World Energy Outlook 2012

EXECUTIVE SUMMARY

Prendete la cartina geografica dell'intero mondo, ritagliatela in numerose tessere, inserite queste tessere in un mixer (quelli che si usano per preparare i cocktail), shakerate energicamente e rovesciate poi il contenuto sulla superficie di un tavolo. Avvicinate tra di loro le singole tessere fino a ricomporre una "inedita" mappa che sarà, a quel punto, totalmente diversa da quella originale. Ebbene, nel mondo dell'energia sta effettivamente succedendo qualcosa di simile.
Come ha sintetizzato il *World Energy Outlook* dell'International Energy Agency, edizione 2012, "la geografia globale dell'energia sta cambiando in maniera straordinaria (*dramatic fashion*) e i mutamenti in atto stanno ridefinendo i ruoli delle diverse nazioni, regioni, fonti, nel sistema energetico globale per i prossimi decenni".
È interessante rilevare come protagonisti di questo *strappo* così deciso siano le più tradizionali tra le risorse energetiche del Pianeta: gas e petrolio. "Il Nord America è in prima linea nel guidare una radicale trasformazione dei sistemi di produzione di oil&gas – prosegue la nota della IEA – e questo cambiamento avrà effetti su tutto il mondo". Grandi aspettative sono riposte anche nell'efficienza energetica – "nel 2035 il suo apporto potrebbe essere equivalente a un quinto dei consumi globali del 2010" – ma è sulle fonti dure che si accendono i riflettori.
"Nel 2035 gli Stati Uniti avranno raggiunto l'indipendenza energetica (essendo già dal 2020 esportatori netti di gas naturale). Per quella data il 90 per cento della produzione del Medio Oriente potrà trovare sbocco solo nei Paesi asiatici".
Attenzione, comunque, a dare per *finita* l'OPEC. Anche se l'America non sarà più in cima alla lista dei clienti, proprio l'aumento della richiesta asiatica continuerà a spingere le esportazioni dei Paesi del Medio Oriente.
A beneficiarne sarà in particolare l'Iraq, che da solo coprirà il 45 per cento della maggiore domanda prevista da qui al 2035, diventando per quella data il secondo esportatore mondiale. Gli esperti della IEA azzardano anche una quotazione di riferimento: 215 dollari a barile (125 in termini reali).
Ma il mixer è ancora in funzione e, forse, già nel giro di pochi anni il quadro di riferimento potrebbe subire ulteriori profondi cambiamenti.

A new global energy landscape is emerging

The global energy map is changing, with potentially far-reaching consequences for energy markets and trade. It is being redrawn by the resurgence in oil and gas production in the United States and could be further reshaped by a retreat from nuclear power in some countries, continued rapid growth in the use of wind and solar technologies and by the global spread of unconventional gas production. Perspectives for international oil markets hinge on Iraq's success in revitalising its oil sector. If new policy initiatives are broadened and implemented in a concerted effort to improve global energy efficiency, this could likewise be a game-changer. On the basis of global scenarios and multiple case studies, this *World Energy Outlook* assesses how these new developments might affect global energy and climate trends over the coming decades. It examines their impact on the critical challenges facing the energy system: to meet the world's ever-growing energy needs, led by rising incomes and populations in emerging economies; to provide energy access to the world's poorest; and to bring the world towards meeting its climate change objectives.

Taking all new developments and policies into account, the world is still failing to put the global energy system onto a more sustainable path. Global energy demand grows by more than one-third over the period to 2035 in the New Policies Scenario (our central scenario), with China, India and the Middle East accounting for 60% of the increase. Energy demand barely

Nuova Energia **pubblica in queste pagine la versione integrale dell'*Executive Summary del World Energy Outlook 2012***

rises in OECD countries, although there is a pronounced shift away from oil, coal (and, in some countries, nuclear) towards natural gas and renewables. Despite the growth in lowcarbon sources of energy, fossil fuels remain dominant in the global energy mix, supported by subsidies that amounted to 523 billion dollars in 2011, up almost 30% on 2010 and six times more than subsidies to renewables. The cost of fossil-fuel subsidies has been driven up by higher oil prices; they remain most prevalent in the Middle East and North Africa, where momentum towards their reform appears to have been lost. Emissions in the New Policies Scenario correspond to a long-term average global temperature increase of 3.6 °C.

