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Sustainable development in Green Energies and the Environment

Abdeen Omer
Energy Research Institute (ERI), UK

The move towards a de-carbonised world, driven partly by climate science and partly by the business opportunities it offers, will need the promotion of environmentally friendly alternatives, if an acceptable stabilisation level of atmospheric carbon dioxide is to be achieved. This requires the harnessing and use of natural resources that produce no air pollution or greenhouse gases and provides comfortable coexistence of human, livestock, and plants. This article presents a comprehensive review of energy sources, and the development of sustainable technologies to explore these energy sources. It also includes potential renewable energy technologies, efficient energy systems, energy savings techniques and other mitigation measures necessary to reduce climate changes. The article concludes with the technical status of the ground source heat pumps (GSHP) technologies.

e: abdeenomer2@yahoo.co.uk

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The use of Imprisonment terms as a tool to Sanction Oil and Gas Pollution offence in Nigeria: A determination of the effectiveness of this tool in the USA

Chukwuemeka Chuks-Ezike
Robert Gordon University, UK

Scholars have argued that Criminal law can be used as a major tool to prevent harm. In China, for example, environmental protection laws provide that certain behaviour such as marine pollution resulting in substantial property loss, injury or death may be dealt with under the criminal law. Hence, pollution crimes (which can cause severe environmental/health harm or even harm to life) can be dealt with using Criminal law.

The exploration and production of oil and gas resources have caused great pollution, and in turn, great environmental and health harm to the Niger Delta region of Nigeria. The pollution is reported to have been mostly caused by oil and gas multinationals operating in the region. Indeed, the extensive nature of the Nigerian oil and gas pollution (together with the enabling statutes that make the offences in its category criminal) makes it the most significant environmental crime in Nigeria.

Interestingly, while Nigeria might have enacted several Environmental-Criminal statutory provisions to deal with these offences, it seems to have continued un-deterred. This is because most of the sanctioning statutory provisions rather project the use of criminal fines to sanction the offence. Moreover, the nature of criminal fines provided under these enabling statutory provisions is often paltry sums that could be easily paid up by the oil multinationals. Even more, some of the statutory provisions that might have created an option of tougher penalties such as imprisonment terms (even up to life imprisonment) might have not been effectively utilised. This is because Nigeria seems to still be lacking in the criminal prosecution of environmental offences in the oil and gas industry.

This article argues that the use of imprisonment terms constitutes sufficient punishment and an effective means to deterrence. To effectively prove this, the article shall review the usage of this tool in the United States of America (USA), the toughness of punishment imposed under the sentencing and the effectiveness of this tool in deterring oil and gas offence in the USA. Hence, the article suggests a wider use of imprisonment terms on offending corporate officers to prevent environmental harm.

e: c.i.chuks-ezike@rgu.ac.uk

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The Climate Change dilemma: Can unpredictability save us?

Aleksandra M Bašič
Cembra Money Bank AG, Switzerland

The climate change is an example of the biggest social dilemma in the human history. Climate change mitigation can be successful only if the whole world will undertake an internationally coordinated collective action. Evolutionary games provide a suitable theoretical framework for studying the challenges of climate change, and we will build on this fact in the present paper to study the evolution of cooperation and discuss its implications for offsetting the temptations to pollute. It has become clear that tackling the climate change will be costly, and accordingly, the temptations to pollute will always be present. Costs to reduce emissions of greenhouse gases can be easily calculated for each individual, but benefits of the successful reduction will be distributed among all the "players", independently from their actual contributions to sustainable development. Evolutionary games have recently been employed successfully to tackle the looming climate change problem. Build on this fact, we study the evolution of cooperation and discuss its implications for offsetting the temptations to pollute. It has namely become very painfully clear that tackling the climate change will be definitely costly, and accordingly, the temptations to pollute will be always be present. Can the element of unpredictability increase the probability of adopting the cleaner strategies? We apply the spatial prisoner's dilemma game where the cooperative behaviour is challenged by defection that promises individuals a higher fitness and is thus more likely to predominate. Results show contrast to the real data and indicators of climate change.

e: sandra666.basic@gmail.com

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Modeling energy efficiency within industry using the IntERACT model

Kristoffer S Andersen[1], **Steffen Dockweiler**[1] and **Henrik Klinge Jacobsen**[2]
[1]Danish Energy Agency, Denmark
[2] Technical University of Denmark, Denmark

The revision of the Energy Efficiency Directive in November 2018 has reaffirmed the focus on energy efficiency policies within EU. However, from a modelling point of view, energy efficiency often appears like an elusive nexus: Where technical savings potential meets market barriers; where fuel cost savings meet demand rebound; and where policy scenarios meets spurious baselines. Nonetheless, the curious task of energy system modelers is to provide insights regarding how to prioritize energy efficiency policies, and what set of policy instruments has the best chance of meeting policy targets. This presentation demonstrates how a state-of-the-art hybrid model (the Danish IntERACT model) provides clarity regarding the interactions within the energy efficiency nexus. In particular, the interaction between the energy system and the wider macro economy. In essence, IntERACT ensures clarity by using a technical energy system model to capture the technical effect, i.e. the choice of end-use technologies and their effect on energy service prices and investments flows. Whereas a general equilibrium model determines activity and price affects associated with changes in energy service prices and investment flows. The presentation demonstrate how keeping track of the activity, price and technological effects, allows IntERACT to provide a unique degree of consistency in assessing the additionality (in terms reduction in final energy demand) associated with an energy efficiency policy.

