world, which is solving a very serious environmental problem, as up to now the manure has been discharged into the sea.

Conventional (oil and gas) thermal power plant rehabilitation and expansion projects are conservatively estimated to constitute a \$2.8 billion opportunity, provided Pakistan and its international partners succeed in solving the reoccurring circular debt problem that has paralyzed the energy sector, as well as other issues, such as substantial delays in tariff determination and notification. Alternative energy sources – especially wind and solar power – are also increasingly attractive, given proposed feed-in tariffs of \$0.23 per kWh for PV projects sized up to 100 MW and of approx-

## Country snapshot

Population:	179 million
HDI rank (2012):	146th of 186 countries
Irrigated land:	93percent of cultivated area
GDP (2012):	518 billion \$ (PPP)
GDP/capita:	2,891 \$ (PPP)
FDI, net inflows (2012):	854 million \$
Investment in energy with private participation (2011):	659 million \$
Ease of Doing Business Rank (2013):	110th of 185 countries
Energy use:	85 million toe (a quarter of Germany's)
Energy trade:	Imports 23percent of energy used
GDP / energy use:	5.5 \$ PPP/toe (USA: 6.5 \$/toe)
Electricity price, industry:	10.5 \$c per kWh
Electricity price, consumers:	6.9 \$c per kWh
RE Share of total energy use:	46percent
GHG emissions:	313 Mt CO <sub>2</sub> e
Per capita GHG emissions:	1.8 tCO <sub>2</sub> e per capita
GHG emissions per GDP	753 tCO <sub>2</sub> e/million \$ GDP PPP

Sources: WDI, ATK, SE4ALL Global Tracking Framework (RE share), WRI (GHG emissions). Unless otherwise specified, all values are in current \$ and from 2010. GHG emissions exclude LU emissions.

<sup>47</sup> World Bank, 2013, *Rethinking Pakistan's Development Choices: Contributions to the Emerging Agenda*, Online feature story, 20 August 2013.



## Biomass fuel sources are cheap and abundantly available. Wind and solar energy are also increasingly attractive

imately \$0.15 per kWh for wind power. These feed-in tariffs are complemented by other private sector incentives offered in Pakistan's Policy for Development of Renewable Energy for Power Generation, which has a target of 9700 MW by 2030.

Pakistan's wind sector, while still in its infancy, has particularly high potential in the coastal Gharo corridor and in Sindh. The sector has been gaining momentum (see case study on Zorlu Pakistan), passing the 100-MW mark in 2012, with over 200 MW approaching financial closure.

Solar energy, in contrast, is off to a slower start, with the country's first installation, with an installed capacity of 356 kW, coming online in 2012. However, the Punjab government's plan to develop 700 MW of desert PV capacity is attracting a range of players, including German solar company AEG, a consortium of European countries, and China North Industries Corporation (NORINCO). The latter is a telling illustration of a key regional trend - namely the economic and energy-based rapprochement between China and its Western neighbours. This trend could have significant implications for the region's solar sector: consider the recent establishment of a \$3 billion fund dedicated to solar energy in Pakistan.

Boosting energy efficiency could be one of the most cost-effective ways to narrow the power deficit in Pakistan while addressing both load shedding and energy shortages. Current low-hanging fruit options range from improvements in lighting and air-conditioning in buildings to street lighting and water pumping in municipalities and waste heat recovery

in industries. Although Enercon, Pakistan's National Energy Conservation Center, was established by the government in the early 1990s, it has taken little action. The large potential for energy savings across the buildings, industry, transport, and agriculture sectors, estimated in the range of 20 to 30 percent, remains largely untapped.

