



**Royal
HaskoningDHV**
Enhancing Society Together

Perspective

12.12

The Global Energy Challenge
Why Water & Energy projects
make sense



Food, Water & Energy under pressure

More and more people become aware that the growing scarcity of water, food and energy is set to be the biggest crisis of the decades to come. We need to ensure food, water and energy security, but there are hazards on all sides. In the decades to 2050 the world population is set to mushroom to nine billion. Taking into account global urbanisation and rising standards of living in large parts of the world this will put an enormous strain on existing resources.

Water consumption is set to rise by at least 30 percent, while the demand for food and energy will jump some 50 percent. Faced with these challenges, a 'business as usual' scenario is hopelessly inadequate. In order to survive, a drastic, worldwide switch to sustainable production and consumption is inevitable. The challenge we face is to maximise efficiency and sustainability.

If we want to reduce our dependence on fossil fuels we cannot afford to rule out any single source of renewable energy. Using water as an energy resource too, is desperately needed despite its inherent difficulties. And there is a lot of energy in water. The trick is to utilise it without making scarce water even scarcer and to harmonise plural use of water resources. Coming from a country where plural use of water resources led to it being used as an 'organising' principle, Royal HaskoningDHV not only has 130 years of world class technical expertise but also the institutional and financial expertise to facilitate Water Infrastructure projects in general and Water & Energy projects in particular.

Such skills have proven of tremendous added value for creating the optimal conditions for a sustainable and commercially successful Water & Energy projects around the world that help addressing the global water, energy and food crises.

In writing this piece Royal HaskoningDHV has drawn on the Vision 2050 document of the World Business Council on Sustainable Development, OECD's Environmental Outlook to 2050 and Green Growth Studies (2012), as well as the IEA's World Energy Outlook. We work together with our customers and partners in realising our vision.

“The key challenge in energy is to slash worldwide carbon emissions by half (based on 2005 levels) by 2050 – with greenhouse gas emissions peaking in 2020 at the latest – through a shift to low-carbon energy systems and highly improved demand-side energy efficiency”

The Global Energy Challenge

Nine billion people on the planet in 2050 need not pose a problem. But only if there is a global revolution in our utilisation of natural resources, particularly in the way we produce, distribute and consume energy. It will not be easy, but the Green Economy opens up a host of possibilities for companies able to identify and exploit the opportunities on offer.

A world population of nine billion in 2050 will generate huge additional demand for energy – particularly in large emerging markets, which are expected to account for 90 percent of the increase in energy demand to 2035. At the same time, some 20 percent of the world's population lacks access to electricity. This prompted the United Nations to declare 2012 the Year of Sustainable Energy for All. The UN has set a 2030 deadline for universal access to modern forms of energy, a doubling of energy efficiency and a doubling of the share of sustainable energy in global energy provision. As such a large-scale transformation of the energy sector is all the more imperative.

Transformation to a Green Economy

The world is on the brink of a growth explosion in clean technology and its commercialisation. We are currently undergoing a phase of dynamic transition in which a joint global vision on sustainability is slowly taking shape. This is the starting point for the actual transformation to a Green Economy. The costs of this transformation are huge, but it brings with it a myriad of opportunities. Staying on the sidelines now will lead to far higher costs in the future.

While fossil fuels are finite, increasingly scarce and polluting, they will continue to play a dominant role in our energy supply for some time. Societies and infrastructures have evolved around these energy-dense resources and innovation and change take time. The challenge for fossil fuel use in the future lies in drastically boosting their energy efficiency and replacing the heaviest polluters with cleaner alternatives. By switching from coal to gas, for example, or by replacing conventional coal-fired power plants with coal gasification technology and co-generation.

Even so, new sources of energy need to be deployed on a scale equivalent to that of the industrial revolution. Without decisive action, energy-related emissions of CO₂ are set to double by 2050.

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Is it possible to achieve fully sustainable energy provision worldwide by 2050? The jury is still out. Optimists believe that by deploying existing green technologies, 95 percent of world demand for energy could be met by 2050. Others regard a mix of 50 percent renewables and 25 percent each for fossil fuels and nuclear as a more likely scenario. In terms of sustainability, energy derived from sun, wind, water and geothermal is preferable. Electricity is meeting an ever larger share of total energy demand. Bio-energy has enormous potential, both at local level and from co-firing biomass. However, such biomass must meet sustainability criteria in order to avoid competing with food crops.

Clean Energy Opportunities

Clean energy growth creates opportunities for new green industries, jobs and technologies, while managing the structural changes associated with the transition to a green economy. Energy and transport will be among the earliest drivers of green growth. Emerging economies in particular need to replace old, inefficient power plants and create new capacity in order to meet rising demand. As far as possible, this should be effectuated in a sustainable way. Governments and industry have a lot to gain by securing a role in the vanguard of this green revolution.