The tide turns for US energy flows

Energy developments in the United States are profound and their effect will be felt well beyond North America – and the energy sector. The recent rebound in US oil and gas production, driven by upstream technologies that are unlocking light tight oil and shale gas resources, is spurring economic activity – with less expensive gas and electricity prices giving industry a competitive edge – and steadily changing the role of North America in global energy trade. By around 2020, the United States is projected to become the largest global oil producer (overtaking Saudi Arabia until the mid-2020s) and starts to see the impact of new fuel-efficiency measures in transport. The result is a continued fall in US oil imports, to the extent that North America becomes a net oil exporter around 2030. This accelerates the switch in direction of international oil trade towards Asia, putting a focus on the security of the strategic routes that bring Middle East oil to Asian markets. The United States, which currently imports around 20% of its total energy needs, becomes all but self-sufficient in net terms – a dramatic reversal of the trend seen in most other energy importing countries.

But there is no immunity from global markets

No country is an energy "island" and the interactions between different fuels, markets and prices are intensifying. Most oil consumers are used to the effects of worldwide fluctuations in price (reducing its oil imports will not insulate the United States from developments in international markets), but consumers can expect to see growing linkages in other areas. A current example is how low-priced natural gas is reducing coal use in the United States, freeing up coal for export to Europe (where, in turn, it has displaced higherpriced gas). At its lowest level in 2012, natural gas in the United States traded at around one-fifth of import prices in Europe and one-eighth of those in Japan. Going forward, price relationships between regional gas markets are set to strengthen as liquefied natural gas trade becomes more flexible and contract terms evolve, meaning that changes in one part of the world are more quickly felt elsewhere. Within individual countries and regions, competitive power markets are creating stronger links between gas and coal markets, while these markets also need to adapt to the increasing role of renewables and, in some cases, to the reduced role of nuclear power. Policy makers looking for simultaneous progress towards energy security, economic and environmental objectives are facing increasingly complex – and sometimes contradictory – choices.

A blueprint for an energy-efficient world

Energy efficiency is widely recognised as a key option in the hands of policy makers but current efforts fall well short of tapping its full economic potential. In the last year, major energy-consuming countries have announced new measures: China is targeting a 16% reduction in energy intensity by 2015; the United States has adopted new fuel economy standards; the European Union has committed to a cut of 20% in its 2020 energy demand; and Japan aims to cut 10% from electricity consumption by 2030. In the New Policies Scenario, these help to speed up the disappointingly slow progress in global energy efficiency seen over the last decade. But even with these and other new policies in place, a significant share of the potential to improve energy efficiency – four-fifths of the

L'edizione italiana del Summary è consultabile all'indirizzo:
http://www.iea.org/publications/freepublications/publication/Italian.pdf

potential in the buildings sector and more than half in industry – still remains untapped.

Our Efficient World Scenario shows how tackling the barriers to energy efficiency investment can unleash this potential and realise huge gains for energy security, economic growth and the environment. These gains are not based on achieving any major or unexpected technological breakthroughs, but just on taking actions to remove the barriers obstructing the implementation of energy efficiency measures that are economically viable.

Successful action to this effect would have a major impact on global energy and climate trends, compared with the New Policies Scenario. The growth in global primary energy demand to 2035 would be halved. Oil demand would peak just before 2020 and would be almost 13 mb/d lower by 2035, a reduction equal to the current production of Russia and Norway combined, easing the pressure for new discoveries and development. Additional investment of 11.8 trillion dollars (in year-2011 dollars) in more energy-efficient technologies would be more than offset by reduced fuel expenditures. The accrued resources would facilitate a gradual reorientation of the global economy, boosting cumulative economic output to 2035 by 18 trillion dollars, with the biggest gross domestic product (GDP) gains in India, China, the United States and Europe. Universal access to modern energy would be easier to achieve and air quality improved, as emissions of local pollutants fall sharply. Energy related carbon-dioxide (CO_2) emissions would peak before 2020, with a decline thereafter consistent with a long-term temperature increase of 3 °C.

