

# THE CHALLENGES OF INVESTING IN NEW ENERGY





In 2008 Vattenfall accelerated its expansion in wind power, primarily through acquisitions in the UK. The Thanet Offshore Wind project will have installed capacity of approximately 300 MW. With the acquisition of Eclipse Energy and AMEC Wind Energy Ltd, and the partnership with Scottish Power Renewables, Vattenfall has taken an active role in wind power development in the UK. Vattenfall already owns the Kentish Flats offshore wind farm in the UK, as well as two of the world's four largest offshore wind farms, Lillgrund off the southern coast of Sweden, and Horns Rev in the Danish North Sea. Vattenfall also operates one of the biggest wind farms in Poland and continues to invest there.

Over the next 20 years, the energy system must be further adapted to support sustainable development in society. The challenge is to provide energy with an acceptable environmental impact at prices that customers, and society, are willing to pay.

Vattenfall's ambition is to develop its generation portfolio in order to meet the long-term target of reducing CO<sub>2</sub> emissions per generated energy unit in own operations by 50% by 2030 compared with 1990. This will be done by replacing old capacity, investing in renewables and nuclear power, and applying CO<sub>2</sub> reduction measures in existing facilities. In addition, the planned growth of the portfolio will enable further emission reductions and meet rising European demand for energy with low emissions. This transition will take time and will require significant financial strength for investment. Vattenfall's plans are already being executed. For example, in 2008, Vattenfall's investments in wind power positions Vattenfall as one of the world leaders in offshore wind power.

### **Society's future need for energy is the starting point**

Vattenfall's business is to provide energy to society. Energy supply of the future is bound by a number of requirements: it must be secure, stable, affordable, meet the environmental requirements of tomorrow, and in all other aspects support sustainable development in society.

Vattenfall's long-term generation portfolio planning is based on society's future energy needs and society's confidence in different energy sources. Development of the generation portfolio and the transition to new energy sources will be gradual and will be based on available technology, resources and infrastructure. New technologies can be introduced when they meet society's need for affordable energy, i.e., when the cost of generation has reached a level that makes energy generation commercially viable.

Vattenfall believes that Europe will be successful in its efforts to boost energy efficiency. This is indicated by estimations of future energy consumption in Europe, where Vattenfall's projection is 10% lower than official EU projections. However, the total amount of energy needed will still be significant, and meeting this need will require the use of all available energy sources. There is no single solution.

### **How investment decisions are made**

Vattenfall's long-term investment roadmap to 2030 represents a transition to new energy sources to ensure future value creation and to reach the tough targets on reducing CO<sub>2</sub> emissions. For further information on strategies and targets, see the section "Vision and strategy for sustain-

ability” (page 4). Vattenfall takes a strategic approach to its production portfolio. In addition to fulfilling criteria for profitability and risk profile, each long-term investment must support Vattenfall’s strategic direction, and the strategic fit is determined by three important aspects:

*The environment:* Investments should support Vattenfall’s environmental ambition or have a specific role in the transition to the energy system of the future. Vattenfall has set tough targets for CO<sub>2</sub> reductions, which has consequences on investment decisions. The wind power acquisitions made in 2008 are examples of preferred investments. Fossil-based power generation will meet this criterion when Carbon Capture and Storage (CCS) technology is mature enough to be applied.

*Society’s confidence:* Society and the market must have confidence in the energy sources in which the investment is made. For example, demands are rising in society for renewable energy sources such as wind power. This is reflected in the introduction of government support schemes to compensate for generation costs above market price. There is also support in general for energy sources that create job opportunities and contribute to regional development.

*Security of supply:* Investments must contribute to the secure supply of energy and stable energy prices. This is achieved by basing generation on fuels with high security of supply, and balancing some energy sources’ dependency on weather conditions (for example wind) with stable base power (such as coal and nuclear power) and regulatory power (such as hydro power). Without security of supply, there is a risk for temporary shortages and blackouts, which would have significant negative impacts on society. Stable and affordable energy prices are the result of low investment costs and secure supply of fuels at stable prices.

An example on how these criteria are applied can be seen in Germany, where lignite is an important source of stable base power, with a supply that is estimated to last hundreds of years. It is also the backbone of industry in the eastern parts of Germany and plays an essential role in the region’s economic development. CCS technology, makes lignite-fuelled generation a viable investment option.

More information regarding Vattenfall’s investment options can be found on the following pages, which provide in-depth information about different sources, their advantages and disadvantages, and the current cost of generation with a market price comparison.

### **Vattenfall’s investments will develop the generation portfolio**

Vattenfall’s roadmap for its future generation portfolio points to increased diversity in energy generation. Profit-

able growth will support achievement of the company’s environmental ambitions by creating the strength and flexibility needed.

*Fossil-based power* generation by Vattenfall will be rejuvenated with the introduction of Carbon Capture and Storage (CCS) technology. By 2030, coal-fired generation employing CCS technology is estimated to make up approximately 16% of total generation, which will significantly contribute to lower CO<sub>2</sub> emissions per kWh in Vattenfall’s portfolio. CCS will initially be introduced where the emission reduction impact is the greatest, taking into consideration plants with high emissions as well as plants with a long remaining useful life.

