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KEYWORDS

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Presently, the world is facing serious questions and intricate problems dealing with the future of energy sustainability. Renewable energy is the only far-reaching solution. This domain includes wind energy, solar energy and biomass energy.

The introduction(Chapter1, Page-1) describes the question of rising fuel prices, and the financial crisis linked to it. The use of energy from renewable sources plays a pivotal role in human society and concerning sustainability strategy for it is an effective way to counteract several problems at the same time: climate change, shortages of non-renewable resources, the high volatility of world energy prices, the dependency on commodities from politically unstable regions, and welfare losses to these countries.

In the introduction it is itself stressed that an alternative, or better, a supplement to the promotion of the use of renewable in the increase in energy efficiency. In Section-I, the introduction is brief and lucid. In Section-II(Page 2, Page3), the authors discussed the several aspects of sustainability and sustainable energy. Section III(Page 4) deals with the EU Sustainable Development Strategy and the development of some of the "Sustainable Development Indicators" relevant to the theme of "Sustainable Energy". In Section IV(Page10), the authors dealt extensively the chances and limits of renewable energy by discussing the example of biomass – to-liquids. The final section of this chapter provides some conclusions to the role of human mankind to the sustainable energy.

The modern use of the concept of sustainability often emphasizes that there are three dimensions of sustainability: the ecological dimension, the economic dimension and the social dimension. These dimensions are often called the three pillars of sustainability.[2], [4] It makes understandable to even distinguish a fourth pillar of sustainable energy: in Europe according to the author and many other regions of the world green sources of energy are not located at the places where the energy is needed. The regional misbalance of green energy supply and energy demand often requires the transportation of energy over far distances. The transportation of energy from source to sink implies leakages that are in contrast to the goal of sustainable energy.

The four pillars of sustainable energy discussed by authors to the fact that sustainable energy is an extremely diverse topic encompassing many different possible approaches, but not a single sufficient instrument.[1] In Section III(Page 4), the authors dealt with interest the indicators of sustainable energy in the context of the EU Sustainable Development Strategy. The EU Sustainable Development Strategy(SDS) aims at setting out a framework to better live up to this general objective:"The main challenge is to gradually change our current unsustainable consumption and production patterns and the non-integrated approach to policy making".

The EU SDS indicators relevant for sustainable energy can be found in the book's area of subject area climate change and energy. The indicators are widely informative.

A treatise on intricate technical issues are delivered with accuracy in this section. In the conclusion of Chapter 1(Page

16), the authors relates to the readers the discussion of sustainability and sustainable energy. According to them both concepts are multi-faceted and multi-dimensional. The notion of sustainability having an economic, an ecological and a social dimension is widely accepted in the literature. Sustainable energy is often said to rest on two pillars: energy from renewable sources and energy efficiency. The authors have argued that it makes sense to add two other dimensions: energy transport and lifestyle. The sustainable Development Strategy of the EU focuses on renewable and energy efficiency. Without minute details on successful introspection, this treatise on Chapter 1 would not have been possible.

In Chapter 2(Page 21), the author dealt lucidly on low cost but totally renewable electricity supply for a huge supply area with an European and trans European example. Diminishing natural resources and global climate change are threatening the peaceful course of human development and that is effecting the survival of mankind. A strong and fundamental prerequisite for alleviating these dangers is to convert our energy system to renewable and pragmatic generation technologies that neither consume exhaustible resources nor degrade environmental quality despite continuous operation. The author pragmatically deals strongly on this facet of sustainable energy. The questions which lie ahead are as to how the future electricity system should be structured, which techniques should be used and of course, how costly the shift to renewable electricity might be.

In Section I(Page 22) of this chapter, the author dealt severely with an overview which is strong to reach the reader. They delineated the solar energy and wind energy potential in European Union and beyond its borders. The most interesting additional resources one can think of are therefore the huge potentials of wind and solar energy beyond the borders of the EU. In Section II(Page 24), the treatise on electricity transmission is taken into account. Transmission technologies will play a key role in any system employing wide-spread renewable resources for a common supply. Current transmission capacities between EU countries and to adjacent regions are entirely inadequate for transferring the quantities of electricity required for a completely renewable electricity supply. The authors lucidly dealt with electricity transmission problems in future in Germany. Section III(Page 24) deals with potentials of wind and solar energy. The potentials of wind power and solar electricity production from PV and concentrating solar power stations are discussed with intense surgical procedure. Section III.1(Page 25) deals with potentials of wind energy. The potentials of national wind energy are dependent not only on prevailing wind conditions but also on factors such as population density or nature preserves and other restrictions. The question remains unanswered- What are the answers about the developing countries rather than Germany? A rigorous detailed approach to wind power potential in EU and Germany is highlighted. Section III.2(Page 29) deals with photovoltaic potential. According to the authors, the potential for photovoltaic electricity generation has been estimated for Germany in numeric details. An analysis is done for Rooftop PV potentials and Load for the countries –Germany, Portugal, Finland, Algeria and Morocco, and finally Mauritania and Senegal. Section III.2,(Page 30) deals with

potentials of solar thermal generation. A second variety of solar electricity generation makes use of linear concentrating of solar radiation in parabolic mirror arrays. Section IV (Page 31) deals with Smoothing effects of energy sustainability[2].