We propose policy principles that can turn the Efficient World Scenario into reality. Although the specific steps will vary by country and by sector, there are six broad areas that need to be addressed. Energy efficiency needs to be made clearly visible, by strengthening the measurement and disclosure of its economic gains. The profile of energy efficiency needs to be raised, so that efficiency concerns are integrated into decision making throughout government, industry and society. Policy makers need to improve the affordability of energy efficiency, by creating and supporting business models, financing vehicles and incentives to ensure that investors reap an appropriate share of the rewards. By deploying a mix of regulations to discourage the least-efficient approaches and incentives to deploy the most efficient, governments can help push energy-efficient technologies into the mainstream. Monitoring, verification and enforcement activities are essential to realise expected energy savings. These steps would need to be underpinned by greater investment in energy efficiency governance and administrative capacity at all levels.

Energy efficiency can keep the door to 2 °C open for just a bit longer

Successive editions of this report have shown that the climate goal of limiting warming to 2 °C is becoming more difficult and more costly with each year that passes. Our 450 Scenario examines the actions necessary to achieve this goal and finds that almost four-fifths of the CO_2 emissions allowable by 2035 are already locked-in by existing power plants, factories, buildings, etcetera. If action to reduce CO_2 emissions is not taken before 2017, all the allowable CO_2 emissions would be locked-in by energy infrastructure existing at that time. Rapid deployment of energy-efficient technologies – as in our Efficient World Scenario – would postpone this complete lock-in to 2022, buying time to secure a much-needed global agreement to cut greenhouse-gas emissions.

No more than one-third of proven reserves of fossil fuels can be consumed prior to 2050 if the world is to achieve the 2 °C goal, unless carbon capture and storage (CCS) technology is widely deployed. This finding is based on our assessment of global "carbon reserves", measured as the potential CO_2 emissions from proven fossil-fuel reserves. Almost two-thirds of these carbon reserves are related to coal, 22% to oil and 15% to gas. Geographically, two-thirds are held by North America, the Middle East, China and Russia. These findings underline the importance of CCS as a key option to mitigate CO_2 emissions, but its pace of deployment remains highly uncertain, with only a handful of commercial-scale projects currently in operation.

Trucks deliver a large share of oil demand growth

Growth in oil consumption in emerging economies, particularly for transport in China, India and the Middle East, more than outweighs reduced demand in the OECD, pushing oil use steadily higher in the New Policies Scenario. Oil demand reaches 99.7 mb/d in 2035, up from 87.4 mb/d in 2011, and the average IEA crude oil import price rises to 125 dollars/barrel (in year-2011 dollars) in 2035 (over 215 dollars/barrel in nominal terms). The transport sector already accounts for over half of global oil consumption, and this share increases as the number of passenger cars doubles to 1.7 billion and demand for road freight rises quickly. The latter is responsible for almost 40% of the increase in global oil demand: oil use for trucks – predominantly diesel – increases much faster than that for passenger vehicles, in part because fuel-economy standards for trucks are much less widely adopted.

Non-OPEC oil output steps up over the current decade, but supply after 2020 depends increasingly on OPEC. A surge in unconventional supplies, mainly from light tight oil in the United States and oil sands in Canada, natural gas liquids, and a jump in deepwater production in Brazil, push non-OPEC production up after 2015 to a plateau above 53 mb/d, from under 49 mb/d in 2011. This is maintained until the mid-2020s, before falling back to 50 mb/d in 2035. Output from OPEC countries rises, particularly after 2020, bringing the OPEC share in global production from its current 42% up towards 50% by 2035. The net increase in global oil production is driven entirely by unconventional oil, including a contribution from light tight oil that exceeds 4 mb/d for much of the 2020s, and by natural gas liquids. Of the 15 trillion dollars in upstream oil and gas investment that is required over the period to 2035, almost 30% is in North America.