The magnitude of the global business opportunities that could arise from realising a sustainable future is considerable. OECD estimates suggest that sustainability-related global business opportunities in natural resources (including energy, forestry, agriculture and food, water and metals) and health and education (social sustainability) could accrue steadily to around US\$ 3-10 trillion annually in 2050 at constant 2008 prices, or around 1.5-4.5 percent of world GDP at that time. By 2020 the figure could be around US\$ 0.5-1.5 trillion per annum at constant 2008 prices (assuming a broadly linear build-up of these opportunities over time as a share of GDP).

Energy Infrastructure Investments

OECD/Global Insight estimates require infrastructure investments at US\$ 10.3 trillion until 2015. Just under a third (US\$ 3.2 trillion) of this will be for new capacity, while US\$ 7.1 trillion is needed for reinvestment.

Energy infrastructure will be made low carbon, and greater demand for energy will drive innovation and investment in its supply, transmission and distribution. The market for renewables is expected to more than double in size from some US\$ 115 billion in 2008 to just over US\$ 325 billion within a decade, according to Clean Edge Research. An estimated US\$ 13 trillion in investments are required to upgrade transmission and distribution networks worldwide by 2030.

Expanding and improving energy network infrastructure is an essential requirement in meeting increasing demand and effecting the transition to a low-carbon economy. Technologically advanced distribution networks are required in order to integrate the increasing number of decentral generators, electric vehicles and heat pumps into the grid and to encourage consumers to actively manage their power demand. This requires additional investments in new infrastructure. The combined new infrastructure is often referred to as a 'Smart Grid'. Whilst in Europe, a reliable network infrastructure already exists, in emerging economies this is usually quite the opposite and requires improvement first as illustrated by the recent blackout in India which left 1/10 of the global population without energy for several days.

It is vital for governments to create the enabling policy framework to catalyse the public-private investment in this transition to a low-carbon energy sector.

There are reasons for optimism in pursuing a greener energy sector. Policy-makers and businesses are making commitments. National targets for renewable energy are spreading. More than 70 governments around the world, including all IEA member countries, have put in place targets and policies to support development of renewable energy technologies. In doing so, they improve energy security and access to modern energy services, reduce dependence on energy imports, protect the environment, provide employment and strengthen the competitive edge of domestic industry. However, there is still an urgent need to accelerate the pace of change.

Governments of both the Major Economies Forum and the IEA have agreed to dramatically increase and co-ordinate public-sector investments in low-carbon R&D, with a view to doubling such investments by 2015.

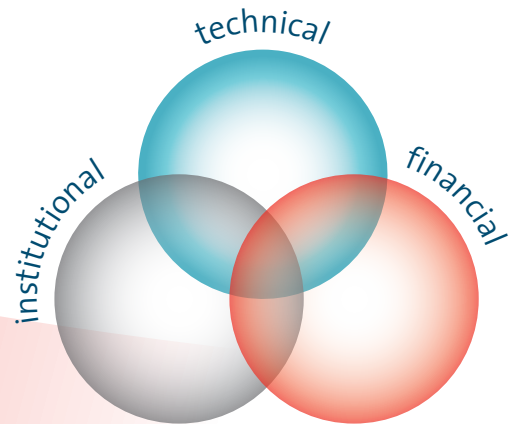
New investment cycle


The environmental imperative to reduce carbon dioxide emissions and ensure sustainable growth in the energy sector coincides with an approaching new investment cycle in power generation in most OECD countries. In non-OECD countries, many power generation facilities are quite young, but more will be built in the coming years to meet growing energy demand. There is a window of opportunity for establishing the policy framework to enable transformational change in the energy sector, including facilitating technological innovation and the creation of new markets and industries to reduce the sector's carbon-intensity, and to improve energy efficiency.

Enhancing energy security

Royal HaskoningDHV enhances the global energy security, amongst others through enabling Water & Energy projects. The benefits from hydropower, offshore wind energy and tidal energy are clear and provide commercially viable options for sustainable energy. Since Water & Energy projects have an inherently complex context as to the financial, political and institutional (social and environmental) aspects, it is essential to fully understand all these different interests. And to oversee the challenges we all have to deal with in the coming decades.

We believe that the full benefits of Water & Energy projects can be secured in a sustainable manner acceptable to our growing global society when it is approached holistically, seamlessly integrating the technical, institutional and financial dimension into an asset that delivers the expected functional performance against mitigated (acceptable) risks and affordable (optimised) cost.





“In the past, hydropower projects have caused controversies due to inadequately addressing of the social (i.e. resettlement) and ecological impact inherently associated with large scale hydropower projects. International Finance Corporation Performance Standards (IFC PSs) establish a private environmental and social regulatory framework against which the project finance required is assessed to ensure 3rd party investment.”

