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Energy certificates REC and PAT sustenance to energy model for India

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ABSTRACT

An innovative energy model is explored for techno-economic feasibility evaluation, taking into consideration the geographical advantages, government policies, regional incentives and energy certificates. In India, two energy certification schemes have been started, namely, the Renewable Energy Certification (REC) mechanism, successfully implemented in India during 2011, and the Perform, Achieve and Trade (PAT) for the Enhanced Energy Efficiency Programme in 2012. This paper reviews the state of the art in designing an energy model at a specific location, with the consideration of solar, wind and ground sources for renewable energy and fossil fuel, to gain optimum performances in energy certificate scenario.

The key design issues about boundary and target settings for REC and PAT energy certificates are discussed to review the financial performance of the schemes taking into considerations energy generators, designated consumers and traders in the market. Due to major impact of micro-medium and small industries (MSME) on Indian economy, this paper discusses the possibilities of inclusion of MSME in PAT scheme. One more addition in PAT scheme, with respect to large unit with marginal available fund for technology upgradation/financially sick unit, invites the creation of consolidated fund, which will support technology absorption and role of state Government policies for funding this mechanism.

The energy model provides the estimation and prediction of hybrid power generation in regard to the parameters of resource potential, technology, efficiency and consumption pattern. The monitoring, statistical and prediction model with inbuilt mechanism for REC and PAT incentives is explored.

Contents

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1. Introduction

After the Kyoto protocol, the United Nations Framework Convention on Climate Change (UNFCCC) had impacted the energy scenario in developing countries like India. The Ministry of New and Renewable Energy (MNRE) had created many schemes for the promotion of generation and use of renewable energy. In 2010 MNRE launched the National Solar Mission to target 20GW off-grid and grid interactive solar power generation by 2022. The Energy Star Rating Programme by the Bureau of Energy Efficiency (BEE) is one of the successful initiatives to target energy efficiency and saving. The Market Transformation for Energy Efficiency (MTEE) scheme targeted to save energy by accelerating the shift to energy-efficient appliances in designated sectors through innovative measures that make the products more affordable. UNFCCC has designed Clean Development Mechanism (CDM) for the implementation at international level for promotion of energy efficiency via technology upgradation in developing countries. India had also implemented CDM and got benefits of the scheme [1,2].

Renewable Energy Certificate (REC) is a National level policy instrument to promote renewable power generation in India. Technologies such as wind, solar PV, solar thermal, biomass and hydro are eligible to earn RECs. Such schemes exist successfully in several parts of the world. Renewable Energy Certificate mechanism in India is a market based instrument to promote renewable energy generation through renewable purchase obligations (RPO) on the energy distributor [3]. The environmental attributes can be exchanged in the form of Renewable Energy Certificates, which are tradable.

Perform, Achieve and Trade (PAT) is a market based mechanism to enhance cost effectiveness of improvements in efficiency in energy intensive industries through certification of energy saving which can be traded. The proposed implementation structure will be institutionalized through an existing institution to provide an extended hand for support to Designated Consumers (DCs) based on measurable performance indicators. The PAT mechanism is designed for review and implementation by Bureau of Energy Efficiency (BEE) under National mission on Enhanced Energy Efficiency (NMEEE) [4,5].

To meet the desired target and support renewable energy, Central Electricity Regulatory Commission (CERC), Ministry of Power, has launched the REC mechanism in consultation with State Electricity Regulatory Commissions (SERC). Bureau of energy efficiency is also working on a draft for PAT mechanism and ESCert trading under NMEEE. In global scenario, solar energy technology diffusion rate is higher due to technological improvements resulting in cost reductions and government policies supportive of renewable energy development and utilization [6]. In India during last decade, wind energy achieved the maximum growth rate in view of regional resource potential. This paper analyses the potential implementation of hybrid power plant (PV/wind/geothermal/fossil fuel) in view of an enhanced energy efficiency scenario.

2. Review of energy model promotion through energy certificate

Richter has designed a utility business model with emphasis on applying the business energy model framework as an analytical tool, and found that existing utility-side business models comprise a series of advantages for utilities in terms of revenue potential and risk avoidance [7]. Ngan and Tan explain the model with the Homer software on the potential implementation of hybrid photovoltaic/wind and diesel system in southern city of Malaysia [8]. Shi and Chew reviewed the state of art in designing a RE model specifically solar, geothermal, and day lighting system to gain the optimum performance in sustainable building [9]. Xie et al. review the status of renewable energy in 34 provinces of China and major cities with focus on national policies, local regulations and the main problems of these provinces [10]. Menegaki, using a random effect model, has studied the causal relationship between economic growth and renewable energy for 27 European countries in a multivariate panel framework over the period 1997–2007 [11]. Jebaraj and Iniyan reviewed different types of models such as energy planning models, energy supply–demand models, forecasting models, renewable energy models, emission reduction models and optimization models [12]. Iniyan et al. explain three models, namely Modified Econometric Mathematical (MEM) model, Mathematical Programming Energy–Economy–Environment (MPEEE) model, and Optimal Renewable Energy Mathematical (OREM) model [13]. The energy certification programmes across the globe are reviewed to study techno-economic feasible energy model.

2.1. European energy certification system (EECS)

Association of Issuing Bodies (AIB) has established a mechanism for the promotion of renewable and efficient energy source by creation of harmonized system "European Energy Certification System" (EECS), to provide an international platform for 18 European countries including Norway, Sweden and 3 from Belgian regions [14]. The EECS system defines the lifecycle of a Guarantee of Origin (GO) in three steps namely issuance, transfer and cancellation [15]. Poullikkas et al. used an optimization model to develop a GA technique for the calculation of both the additional cost of electricity due to the penetration of RES-E technologies as well as the required RES-E levy in the electricity bills in order to fund this RES-E penetration for European Union [16,17].

Electricity Disclosure (ED) as a requirement, was implemented for the first time in the Electricity Market Directive in 2003 and modified in 2009 with EC directive 2009/72/EC, Article 3 (9). This directive requires that suppliers of electricity disclose their electricity portfolio with regard to energy source and environmental impact, specifying the emissions of CO2 and the production of radioactive waste [18]. Valentina and Maarten summarize green certificate/REC trading in the Netherlands in view of ED [19].

RECS International is an association of market players in renewable electricity certificates with 230 members (September 2012) in more than 22 mostly European countries and its stated objective is to promote a pan-European renewable electricity market, facilitated by a commonly accepted and harmonized European information system [14].

The Italian Regulatory Authority for Electricity and Gas is working on steps to increase demand and provide certainty to investors [20].