The opportunities offered by Pakistan's energy shortages are paralleled by those presented by its water scarcity, amid fears that severe water shortages will be felt as soon as 2025. Wastewater treatment, for instance, accounts for a \$13.8 billion investment opportunity. This level of investment, enabled by the combination of water scarcity, low levels of water treatment (either percent of municipal wastewater and one percent of industrial effluents) and the region's highest water prices (\$ 0.62 per m<sup>3</sup>), would bring Pakistan's wastewater treatment capacity from

## The combination of water scarcity, currently low levels of treatment and relatively high water prices lead to opportunities in both domestic and industrial wastewater treatment

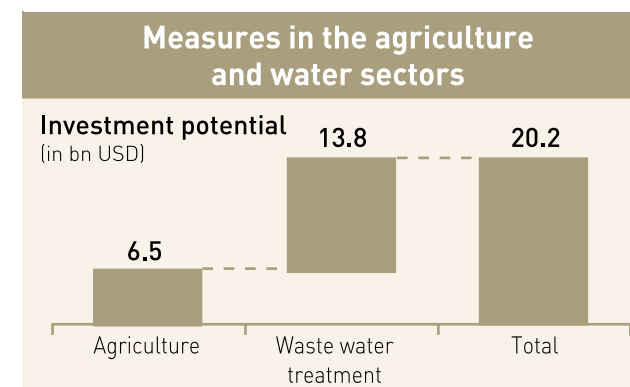


Figure 15: Estimated investment potential in water and agriculture in Pakistan

## Pakistan's agriculture is heavily dependent on highly inefficient irrigation systems. Many measures to improve water use efficiency are both technologically feasible and commercially viable

one percent to 75 percent. Many projects currently in the pipeline concern industrial wastewater treatment - with Pakistan's National Water Engineering claiming to have leveraged \$2 billion to develop industrial wastewater treatment plants in Pakistan.

Providing improved drinking water supplies and sanitation to 90 percent of Pakistan's population is also expected to engender significant opportunities. A World Bank study calculates the costs of achieving this target at \$4.8 billion, with associated annual recurring costs of \$828 million.<sup>48</sup>

Pakistan's agriculture is heavily dependent on mostly inefficient and aging irrigation systems. In Punjab, sometimes referred to as the breadbasket of Pakistan, the network of irrigation canals, built in the 1960s, is in poor repair. Low water-use efficiency and over-exploitation of groundwater also need to be addressed.

The upgrading of irrigation systems has great potential, since 61 percent of water is lost in watercourses and fields. While no estimates of potential savings currently exist, measures such as canal lining, dredging, and on-farm water storage are technologically feasible and - given farmers' have access to finance - commercially viable investments.<sup>49</sup> At the smaller end of the spectrum, Micro Drip has invested \$500,000 since 2008 in improving smallholder farmers' yields by more than 40 percent at input cost savings of about 30 percent.

As yet, Pakistan is no exemplar of sustainable de-

## Zorlu Pakistan

Turkey-based Zorlu Enerji recently spotted an opportunity to turn the steady breezes sweeping across the vast plains of Pakistan's Sindh Province into a source of power. In October 2011, Zorlu Enerji Pakistan, with the support of international backers, financed Pakistan's first private wind farm, at a cost of \$159 million. Incentives offered by the Pakistani government, such as a generous feed-in tariff, also helped get the project off the ground.

The 56-MW Zorlu Pakistan wind project recently began operations, producing enough electricity for 350,000 people and cutting CO<sub>2</sub> emissions by 90,000 tons each year. "By demonstrating the viability of Pakistan's local and renewable resources, this project is expected to have a considerable impact on the economy," said Zorlu Enerji General Manager Arif Özozan. Indeed, Zorlu is so satisfied with their investment that they've begun looking into another Pakistan wind project, with 200 MW of capacity.

Source: IFC

velopment. As its agrarian economy gradually shifts to services and manufacturing, Pakistan shares acute resilience challenges and massive infrastructural needs with many countries in the region and beyond. Energy needs are spiralling, while key strategic sectors are exposed to the adverse effects of climate change. However, these challenges also inject urgency and dynamism into Pakistan's struggles to find a path to sustainable development, resolving the environment vs. development dilemma.

<sup>48</sup> World Bank, 2005, *Pakistan Country Water Resources Assistance Strategy*, Paper 3.

<sup>49</sup> Absar SM, Fuss S, Reuter WH, 2013, *Investment in Water-Saving Irrigation Options under Uncertainties - A Comparative Analysis - interim report*, International Institute for Applied Systems Analysis, Austria.

