The digital edge-transforming responsible development in the energy transition

Dr. Nigel H Wright .Royal Haskoning DHV .Westminster. London.UK

Energy Transition

The energy scape is being transformed and the oil and gas industry is undergoing its own natural selection, requiring leaner more flexible business attuned to exploit new energy resources, in order to survive. Decarbonisation has become a feature in the energy investment market . The Norwegian sovereign fund, worth 1 trillion $, is withdrawing investment in oil and gas companies. Meanwhile ,increasing prosperity around the globe means that millions of people transition from low to middle income. According to The United Nation's Human Development Index (HDI) trends in improved human development, health and well-being are linked to increases in energy consumption up to around 100 Gigajoules (GJ) per head. At $60 a barrel oil and natural gas will represent 50 per cent of power generation by 2040, while renewable energy will lead the new generation capacity. Shell plans to be one of the largest electricity suppliers in the world, while the oil industry is re-inventing itself, exploiting data analytics to catalyse its business delivery, energy supply and products more efficiently.

Big Data in Exploration and Production

In the past, exploration geosciences in exploration and 3D seismic acquisition processing, transformed the oil and gas business. Today, however, the digital edge is led by cloud computing companies. Indeed, oil majors are partnering with "digital cloud giants" to leverage solutions. Total is working with Google, Shell with Amazon web services and Chevron with Microsoft (Upstream 2019).The 4th industrial revolution is here .

Big data technology is transforming exploration and production operations -from identifying prospects on the ground and in reservoirs to corporate strategy decision making at the global level. Analytics companies make production more efficient, automation of problem solving and machine learning will accelerate supply chains and reduce wastage . Increasingly, artificial intelligence is employed to monitor live,,both the performance and the security of infrastructure. Drones, autonomous vehicles and satellites are exploited across the supply value chain. Machine learning is being used to examine the data sets of 1000s of wells in the Northern North Sea to see if oil resources have been missed . Digital twins provide a virtual model of facilities which allow low cost extensive modelling and testing of scenarios to determine reliability and prevent emergencies. Major global energy company's such as Shell are developing the "data driven oil field". Highly trained algorithms, which read seismic surveys and analyses of global reservoirs will increase the success rate of finding oil . Big data is also used to monitor performance of equipment and forecast reserves of oil and gas by determining tends hidden in extensive background data.

Corporate Sustainability

There are wider opportunities to re-focus the use of sophisticated analytics and AI to realistically monitor environmental resources and their status. This can be done simultaneously across the globe from refreshed time series of satellite data and social media-based analytics (twitter feeds , media and semantic tracking). Mapping the environmental and social performance of companies over time ,linked to business and development decisions and programmes, will reveal the real responsibility behind corporations,which in turn impacts industry's licence to operate and corporate reputation for sustainability.

Rise of Renewables

Costs of renewable power continues to fall, due to lower equipment costs, improvement in performance and licence tenders. Renewable energy is rapidly becoming the economic alternative for global energy provision and has had consequences for innovative tidal and wave energy projects. Today's turbines produce 10 times more power per unit. To accelerate the delivery of energy projects at scale, deployment is key, and large turbine arrays are installed with the economies of scale . In UK waters one new turbine per day is being installed. The licencing process has become more streamlined with development companies(supported by specialist consultants) becoming more agile in navigating and delivering the full spectrum of digital data ,analysis and requirements to get a "GO". This expertise will be exploited in new markets in the USA, Japan, Taiwan, China, Australia and beyond.

Wind farm developments based on structures built on the seabed (fixed-bottom solutions), are generally restricted to water of less than 50 metres, due to escalating cost in deeper waters. However, the frontiers of offshore wind are moving to floating units in the deep-water offshore where wind speeds are higher. The world's first floating turbines are providing electricity to the grid through Scotland's Hywind project (Equinor) and Kincardine while trials are being undertaken in Japan. The Hornsea 1 and 2 in the North Sea are the largest farms under construction in the world (developed by Orsted with investment from major pension funds). Dogger Bank, in the North Sea, is located 200 km off the Yorkshire coast, will have an energy generating capacity of 4.8 GW. The Global Wind Energy Council 2018 indicated that 36% of the offshore wind capacity is controlled by the UK, while China South Korea and America are developing their own interests.

Energy resource modelling and risk reduction

Big data is being exploited for wind power involving the use of complex algorithms to construct predictive models of wind conditions which helps determine the amount of energy that is going to be produced. Satellite sensors can be used to scan the globe, and smart algorithms (using multiparameter models) can search for areas and sites where the best wind resource prospects are for future development. Data from space and sensors will facilitate digital twins, sophisticated modelling of wind farm performance and analysis of existing data.

Monitoring

Data analytics will mean greater automation of environmental monitoring. For wide ranging species, such as seabirds and marine mammals, data analytics enables the evaluation of collision risks and wider impacts associated with displacement, breeding and population viability. We are moving towards real time radar monitoring and device management. Digital platforms allow a common data environment for decision makers and developers enabling integration of data streams and common visualization.