e: ksa@ens.dk

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Modeling and optimal management of renewable energy resources using multi-agent systems

Muhammad Waseem Khan
Shanghai Jiao Tong University, China

Electrical systems composed of numerous and usually multifaceted components which are difficult to operate and control by efficient ways at the centralized level having problems such as adaptability, mobility, and fault tolerance. Thus, in recent evaluation, renewable energy resources (RERs) have been considered as clean and cost-effective sources for the generation of electrical power at the distributed level. In this context, the awareness of the microgrids (MGs), as sub level technologies of the central grid, booms particularly because of the precise amenities that they can deliver. Therefore, a novel multi-agent system (MAS) based model and the optimal management of a MG integrated with RERs at distributed level is proposed in this paper. Power generation at distributed level comprises of numerous disseminated energy resources having critical and non-critical loads. A controlled architecture of a MG based on the MAS technique is employed for the finest operations of the MG management and power delivery and also offers intelligence to the MG at distributed level. For validation of the proposed model, the power generation within the MG was evaluated by simulation under the capabilities of RERs power production, critical and non-critical load demands, and several grid instabilities. The simulation results prove that the proposed model for the MG management based on MAS technique at distributed level offers robustness and high-performance supervision and control than centralized arrangements.

e: engr_waseem90@yahoo.com

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Optimal economic dispatch in Microgrids with Renewable Energy sources

F Daniel Santillan Lemus
Polytechnic University of Tulancingo, Mexico

Currently, the opening of the energy sector yields a new form of competition and changes of paradigms in the pattern of electricity generation. Then, distributed generation has attracted a great interest for energy contribution in the whole generation of electric power. Today, the concept of microgrids emerges as a natural alternative to the conventional electric power systems, where big synchronous generators in remote sites could be accompanied with smaller generators and shorter transmission lines near to the loads, which provide an effective and sustainable alternative for the integral use of renewable energies. Generation units in microgrids can be conventional generators in the case of thermal generators or diesel engines, in the same way, Renewable Energy Sources (RES) can be included as wind turbines, photovoltaic systems, fuel cells or Battery Energy Storage Systems (BESS). These new technologies offer a feasible electric power system, but its operation is conditioned to consider the particularities and nature of each generation system, combined to the stochastic profile of the primary energy.

It is very important to consider in RES projects that their operation is subject to randomness and interruptions, which makes difficult to find the best dynamic solution in an economic dispatch problem. Thus, the energy management in microgrids seeks to optimize some desired objective function, that defines the cost behavior, reliability and efficiency of the system, as well as the determination of the optimal energy dispatch (economic dispatch), within physical restrictions of conventional and emerge generation systems. Thereby, RES and BESS could meet with complex tasks of interconnection to large power systems, or as a technical alternative to the management of excess/deficiency of generated energy in smaller grids, considering the load variations.

e: fdanielsale@hotmail.com

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The solar irradiance dictates the climate

Habibullo I Abdussamatov
Pulkovo observatory of the RAS, Russia

The climate system depends at an extremely complex set of long-term (≥ 20 years) physical processes in the ocean-land-atmosphere system, which, in turn, is influenced by diverse, mainly quasi-bicentennial variation of the total solar irradiance (TSI). If we take into account only by direct impact of variations TSI~0.4%, the resulting increment in the planetary temperature is ~0.3 K; however, it is extremely important as a triggering mechanism of subsequent multiple feedback effects, which cause a significant change in the magnitude of the Earth's Bond albedo, the content of greenhouse gases in the atmosphere, and the transmission of the atmospheric transparency window. Their climatic influence may up to three times as strong as directly TSI variations do. Quasi-bicentennial cyclic variations of TSI along with very important successive multiple influences of the feedback effects are the main fundamental cause of corresponding alternations of climate variation from warming to the Little Ice Age and by the main factor that controls the climate system. The impact of an increase in the area of the cloud cover, presumably caused by the growth of the cosmic rays flux, on climate is practically absent. The long-term (≥ 20 years) equilibrium state of the average annual energy balance between the Earth and outer space determines stability of the climate. However, since ~1990, the Sun has been in the declining phase of the quasi-bicentennial variation in TSI. The observed practically proportional decrease in the average annual TSI portion absorbed by the Earth since ~1990 has not been compensated by a decrease in the average annual energy radiated into space due to the thermal inertia of the oceans. Since ~1990, the Earth radiates more energy back to space than it absorbs. As a result, the Earth has, and will continue to have, a negative average annual energy balance and a long-term adverse thermal condition. Such gradual loss in the total amount of the solar energy accumulated by the oceans during the twentieth century has resulted in the beginning of a quasi-century epoch of a new Little Ice Age after the maximum phase of solar cycle 24. The warming ended in the 2016. The start of the solar Grand minimum is anticipated in the solar cycle 27±1 in 2043±11 and the beginning of the phase of deep cooling in the new Little Ice Age in 2060±11. Long-term changes in the Sun's energy output can to explain simultaneous climate changes on planets of the Solar system in the last quarter of the 20th century. The gradual weakening of the Gulf Stream power will result in even stronger cooling in the zone of its action. We have developing the special space project "Lunar Optical Observatory" on monitoring energy imbalance between the Earth and space.

e: abduss@gaoran.ru

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