## Country spotlight 5

# Morocco's big, fast green expansion

Morocco's future could be bright and breezy. Indeed, given a conservative investment potential of \$13.4 billion, there is little doubt that renewable energy is a substantial growth sector in this hydrocarbon-poor kingdom (see figure 16). While largely dependent on energy imports from its North African neighbours (and Spain for surplus electricity needs) – Morocco imports 96 percent of its energy – the country's technical potential for wind and solar power is excellent: The International Renewable Energy Agency (IRENA) estimates as much as 3,200 MW of new capacity is economically achievable for wind by 2020.<sup>50</sup> In addition, electricity prices in Morocco are among the highest in the region. This means that even at current energy prices, many renewable energy options and other investments are viable, and price increases and the gradual reduction of subsidies will drive further investment.

Overall, our estimates put the commercial climate-smart business investment potential in Morocco at over \$13 billion. In the sectors we considered,

### Renewable energy is a substantial growth sector in Morocco, with many viable investment options

potential investment in energy generation and transmission accounts for more than \$6 billion, almost all in renewables. The potential for energy efficiency in the consumer and industrial sectors is estimated at more than \$3 billion.

Morocco's ambitious renewables expansion is supported by the state-owned investment company SIE (Société d'Investissements Energetiques) and by a regulatory and legal framework that is progressive by regional standards (see figure 17). One of the most

<sup>50</sup> IRENA, 2013, IRENA Case Study 2013 – Morocco Wind Atlas, IRENA, Abu Dhabi.

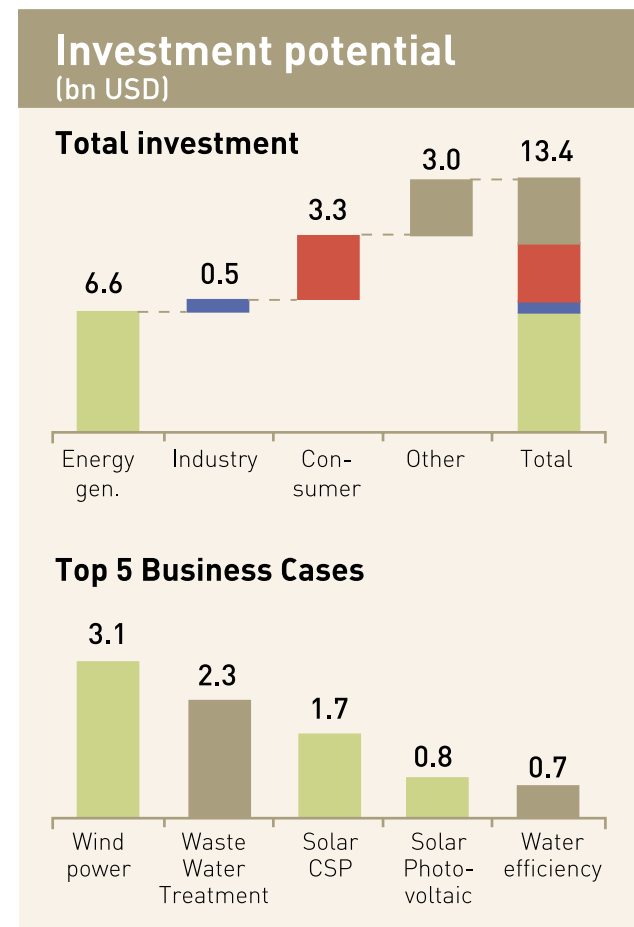
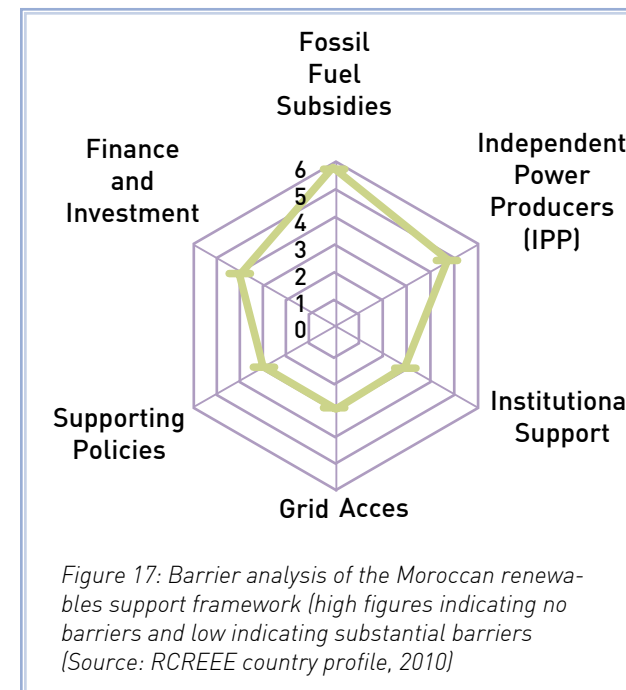