Much is riding on Iraq's success

Iraq makes the largest contribution by far to global oil supply growth. Iraq's ambition to expand output after decades of conflict and instability is not limited by the size of its resources or by the costs of producing them, but will require co-ordinated progress all along the energy supply chain, clarity on how Iraq plans to derive long-term value from its hydrocarbon wealth and successful consolidation of a domestic consensus on oil policy. In our projections, oil output in Iraq exceeds 6 mb/d in 2020 and rises to more than 8 mb/d in 2035. Iraq becomes a key supplier to fast-growing Asian markets, mainly China, and the second-largest global exporter by the 2030s, overtaking Russia. Without this supply growth from Iraq, oil markets would be set for difficult times, characterised by prices that are almost 15 dollars/barrel higher than the level in the New Policies Scenario by 2035.

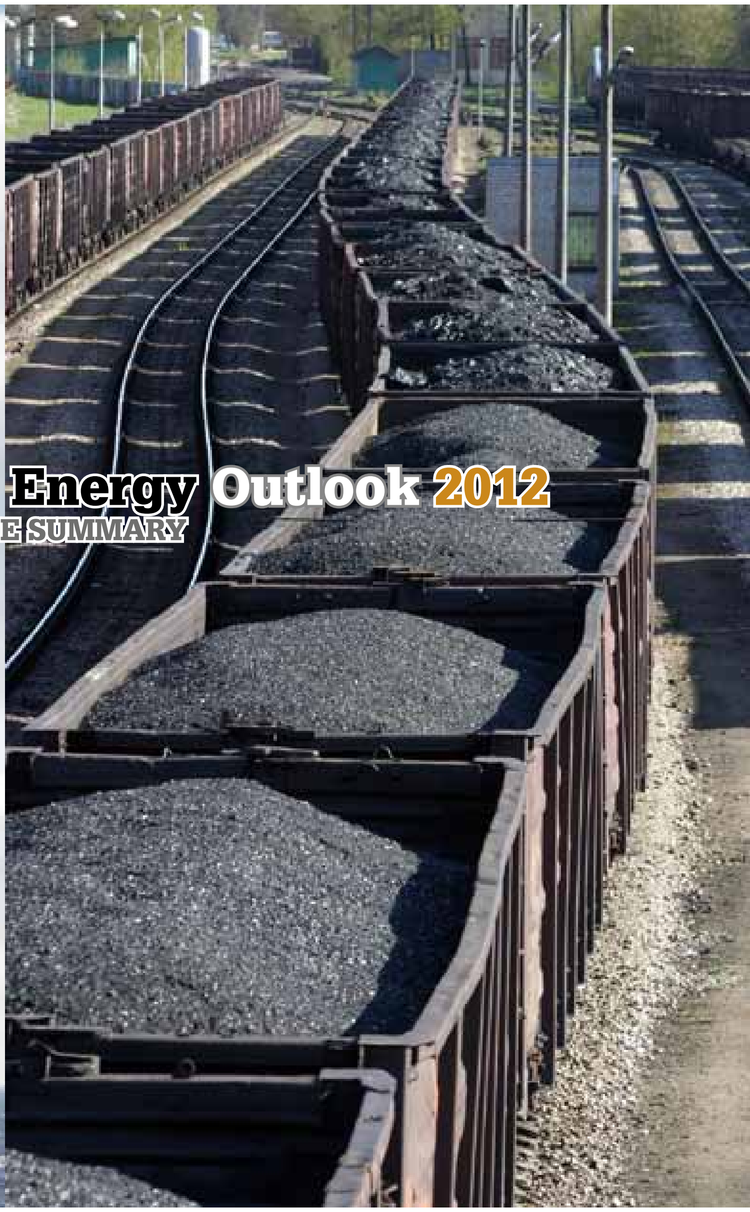
Iraq stands to gain almost 5 trillion dollars in revenue from oil exports over the period to 2035, an annual average of 200 billion dollars, and an opportunity to transform the country's prospects. The energy sector competes with a host of other spending needs in Iraq, but one urgent priority is to catch up and keep pace with rising electricity demand: if planned new capacity is delivered on time, grid-based electricity generation will be sufficient to meet peak demand by around 2015. Gathering and processing associated gas – much of which is

