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Opportunities, barriers and issues with renewable energy development – A discussion

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ABSTRACT

Energy has come to be known as a 'strategic commodity' and any uncertainty about its supply can threaten the functioning of the economy, particularly in developing economies. Every society requires energy to meet the basic needs. A sustainable socioeconomic development needs secure energy supplies in an affordable rate which have low environmental impacts and low greenhouse gas (GHG) emissions. However 85% of primary energy demand is met by conventional fossil fuel combustion, which is responsible for 56.6% of anthropogenic GHG emissions. Renewable energy (RE) forms play an important role in providing sustainable and clean energy mitigating climate change. In a present scenario, with technological advancements, broaden understanding of renewable energy knowledge and positive support from governments with favorable promoting policies, RE forms are developing meeting energy demands in a cleaner way. This paper focuses on the opportunities, barriers and related issues with the RE developments. These, if taken cared positively, will lead to a sustainable social and economic development

1. Introduction

Because of the increase in petroleum prices, especially after the oil crisis in 1973 and the Gulf War in 1991, geographically reduced availability of petroleum, and the imposition of more stringent governmental regulations on exhaust emissions, researchers have studied alternative fuels and alternative solution methods [63]. When oil price are low the alternative energy becomes less desired, but when oil price increase, alternate energy like solar power, and wind power become good alternatives to oil and gas. Energy quality is an important factor for the development process [10,14,40]. To achieve sustainable development, continuous flow of clean and secure energy is required which has lesser environmental impacts [63]. The fossil fuels fulfill almost 85% of our cumulative energy needs [64]. It also accounts for 56.6% of GHG emissions (CO₂ equivalent) [62]. To achieve sustainable development without damaging climate system, a major shift in energy forms is required [39,54]. However RE technologies are growing continuously and being deployed rapidly, though the RE share of global energy consumption is small.

Speculation over the likely impact of the oil price drop on the renewables market has dominated the headlines. However, we must try to avoid arriving at oversimplified conclusions that assume the two are mutually exclusive or confuse short-term fluctuations with long-term

objectives. The economic, societal and environmental fundamentals underpinning the case for a diversified generation mix to achieve secure and affordable energy are increasingly coming to the fore, removing the black and white choice between renewables and conventional fuels. This article focusses on the current renewable energy initiatives and developments across the globe; opportunities, barriers and issues related with renewable energy development and potential countermeasures and policy implications to overcome these issues.

2. Renewable Energy (RE) – present scenario

Theoretical potential of RE largely exceeds all other energy forms. The absolute size of global technical RE potential is unlikely to constrain RE deployment [53]. Globally it has been estimated that RE accounted for 12.9% of total 492 EJ of primary energy supply in 2008. Major RE contributor has been biomass (10.2%) – most of which is being used for traditional cooking and heating purposes in developing countries. Hydropower accounted for 2.3% and other RE forms accounted for 0.4%. A special report on Renewable Energy Sources and Climate Change Mitigation by [53] states that in 2008, RE contributed 19% of global electricity supply (hydropower 16%, 3% by other RE), biofuel accounted for 2% of global road transport fuel supply and biomass, solar and geothermal together contributed to 27% of global

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demand for heat.

The contribution of RE in the field of energy supply varies by country and region because of diversified geographic distribution of manufacturing, usage and export. From developed nations, the wide acceptability and usage of RE is now moving to developing nations, especially Asia including China, India etc. [71]. China is now one of the highest producer and exporter of solar thermal panels for hot water production, largest investor in thermal water heating and third in bioethanol production [59].

2.1. North America

In the US, projections that solar will reach grid parity in many states by 2016, and a one-year renewal of the production tax credit (PTC) for wind projects applied retrospectively through 2014, are expected to boost a sector already showing signs of recovery [3]. President Obama's ambitious climate change agenda is also helping to drive policy support and investment, though fierce Republican opposition and mixed fortunes for offshore wind are reminders of the uphill battle ahead.

- In the US, the PTC for wind projects was renewed and applied retroactively through 2014, with projects that started construction before the end of the year eligible for the credit. However, the last-minute decision gave developers a limited window to react, potentially reducing the impact [30].
- The US offshore sector has received a further blow, with its flagship 468 MW Cape Wind project pulling out of its land lease contract and losing PPAs representing almost 80% of proposed generation. A 5 GW tender of wind tracts off Massachusetts also resulted in only 2 GW of contract awards, and for lower-than-expected prices [30].
- In Canada, Quebec's 450 MW wind auction has attracted 54 bids totaling 6.6 GW in the call for tenders launched in late 2014, while the Ontario Power Authority has published a list of the 42 firms qualified to participate in its first 565 MW tender for large-scale renewables [31].
- Canada can also now expand its export potential, with the U.S. Department of Energy signing off a presidential permit for a US\$2b transmission line to carry primarily hydro and wind power from Quebec to New York City [31,34].
- Appetite for large-scale projects in Mexico continues to grow, with Chinese developer Risen Energy unveiling plans to build a 300 MW solar power project in Durango State. Meanwhile, Spain's Banco Santander and Gamesa Corp. Tecnologica have applied for environmental permits for a 242 MW wind park in Oaxaca [31,34].