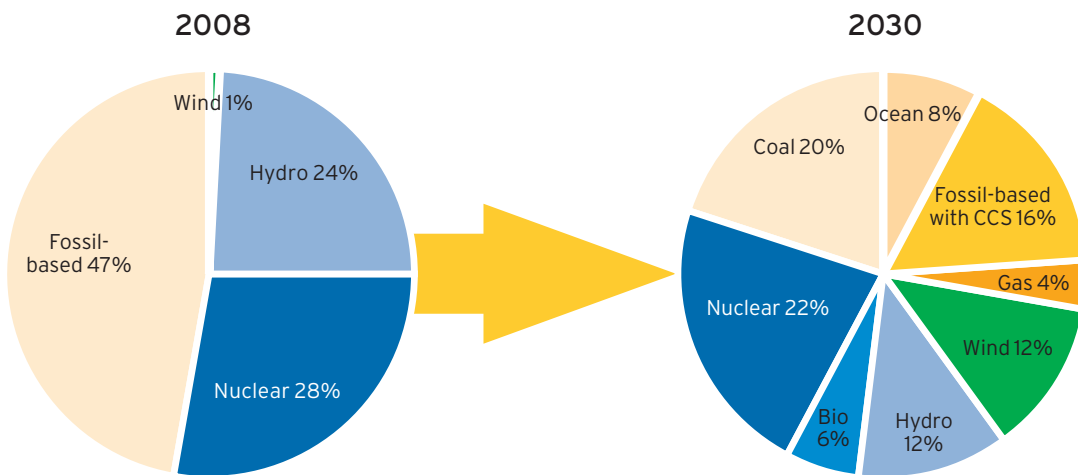
*Wind power* will grow significantly in Vattenfall’s portfolio. Through the investments made in 2008, Vattenfall is well on its way to becoming a world leader in offshore wind power. Investments will continue, and by 2030 wind power is expected to have equal weighting in the portfolio with hydro power. This will also require substantial investments in the electricity distribution grid.

*Ocean energy*, including wave and tidal power, encompasses technologies with immense potential. Ocean energy is also less weather-dependent than wind power, since waves are less variable in power and time. Vattenfall believes that by 2030, ocean energy will be as economically competitive as offshore wind, and the company’s investment plan includes various pilot projects in the years ahead. The Atlantic coastal areas in the U.K, Ireland, Norway and Denmark are well suited for ocean energy.

*Bioenergy* will play a role in heat and electricity generation, though not as a central energy source in the portfolio. Biomass, and especially residual products from other industries and waste, will be used in co-combustion with, and as a substitute for, fossil fuels when possible. Vattenfall addresses sustainability aspects in the use of bioenergy, including such factors as carbon neutrality, transport, and land use changes, such as the risk of deforestation and loss of biodiversity. Vattenfall takes a careful approach to bioenergy in its future generation portfolio.

*Hydro power* is an area where investments are attractive due to its low emissions and its potential as regulating power, which can be balanced against the use of other energy sources. The current expansion potential consists mainly of acquisitions outside Vattenfall’s existing markets. In 2008 a project planned in Vojmån, Sweden, was rejected by a local referendum. Other smaller projects will be continuously proposed. Hydro power will continue to play an important role at Vattenfall, but its share of total generation is expected to decrease to approximately 12% by 2030 due to the limited

Plans for Vattenfall's generation portfolio



Vattenfall's long-term investment roadmap represents a transition to new energy sources to ensure future value creation and to reach the tough targets on reducing CO<sub>2</sub> emissions. The roadmap for the future generation portfolio comprises an increased diversity in power generation and also reflects Vattenfall's intentions to grow. The roadmap is an example how Vattenfall's strategic ambitions are realised and is based on current knowledge and preconditions in terms of cost, environmental impact, society's confidence and security of supply.

Fossil-based power generation with Carbon Capture and Storage (CCS) technology is estimated to make up approximately 16% of

total generation. Wind power will grow significantly in the Vattenfall portfolio, and by 2030 ocean energy will be as economically competitive as offshore wind. Hydro power is an area where investments are attractive due to its low emissions and its potential as regulating power, and nuclear power is expected to continue as an important energy source. Bioenergy will play a role, though not as the most central energy source in the overall portfolio, and natural gas will probably play a minor role for Vattenfall also in the future. Other potential energy sources, such as geothermal and solar energy, are not predicted to be viable large scale options by 2030.

ability for expansion and growth of the total portfolio.

*Nuclear power* is important in Vattenfall's electricity generation. On account of its very low CO<sub>2</sub> emissions, environmental performance, competitiveness and safe operation, nuclear power will continue to be an important part of the energy system in the foreseeable future. Vattenfall believes that nuclear power is needed as a stable base power source and Vattenfall's roadmap calls for expansion of total nuclear power generation in markets where there is confidence in this source of energy. This includes renewing current capacity and potentially investing in new and more efficient capacity. However, the share of nuclear power in the total portfolio is expected to decline since other energy sources are expected to grow more.

*Natural gas* will probably play a minor role in Vattenfall's generation portfolio also in the future. The most efficient way to use natural gas is in combined heat and power production (CHP). Nevertheless, gas is a fossil energy source of high cost and partly insecure supply conditions, and will in the long term require CCS technology to reach emission reduction targets, which will increase cost of generation.

*Other potential energy sources*, such as geothermal and solar energy, are currently not predicted to be viable large-scale options for Vattenfall's generation portfolio by 2030 given the available technology and cost of generation.