In this Section IV of Chapter 2 the author cites a problem- if the renewable electricity is delivered with large fluctuations of the generated electricity, the availability of quickly responding power plants becomes increasingly important to avoid bottlenecks of the supply. According to the authors and facts, storage hydropower stations are among the most interesting technologies for this purpose and already exist with high capacities.

The better the renewable energy generation corresponds with the temporal electricity demand, the smaller the power requirements and the necessary storage capacities of the storage power plants engaged for backup purposes. The question of smoothing-generation variations may be smoothed by increasing the geographic distribution of the plants delivering fluctuating electricity.

Section IV.1 (Page 32) deals with smoothing effects for wide-area employment of wind energy. Section IV.2 (Page 33) deals intricately with smoothing effects for wide-area employment of PV generation. Section IV.3 (Page 34) gave a final touch on temporal behavior of the electricity produced by parabolic trough power plants. Section V (Page 34) deals with costs of electricity production and transmission. Section V.1 (Page 35) delineated costs of wind energy- a cost benefit analysis. In a similar manner the author in Section V.2 (Page 37) delves into the costs of solar electricity from photovoltaic generation. The author details the economic facets of the costs of solar electricity. Section V.3 (page 37) deals with costs of solar electricity from concentrating parabolic trough plants.

Section VI (Page 38) deals hard factual scenarios with cost-optimized electricity supply entirely with renewable energies. At the ISET Institute, Germany scenarios for a future electricity supply entirely with renewable energies have been developed. Various and wide-ranging concepts have been studied for providing renewable energies to Europe and neighbouring regions.

Mathematical optimization routines have been applied to the question of which renewable resources with their individual temporal behavior at different sites and different yields should be used, and how selection should be made to achieve optimum cost performance. A mathematical treatise is explained – a linear optimization with roughly 2.45 million restrictions and about 2.2 million free variables was employed to find the best combination in each scenario.

Section VI.1 (Page 40) deals with the promising results for the base-case scenario. The authors analyzed the renewable energy scenario and the biomass energy domain. Section VI.2 (Page 41) deals with the Scenario with transport restrictions. The authors dealt with immense intuition the questions of interregional transmission.

Section VI.3 (Page 41) dealt with scenarios with reduced costs for individual components. The effect of cost changes for individual technologies and components was also investigated in particular scenarios. Again the cost benefit effect of solar thermal power plants comes into picture. Section VI.4 (page 42) deals with the scenario with hydropower at Inga in the Democratic Republic of Congo. Section VI.5 (page 42) deals strictly with the electricity transmission within the scenarios.

A question arises in Chapter 3 (page 48)-What sort of policy instruments do we need to deliver clean energy? The authors dealt with it in details. Much store has been set by "carbon trading" and "green electricity certificate" trading schemes in recent years. They are said to be devices which ensure cost-effective implementation of green energy objectives through competition. By contrast, it has become fashionable to deride instruments which set standards for energy perfor-

mance and which set prices to be paid for different types of renewable energy. They are called "command and control" mechanisms. [2]

Chapter 4 (page 70) deals with economics of decarbonisation. A quote at the beginning of the chapter- "In his famous study about the history of economic theory, Philip Mirowski (1989) claims that economic theory has produced more heat than light when it uses thermodynamic analogies for understanding socio-economic phenomena." . Irrespective of this specific blame, many scientists are convinced that economists have produced more heat than light in the field of climate policy. In contrast to this proposition, it is argued here that economics is necessary to shed light on the dark pathways of decarbonisation. The author deals with the threat of global climate change and avoiding the unmanageable. The role of IPCC is targeted.[3] According to its mandate, the IPCC is charged with summarizing the published readership information concerning global warming and its potential impacts and opportunities to mitigate them. According to the authors , achieving the 2 degrees Centigrade target can be translated in an atmospheric concentration or a global CO2 budget which can be achieved by a certain confidence interval.[4],[5]

Chapter 5 (page 109) is a scientific and technological treatise on combining insights from economics and social psychology to explain environmentally significant consumption.

In Chapter 6, (page 128), the author takes an example of a developed country as Germany on the way to a full supply on the basis of renewable energy.

A scientific treatise so informative can be concluded in this Chapter by the effective admission to the facets of a sustainable energy system which is more than just climate protection and supply security. [1],[2]

Sustainability is more than just climate protection. To be sustainable , any energy supply system must also meet environmental and health standards and be low in risks, error-tolerant, resource-efficient as well as fully economically viable taking external costs into account. A keen insight to this facet- the study of Renewable Energy Outlook 2030 of the "Energy Watch Group".

Another study the author focuses is "Solar Catalonia". The study is targeted on Catalonia's actual electricity energy demand- and how it can be reduced – and the design of an energy supply system, which is able to cover the electricity demand on base of renewable energy technologies.

The question of sustainability and sustainable energy can be highlighted as a groundbreaking step towards the march of our civilization. The fruits are many and varied. The authors pin-points the visionary and versatile facts of this fact in this treatise. The vision of renewable energy and its application is true and rigorous.[3] The book is a highly recommended treatise to a wide range of audience ranging from all areas of human society.[1],[6] It will be useful to engineers, scientists and economists. Besides the book is of reference value for graduate students and researchers.

While the paths leading to environmental sustainability and energy sustainability in each country or each sector will differ , the imminent goal and vision remains constant.[1] But this generalization is far from academic exercise. Ensuring within less than three generations , that as many as 10 billion people are decently fed and housed without damaging the environment on which we all depend represents a monumental challenge and the ultimate target.[6]

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