Tidal and wave energy never stops, but the challenges of high capital costs ,limited site selection , environmental impacts , technology uncertainties remain as significant risks for bankable projects.

Energy resource prospecting

The use of space data to identify opportunities for renewable energy mixes (wave wind or solar) for different regions or islands remotely, provides a new age of delivering energy for society. Along with larger wind units onshore and offshore fixed and floating wind, a new spectrum of sensors linked to GIS and data banks will allow better prediction of risks through AI and machine learning from operations around the globe, transforming safety in operations and protection of communities.

Remote Management

Once wind farms are installed, sensors transmit vast amounts of data to facilitate remote management of the energy facilities. ENGIE's digital renewable energy solutions has developed the Darwin digital platform. It provides decision support for their operators: performance monitoring and analysis, fault detection and alerts, predictive maintenance, weather-based scheduling of maintenance operations, etc.

Climate Change

Today, climate change is the greatest challenge we face as a species and environmental big data provides an opportunity to understand the scale of complex interrelationships. Satellite data provides a global reach which needs to be exploited. Copernicus and other satellite-based Earth observation programmes provide key information to optimize water resource management, biodiversity, air quality, fishing, agriculture and the ability to track changes driven by the relentless consumption of energy. Forecasting expected long term cumulative impacts, losses of critical environmental functions and modelling impacts of natural events, will future proof development and contingency planning.

Corporate Social Responsibility (CSR)

CSR has emerged as a driver in the financial markets and is increasingly used as a benchmark . Definitions of CSR vary,but put simply it means 'actions by companies over and above their legal obligations towards society and the environment' (European Commission 2011). The reason why companies want to be socially responsible include: attracting investment, marketing and competitive advantage; creation of new value opportunities; reputation enhancement and risk reduction used by markets to rank credit worthiness.

Private companies which claim market share advantage from CSR credentials are often responsible for large areas of land, water resources and environmental resources. However, today these is no standardised approach to track and assess this natural capital on a global basis. To ensure transparency, big data analytics can process time series of data from land measurement, satellites, specialist remote sensing, combined with social needs and resources use (from social media on the internet) , and translate it to a meaningful and transparent metrics, to reveal the true guardianship of resources. Machine learning has the potential to solve some of the world's major environmental change mapping and biodiversity challenges, by addressing data gaps at scale.

Environmental Social and Governance (ESG)

Financial markets continue their drive in evaluation of ESG risk exposure in stocks, in a relentless effort to differentiate themselves as a leading "Responsible Investment House". Increasingly environmental social and performance have revealed "hot spots" which are "red flags" for possible deeper underlying risks which impact stock value and degrade reputation, value, and trust. In the future, it should be a few clicks away to determine the authenticity of social responsibility and then drill down to the real environmental pulse of companies. The day will come when the value of environmental services (under the custodianship of an oil operator, government or investment company) will be "live " (extracted from the ocean of big data), providing penetrating insights into the reality or otherwise of the corporate claims made by companies. Such transparency enables stakeholders and investors to judge their credibility and credentials.

UN Responsible Investment Driver

The United Nations Principles for Responsible Investment (UNPRI) programme -which requires environmental social and governance (ESG) to feature in investment decisions -has been driving investment companies to undertake sustainability assessments of major companies . These serve as

the basis for the Dow Jones Sustainability Indices (DJSI). The financial markets include a wide range of elements in their sustainability indices to rank companies e.g. environment, social, corporate governance ,business behaviour, community, quality global competitiveness , use of resources human and labour , risk management, future proofing etc., openness in reporting positive and negative elements and ethics. However, lack of standardisation threatens to undermine the value of environmental disclosure and SD assessment. The Global Sustainable Investment Alliance (GSIA) indicates that globally sustainable investment assets reached $30.7tr at the start of 2018, a 34 per cent increase from 2016.

In order better predict company's financial performance metrics of industry performance trends, risks and opportunities along the value chain, CSR, and sustainability, have been combined by rating companies. The CSRHub provides access to data on 15,000+ companies from 134 countries. By aggregating and normalizing the information from data sources, a consistent sustainability rating system can be formulated. Linking millions of rating elements on a data base back to their source affords the possibility of benchmarking company performance. Bloomberg uploads financial and ESG data disclosed by public companies in annual sustainability or corporate social responsibility (CSR) reports. Some 800 ESG metrics are tracked by Bloomberg including: environmental, social, carbon use ,water foot-printing, health and safety, and governance elements .

Future

Big data has a role to play in delivering energy with a lower footprint -key to meeting development needs. In parallel, big data analytics is delivering green data to help police the effects of climate change, social impacts and costs associated with energy development. This enables live monitoring and tracking of cumulative impacts , at low cost, and enhanced decision-making ,through learning from a wide spectrum of global events. However, barriers still exist to open access and free sharing of data together with concerns about security. Global calls continue for more transparency to hold companies to account for their stewardship of global resources. Live tracking on the net, and ultimately a responsible league table of energy companies and investors, will drive the market and shine a new light on transparent and responsible investment in society and its needs.

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