Hydropower

Water is an infinite source of clean energy and in vast parts of the world a realistic alternative to fossil fuels. But it needs to be handled with care. Hydropower plants in rivers invariably have an impact on water life and the environment and can be potentially controversial. Royal HaskoningDHV has all the expertise in-house to build hydropower plants from small-scale to large hydropower installations that meet the highest technological, social and ecological standards.

Superior technology

Hydropower plants are superior to nearly all other energy technologies. They generate clean energy and the flow of water is free, unlimited and relatively predictable, making it easy to match energy supply and demand. Hydropower plants are highly efficient (on average 70 percent). What is more: hydropower is cost effective and low-maintenance. The payback period of a plant averages around 10 years, while its lifetime is around 50 years.

Battle for water and space

Inevitably the pressure on water resources is set to increase – on both sweet and salt water. There is already a marked increase in demand for river water – not only in the industrialised West but also in developing countries. Interested parties are all claiming their share of the limited water available for drinking water, for crop irrigation, for industrial processing and for the natural environment. And so surface water is becoming increasingly crowded. The fishing industry, utility companies, shipping and environmental sector are all laying claim to the same rivers and estuaries.

Different interests can often be combined, as in the case of small-scale hydropower plants and irrigation. But it is often a case of competing interests. The challenge is to take a holistic approach to all these claims on our water resources to achieve optimal and multiple use.





Tidal Energy

Tidal energy in general is a form of energy with enormous potential: unlike sun and wind, the tides are constant and predictable. As such tidal energy should not be omitted from any balanced mix of renewable energy sources. Tidal energy, whether in conventional or free stream tidal energy form, will have a significant contribution to make in the coastal zones around the world where the need for energy increases due to coastal urbanisation and pressure on resources is strong.

Conventional tidal power

Conventional tidal energy implies constructing a dam to create enough head to generate energy. In general, this is associated with a relatively large capital expenditure in relation to the amount of energy generated. Whilst there are enough examples of successful tidal energy schemes, despite the small scale the inherent need for a dam to be constructed often has an unacceptable impact on the environment, most clearly ecology and the tidal dynamics in an estuary. Such aspects are of critical importance to consider when aiming to develop conventional tidal power.

Free Stream Tidal energy

Free stream tidal energy concerns using free-standing turbines to use strong tidal currents to generate energy and as such, require little additional civil infrastructure. The technology is relatively new, environmentally benign and invisible to the public. It has become commercial reality in the past one to two years. Originating from offshore application, in areas with a strong tidal current (Britain, Canada, India, China and Indonesia amongst others), nearshore application and even inshore application in estuaries is now possible. The fact that they are free-standing and do not require a civil infrastructure, makes them ideally suitable for application in densely populated coastal zones around the world. Particularly now that technology is improving to the extent that lower currents are commercially attractive.

Royal HaskoningDHV operates at the forefront with the major players in the field such as Atlantis Resources Corporation, Marine Current Turbines and Rushydro as well as a range of developers and independent power producers, we help enhancing society together and maximising the contribution of tidal resources to address the global energy crisis.

“As opposed to onshore and despite the more complex technical aspects of offshore wind energy, it does allow for economy of scale and sharing of network infrastructure with other types of water & energy projects.”



Offshore wind energy

Wind energy is clean and offshore wind energy plays a key role in the transformation to a green economy. Whilst not strictly using water as a resource for energy, offshore wind requires much a similar approach as hydro and tidal energy projects do, due to the fact that offshore wind projects lay claim on water as a resource.


An easy win(d)

Why invest in wind energy? The unpredictability of wind makes it an uncertain resource. You cannot predict whether you can meet the demand. On the other hand, wind energy is one of the few forms of clean energy that is technologically relatively easy to implement on a large scale. What is more, wind parks remain operational for several decades. The costs of wind energy – in particular offshore wind energy – is expected to fall further. Notwithstanding the merits of onshore wind, offshore wind energy allows for large scale implementation making it economically more attractive and adding substantially to the generation capacity. Also offshore wind projects have less direct impact on the landscape and on the community. Future developments in combinations with other types of Water & Energy projects such as tidal stream energy can increase the competitiveness.

From development to implementation

It is for sure that political certainty is a key to move from a pioneering phase to large scale offshore wind development. The expansion of offshore wind energy can be strongly driven by national policies that aim to provide a much greater penetration of renewable energy sources. Apart from that wind energy projects involve many players, both public and private. Despite the fact that the offshore space seems largely empty and unused, offshore wind developments require a careful approach with great attention for the environment, other users of the sea and various stakeholder interests. Particularly in the development phase making the right design decisions is crucial; a reliable resource assessment is paramount. A mistake can cost millions.