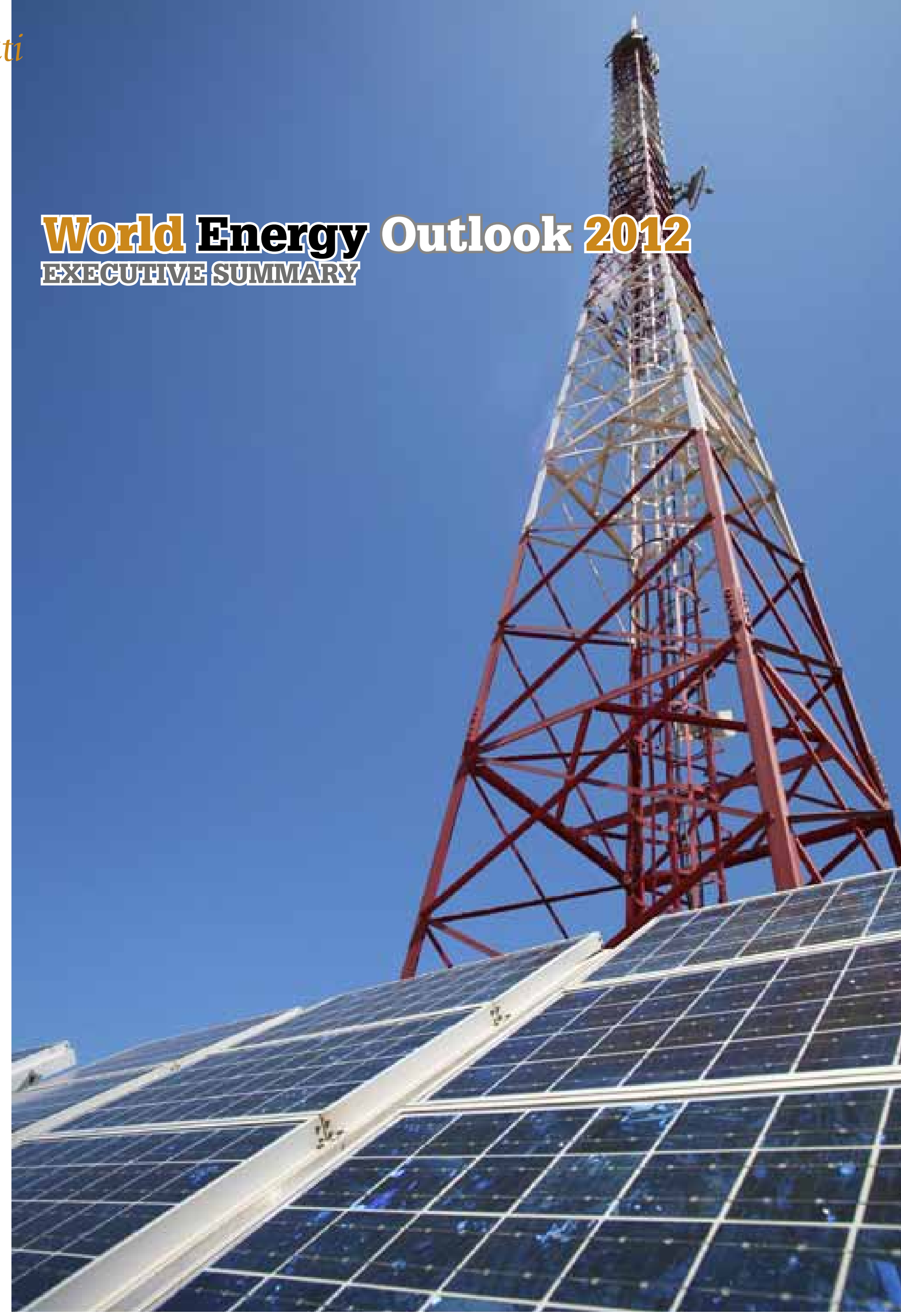
currently flared – and developing non-associated gas offers the promise of a more efficient gas-fuelled power sector and, once domestic demand is satisfied, of gas exports. Translating oil export receipts into greater prosperity will require strengthened institutions, both to ensure efficient, transparent management of revenues and spending, and to set the course necessary to encourage more diverse economic activity.