Figure 16: Estimated commercial investment potential and top 5 business cases (by value) in Morocco

deregulated electricity sectors in the MENA region, Morocco implemented new energy subsidy reforms affecting the price of diesel, gasoline, and fuel oil in mid-2013, and several laws aimed at project developers and investors, including the use of power purchasing agreements and tenders, the obligation to award public projects through competitive tenders (e.g. for municipalities wishing to contract renewable energy projects), and the authorization (albeit no take-off obligation) to supply local, national, and international markets (i.e. through cross-border transmission).

With a target of 42 percent renewable energy by



2020, Morocco is planning big and fast. In addition to a sizeable hydroelectric capacity (of 1,745 MW), the aim is to increase installed renewable capacity to 2 GW of solar, 2 GW of wind, and 2 GW of hydropower. For each renewable energy source, meeting the target would mean additional capacities of, respectively, approximately 1,980 MW (solar), 1,661 MW (wind), and 255 MW (hydro). At present, the bulk of Renewable Energy Sources (RES) capacity (in particular wind, 1.5 GW, and solar, 170 MW) is in the pipeline stage – with more wind than solar either in operation or under construction in 2013. However, if the current pipeline of government projects is realized, the target of 2 GW is likely to be significantly exceeded by 2020. We estimate that the commercially viable investment potential by 2020 is over \$3 billion for wind power, \$1.7 billion for Concentrated Solar Power (CSP), and \$800 million for PV.

In the renewable energy sector, Morocco is keen to build up a track record and gain experience. For instance, to foster confidence that the development of the renewables sector is robust, an early CSP pro-

## Country snapshot

Population:	33 million
HDI rank (2012):	130th of 186 countries
GDP (2012):	172 billion \$ (PPP)
GDP/capita:	5,192 \$ (PPP)
FDI, net inflows (2011):	2,521 million \$
Ease of Doing Business Rank (2013):	87th of 185 countries
Energy use:	17 million toe (20 times less than Germany)
Energy trade:	imports 96percent of energy used
GDP / energy use:	9.4 \$ PPP/toe (USA: 6.5 \$/toe)
Electricity price, industry:	17.2 \$c per kWh
Electricity price, consumers:	12.8 \$c per kWh
RE Share of total energy use:	7.2percent
GHG emissions:	44 MtCO <sub>2</sub> e
Per capita GHG emissions:	1.4 tCO <sub>2</sub> e per capita
GHG emissions per GDP	323 tCO <sub>2</sub> e/million \$ GDP PPP

Sources: WDI, ATK, SE4ALL Global Tracking Framework (RE share), WRI (GHG emissions). Unless otherwise specified, all values are in current \$ and from 2010. GHG emissions exclude LU emissions.



ject tender pre-qualified only reputable companies with existing CSP experience (see case study box, Ouarzazate and Tarfaya). A potential challenge for international investors is Morocco's "local content provision," which is stipulated as a key criterion for awarding tenders in the Moroccan Solar Plan and Wind Energy Program. While developing component supply chains (e.g. PV films cells and panels, thermoelectric mirrors, control systems, and condensers), the government is also supporting the development of local expertise through new agencies and training and certification programs.<sup>51</sup>

Besides green growth in the energy sector, Morocco is using the momentum generated by public