2.2. South America

- Almost 15 GW of wind and biomass projects have been registered to participate in Brazil's April 2015 alternative energy auction. This follows the award of 5 GW in late November 2014 in a tender that attracted 14.2 GW and 4.9 GW of wind and solar applications, respectively [34].
- The latest forecasts indicate Uruguay will be the global leader for wind energy as a proportion of the total energy mix, expected to reach 30% by 2016. State utility UTE intends to sell bonds to help finance the 140 MW Pampa wind farm, the country's largest to date [34].
- Nicaragua is seeking US\$4b of investment to develop almost 1 GW of renewables capacity by 2028.
- The Government of Trinidad has proposed a US\$1b Caribbean Energy Thematic Fund for CARICOM member states to address regional energy security [31].
- Panama has awarded 172 MW of capacity in its first solar tender.
- Honduras has approved 20 solar projects representing 450 MW of capacity, in addition to the 250 MW already under construction

[36].

- In Argentina, China's Power Construction Corp. and US-based Atlanta Power Corp. plan to develop 500 MW of wind projects, while domestic company IMPSA is planning a 250 MW wind park [36].

2.3. Europe

- Germany's cabinet has approved plans for a three-year pilot tender program to award 1.2 GW of new ground-mounted solar capacity, as a test for more far-reaching technology auctions from 2017 onward. The decree foresees 500 MW of solar being awarded this year. The tenders are partly to meet EC guidelines that are looking to phase out FITs, but have attracted criticism from the renewables industry [61].
- The UK has officially launched the first round of its CfD regime, seeing renewables developers compete for £300 m (US\$480 m) of state subsidies. Meanwhile, mixed fortunes for the offshore sector saw a green light for the 1.2 GW Hornsea Project One Wind Park and 2.4 GW of capacity across four projects in Scottish waters; however, the 340 MW Galloper project and 600 MW First Flight wind park have both been dropped by their respective developers. In other marine news, UK insurer Prudential is to inject up to £100 m (US\$154 m) into the £1.0b (US\$1.5b) Swansea Bay Tidal power station, a much-needed boost for the project [36].
- The Netherlands is considering tendering North Sea offshore wind sites that are fully licensed and prepackaged with a subsidy allocation, replacing the current system, which tenders these separately [61].
- China-based PV manufacturer Hareon Solar Technology plans to develop up to 2.5 GW of solar capacity in Turkey, requiring investment of US\$4.5b. The sale of state-owned assets, including energy infrastructure, is expected to dominate M&A activity in 2015 [36].
- Spain's Ministry of Industry says it will support the installation of around 8.5 GW of renewables capacity between 2015 and 2020, comprising mainly wind power. The pledge comes as Spanish clean energy plants are requested to repay €1.2b (US\$1.6b) in FITs paid after subsidies were formally ended in 2013.
- Danish developer European Energy is partnering with NIBC and Boralex to develop a 560 MW near-shore wind portfolio off the coast of Denmark.
- The involvement of pension and life insurance fund Skandia in four wind projects in Sweden totaling 141 MW and worth around US\$260 m represents one of the few direct construction phase investments by an institutional fund.
- Sweden-based Eolus Vind has received the green light to build the 330 MW Oyfjellet onshore wind park in Norway at a cost of around US\$590 m. Meanwhile, Norway's Parliament has approved a US\$1.4b equity investment into state utility Statkraft, to support renewable energy projects throughout Europe [34].
- Despite the relatively slow pace of renewables deployment in Russia, an international JV including Germany's SCHMID Group and Pekintas Group of Turkey has announced plans for a 200 MW solar cell and module manufacturing plant at a cost of US\$450 m [61].
- The Norwegian Ministry of Petroleum and Energy has granted licenses for the construction of two undersea power cables linking Norway with the UK and Germany to facilitate sharing of renewable electricity.

2.4. Middle East and Africa

- South Africa's energy regulator is considering proposals that could see homes and businesses gain credits for feeding surplus rooftop solar power back into the grid. Looking to large-scale solar, the 96 MW Jasper PV plant has begun operations two months ahead of

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