Different shades of gold for natural gas

Natural gas is the only fossil fuel for which global demand grows in all scenarios, showing that it fares well under different policy conditions; but the outlook varies by region. Demand growth in China, India and the Middle East is strong: active policy support and regulatory reforms push China's consumption up from around 130 billion cubic metres (bcm) in 2011 to 545 bcm in 2035. In the United States, low prices and abundant supply see gas overtake oil around 2030 to become the largest fuel in the energy mix. Europe takes almost a decade to get back to 2010 levels of gas demand: the growth in Japan is similarly limited by higher gas prices and a policy emphasis on renewables and energy efficiency.

Unconventional gas accounts for nearly half of the increase in global gas production to 2035, with most of the increase coming from China, the United States and Australia. But the unconventional gas business is still in its formative years, with uncertainty in many countries about the extent and quality of the resource base. As analysed in a World Energy Outlook Special Report released in May 2012, there are also concerns about the environmental impact of producing unconventional gas that, if not properly addressed, could halt the unconventional gas revolution in its tracks. Public confidence can be underpinned by robust regulatory frameworks and exemplary industry performance. By bolstering and diversifying sources of supply, tempering demand for imports (as in China) and fostering the emergence of new exporting countries (as in the United States), unconventional gas can accelerate movement towards more diversified trade flows, putting pressure on conventional gas suppliers and on traditional oil-linked pricing mechanisms for gas.





Will coal remain a fuel of choice?

Coal has met nearly half of the rise in global energy demand over the last decade, growing faster even than total renewables. Whether coal demand carries on rising strongly or changes course will depend on the strength of policy measures that favour lower-emissions energy sources, the deployment of more efficient coal-burning technologies and, especially important in the longer term, CCS. The policy decisions carrying the most weight for the global coal balance will be taken in Beijing and New Delhi – China and India account for almost three-quarters of projected non-OECD coal demand growth (OECD coal use declines). China's demand peaks around 2020 and is then steady to 2035; coal use in India continues to rise and, by 2025, it overtakes the United States as the world's second-largest user of coal. Coal trade continues to grow to 2020, at which point India becomes the largest net importer of coal, but then levels off as China's imports decline. The sensitivity of these trajectories to changes in policy, the development of alternative fuels (*e.g.* unconventional gas in China) and the timely availability of infrastructure, create much uncertainty for international steam coal markets and prices.

If nuclear falls back, what takes its place?

The world's demand for electricity grows almost twice as fast as its total energy consumption, and the challenge to meet this demand is heightened by the investment needed to replace ageing power sector infrastructure. Of the new generation capacity that is built to 2035, around one-third is needed to replace plants that are retired. Half of all new capacity is based on renewable sources of energy, although coal remains the leading global fuel for power generation. The growth in China's electricity demand over the period to 2035 is greater than total current electricity demand in the United States and Japan. China's coal-fired output increases almost as much as its generation from nuclear, wind and hydropower combined. Average global electricity prices increase by 15% to 2035 in real terms, driven higher by increased fuel input costs, a shift to more capital-intensive generating capacity, subsidies to renewables and CO_2 pricing in some countries. There are significant regional price variations, with the highest prices persisting in the European Union and Japan, well above those in the United States and China.