As an international company we see it as our duty to exchange best practices of our North West European experience worldwide, with developing countries. And we are playing a crucial role in tackling technical, financial and institutional bottlenecks and further develop carbon finance options.



“A well structured approach and integration of the three dimensions of a project’s business case ensures that the growing global society may sustainably benefit from what energy from water resources has to offer.”

Our added value

Being an engineering and consultancy company, from Royal HaskoningDHV you may expect that technology comes first. But let us surprise you: in order to enable sustainable and technical solutions, Royal HaskoningDHV always operates on the cutting edge of people, technology and environment. We see things in context. Without in-depth knowledge of the legal, financial, social and political framework of a project even the most advanced technological achievement will not see the light of day, which is particularly true for Water & Energy projects.

130 years of experience

Our experience is rooted in our Dutch origins. The Netherlands is a delta in one of the most heavily populated regions of Europe, with the lion's share of economic activity situated below sea level. That is why we can offer using water as an organising principle. We are experts in optimising plural use of (water) resources in a growing society and so can heavily contribute to making Water & Energy projects a success for all involved.

One stop shop

We are experienced Water & Energy experts. Royal HaskoningDHV has the combined expertise required for all stages of the project lifecycle under a single roof, whether you seek to greenfield develop hydropower, need support in your transaction, whether you require support in design, tendering and supervision of a construction of a new plant or whether you need support in Asset Management.



State-of-the-art technical expertise

To maintain our leading position and to continue to offer the best possible services and sustainable solutions to our clients, successful innovation, research & development are vital constituents of our activities at Royal HaskoningDHV. Our experts are active in identifying new trends, emerging challenges and technical advancements which we develop into promising opportunities. By using our advanced skills, network and business model we are able to convert opportunities into innovative implementation which offer tangible transformational value within society.

Investment Grade Project Finance & Origination

We understand the commercial needs of our clients and are at home in the fast-paced world of project finance while also being able to liaise closely with technical experts to arrive at an Investment Grade Business Case that delivers the expected functionality against mitigated (acceptable) risk and affordable (optimised) cost and revenue. Our solid project management and stakeholder engagement capability comes in handy due to the dynamic nature of establishing a business case for Water & Energy projects.

Our global network of (private and institutional) investors & financiers, financial institutions, credit agencies, governments, contractors and clients allows us to always provide you the right local context. Our global and local network and presence in the market makes us uniquely capable of pinpointing greenfield investments opportunities at an early stage and develop them into business cases worthy of investment. And of course, all within IFC's Environmental & Social Performance Standards which are a global benchmark for sustainability in Project Financing.

Stakeholder Engagement

Royal HaskoningDHV is an expert in the area of environmental and stakeholder management. The art lies in getting everyone on board around a project from the start and to keep them there until the project is delivered: policy makers, shareholders, interested parties. Without this broad support base, a project has no chance of commercial success. We draw up environmental impact assessments, supervise permit applications and ensure an acceptable project result that enjoys broad support.

Solid Project Management

Securing an unequivocal business case for Water & Energy projects requires understanding of the dynamics of the origination and transaction stage. But also post financial close, detailed design, procurement, implementation and construction of Water & Energy projects are generally of a high risk and require no less than rock solid project management either. Our way of working is grounded in a self-developed and perfected project management quality system. We employ one hundred independently (IPMA) certified project managers who work for public and private partners and who appreciate the dynamics of implementing sustainable Water & Energy projects like no other.





Royal HaskoningDHV

We are a leading, independent, international project management and engineering consultancy service provider. Specialising in Planning & Transport, Infrastructure, Water, Maritime, Aviation, Energy, Mining and Buildings, each year we contribute to the delivery of some 30.000 projects around the world on behalf of our public and private sector clients.

Worldwide expertise

Our 8.000 staff add value to our client's projects by providing a local professional service in more than 35 countries via our fully integrated international office network. As leaders in sustainability and innovation, we are deeply committed to continuous improvement, business integrity and sustainable development and work with our clients, stakeholders and communities to enhance society together.

Our heritage

Prior to merging on 1 July 2012, Royal Haskoning and DHV have successfully delivered millions of world class projects during the past two centuries. With roots established in The Netherlands, United Kingdom and South Africa, our combined experience and longevity span more than 225 years. Now, as one company, we have the power to make a bigger difference in the world as we rise to the challenges of our 21st century planet, towards a better, brighter future.

Today, Royal HaskoningDHV ranks in the top 10 of global, independently owned, non-listed companies and top 40 overall. This makes us the first choice consultancy for involvement in major world themes, such as port-to-port, food and water scarcity, development of mega-cities, and sustainable infrastructure and energy resources & supply, such as wave, tidal and hydropower. We are also well positioned to contribute to the latest business models from PPP to Project Finance.



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