### Subsidy reforms, a deregulated electricity sector, and a progressive regulatory and legal framework all support the expansion of renewables

sector reforms to improve its water supply for use by both people and agriculture (see also *section Trend 4: MENA's Water energy nexus, page 23*). Like Pakistan (see *section Country Spotlight 4, page 41*), Morocco is an agrarian economy whose economic fate is tied to its ability to adapt to climate change. Morocco has arid and desert regions in which rainfall is scarce and water resources unevenly distributed. In the South of the country -Laâyoune, Boujdour, Tarfaya, and Tan-Tan - over 10 desalination stations have already been installed. While the sector suffers from under-investment, the aim to desalinate 200,000 m<sup>3</sup>/day of drinking water would require an investment of \$178 million by 2016. As discussed elsewhere (see *section*

<sup>51</sup> REN21, 2013, *MENA Renewables Status Report*, REN21, IRENA and UAE Ministry of Foreign Affairs



### Competitive water prices mean that many investments in water supply and wastewater treatment, as well as improved irrigation, are commercially viable

*Trend 4: MENA's Water energy nexus, page 23*), the energy requirements for desalination are substantial, and the high cost of water purification means incentives for energy and water efficiency are needed. The investment potential for improved water efficiency in agriculture, based on a large amount of addressable, irrigated land (total area of irrigated land: 1.5 million hectares) is conservatively estimated at \$700 million. Investments in agricultural water efficiency are financially attractive due to water savings, but especially due to crop yield improvements of approximately two percent. In addition, we estimate investment opportunities to expand wastewater treatment capacity (by around 0.4 billion cubic meters per year), at \$2.3 billion (given that over 80 percent of current wastewater is left untreated). These investments are commercially viable due to competitive water prices of approximately \$0.9 per m<sup>3</sup>, though investments remain challenging given the high capital intensiveness and relatively low yield of the business.

On the whole, the government of Morocco has taken some positive first steps to generate a favourable investment climate for investors in the energy and water sectors. Our estimates suggest considerable investment potential in renewable energy generation, particularly solar and wind power. In the water sector, an increase in the percentage of water supplied through desalination also means investments in water use efficiency will be unavoidable.



### Ouarzazate and Tarfaya

The Moroccan Agency for Solar Energy (MASEN) is planning to construct a 500-MW solar power complex in Ouarzazate to meet national renewable energy policy objectives. A consortium, led by the Saudi Arabian project developer, investor, and operator ACWA Power, was awarded the EPC for the first phase of the project in September 2012, which will produce 160 MW using parabolic solar power concentration technology. This investment, valued at \$1.16 billion, has received finance from the African Development Bank (AfDB), the European Investment Bank (EIB), the International Bank for Reconstruction and Development (IBRD), the German development bank (KfW), the French development agency (AFD), and the Clean Technology Fund (CTF), along with World Bank financing through the Climate Technology Fund.

A 300-MW wind farm at Tarfaya in Morocco also obtained debt financing, of \$563 million from the Banque Centrale Populaire and the Attijariwafa Bank, as well as equity funding from Nareva Holdings SA in 2012. This project is being developed by the Moroccan company Nareva Holdings SA and International Power plc.

Source: REN21, 2013, AfDB website

## Acknowledgements

This report has been prepared by a core IFC team led by Patrick Avato and Hendrik Engelmann Pilger. The report is based on a principal business case analysis by A.T. Kearney, comprising Carsten Gerhard, Andre Jerenz, Denis Bassler, Elisabeth Chasia, Simon Welter and Britta Meinert. ECO Ltd., led by Grant Ballard-Tremer, Anne Maassen and Morna Isaac, synthesized the analysis into this report and provided further country context and analysis.

The report has substantially benefited from comments by Martin Dasek, Robin Sandenburg, Selcuk Tanatar, Alexios Pantelias, George Konda, Rapti Goonesekere, Hester Marie de Casper, Alasdair Miller, Efstratios Tavoulareas, Fuphan Chou, Bryanne Tait, Viera Feckova, Patrick Willems, Sean Whittaker, Luiz Maurer and Anastasia Gekis. In addition, Lotte Pang, Başak Ülgen, Berrin Akyıldız and David Lepeska provided important editorial, strategic and production support.