The anticipated role of nuclear power has been scaled back as countries have reviewed policies in the wake of the 2011 accident at the Fukushima Daiichi nuclear power station. Japan and France have recently joined the countries with intentions to reduce their use of nuclear power, while its competitiveness in the United States and Canada is being challenged by relatively cheap natural gas. Our projections for growth in installed nuclear capacity are lower than in last year's *Outlook* and, while nuclear output still grows in absolute terms (driven by expanded generation in China, Korea, India and Russia), its share in the global electricity mix falls slightly over time. Shifting away from nuclear power can have significant implications for a country's spending on imports of fossil fuels, for electricity prices and for the level of effort needed to meet climate targets.

Renewables take their place in the sun

A steady increase in hydropower and the rapid expansion of wind and solar power has cemented the position of renewables as an indispensable part of the global energy mix; by 2035, renewables account for almost one-third of total electricity output. Solar grows more rapidly than any other renewable technology. Renewables become the world's second-largest source of power generation by 2015 (roughly half that of coal) and, by 2035, they approach coal as the primary source of global electricity. Consumption of biomass (for power generation) and biofuels grows four-fold, with increasing volumes being traded internationally. Global bioenergy resources are more than sufficient to meet our projected biofuels and biomass supply without competing with food production, although the landuse implications have to be managed carefully. The rapid increase in renewable energy is underpinned by falling technology costs, rising fossil-fuel prices and carbon pricing, but mainly by continued subsidies: from 88 billion dollars globally in 2011, they rise to nearly 240 billion dollars in 2035. Subsidy measures to support new renewable energy projects need to be adjusted over time as capacity increases and as the costs of renewable technologies fall, to avoid excessive burdens on governments and consumers.

A continuing focus on the goal of universal energy access

Despite progress in the past year, nearly 1.3 billion people remain without access to electricity and 2.6 billion do not have access to clean cooking facilities. Ten countries – four in developing Asia and six in sub-Saharan Africa – account for two-thirds of those people without electricity and just three countries – India, China and Bangladesh – account for more than half of those without clean cooking facilities. While the Rio+20 Summit did not result in a binding commitment towards universal modern energy access by 2030, the UN Year of Sustainable Energy for All has generated welcome new commitments towards this goal. But much more is required. In the absence of further action, we project that nearly one billion people will be without electricity and 2.6 billion people will still be without clean cooking facilities in 2030. We estimate that nearly 1 trillion dollars in cumulative investment is needed to achieve universal energy access by 2030.

We present an Energy Development Index (EDI) for 80 countries, to aid policy makers in tracking progress towards providing modern energy access. The EDI is a composite index that measures a country's energy development at the household and community level. It reveals a broad improvement in recent years, with China, Thailand, El Salvador, Argentina, Uruguay, Vietnam and Algeria showing the greatest progress. There are also a number of countries whose EDI scores remain low, such as Ethiopia, Liberia, Rwanda, Guinea, Uganda and Burkina Faso. The sub-Saharan Africa region scores least well, dominating the lower half of the rankings.

Energy is becoming a thirstier resource

Water needs for energy production are set to grow at twice the rate of energy demand. Water is essential to energy production: in power generation; in the extraction, transport and processing of oil, gas and coal; and, increasingly, in irrigation for crops used to produce biofuels. We estimate that water withdrawals for energy production in 2010 were 583 billion cubic metres (bcm). Of that, water consumption – the volume withdrawn but not returned to its source – was 66 bcm. The projected rise in water consumption of 85% over the period

to 2035 reflects a move towards more water-intensive power generation and expanding output of biofuels.

Water is growing in importance as a criterion for assessing the viability of energy projects, as population and economic growth intensify competition for water resources. In some regions, water constraints are already affecting the reliability of existing operations and they will increasingly impose additional costs. In some cases, they could threaten the viability of projects. The vulnerability of the energy sector to water constraints is widely spread geographically, affecting, among others, shale gas development and power generation in parts of China and the United States, the operation of India's highly water-intensive fleet of power plants, Canadian oil sands production and the maintenance of oil-field pressures in Iraq. Managing the energy sector's water vulnerabilities will require deployment of better technology and greater integration of energy and water policies.