

05/01131 Wind power electronics. Achieving lower cost, higher efficiency, and superior reliabilityHammell, D. *Refocus*, 2004, 5, (3), 36–38.

There are vast areas of the world with lower wind speeds than are economically viable for electric power generation. The author describes a new development in power electronics for small wind turbines that could make generating wind power at these sites a reality.

Others, including development, economics

05/01132 A new concept for integrating a thermal air power tube with solar energy and alternative, waste heat energy sources and large natural or man-made, geo-physical phenomenonDi Bella, F. A. and Gwiazda, J. *Renewable Energy*, 2005, 30, (2), 131–143.

A method for power generation combining a solar concentration system and a pneumatic power tube system in a large open pit is described. Solar energy is concentrated by a plurality of heliostat mirrors placed along the embankment of the pit, which tends to be spherical in contour. The pneumatic tubes recover waste heat energy from the solar Rankine power cycle system and from a variety of sources that originate from or are in close proximity to the very deep, man-made open-pit mine or from other naturally occurring geo-physical chasms. The man-made or naturally formed chasms provide structural support for the pneumatic power tubes. The air in the tubes is heated by the recovered waste energy, and in so doing, its density is sufficiently reduced so as to produce air drafts from which mechanical power can be recovered from wind turbines and converted into electrical power by suitable electric generators. The deep chasms can be from a man-made phenomenon such as commissioned, open-pit mines or from naturally occurring fissures in the earth. The waste heat can be from solar energy, ground source energy or products of combustion from waste products that are to be mitigated or destroyed. The concept is novel in its integration of a solar powered heat engine with recoverable waste heat via the proposed pneumatic power tube as well as in the means of structural support that the geo-physical phenomenon provides and the modularity (for ease in manufacturing and installation) that makes the pneumatic power tube economically viable. The complete system uses state-of-the-art wind turbine power recovery, solar reflective surfaces for solar energy collection, heat pipe arrays for ground source heat recovery, and air diffuser subsystems for enhanced wind turbine efficiency.

05/01133 Adjustment factors for the ASHRAE clear-sky model based on solar-radiation measurements in RiyadhAl-Sanea, S. A. *et al. Applied Energy*, 2004, 79, (2), 215–237.

The solar-radiation variation over horizontal surfaces calculated by the ASHRAE clear-sky model is compared with measurements for Riyadh, Saudi Arabia. Both model results and measurements are averaged on an hourly basis for all days in each month of the year to get a monthly-averaged hourly variation of the solar flux. The measured data are further averaged over the years 1996–2000. The ASHRAE model implemented utilizes the standard values of the coefficients proposed in the original model. Calculations are also made with a different set of coefficients proposed in the literature. The results show that the ASHRAE model calculations generally over-predict the measured data particularly for the months of October → May. A daily total solar-flux is obtained by integrating the hourly distribution. Based on the daily total flux, a factor ϕ (<1) is obtained for every month to adjust the calculated clear-sky flux in order to account for the effects of local weather-conditions. When the ASHRAE model calculations are multiplied by this factor, the results agree very well with the measured monthly-averaged hourly variation of the solar flux. It is recommended that these adjustment factors be employed when the ASHRAE clear-sky model is used for solar radiation calculations in Riyadh and localities of similar environmental conditions. Instantaneous, daily and yearly solar-radiation on various surfaces, such as building walls and flat-plate solar collectors, can then be conveniently calculated using the adjusted model for different orientations and inclination angles. The model also allows the beam, diffuse and ground-reflected solar-radiation components to be determined separately. Sample results characterizing the solar radiation in Riyadh are presented by using the 'adjusted' ASHRAE model.

05/01134 Design for renewable energy systems with application to rural areas in JapanNakata, T. *et al. Energy Policy*, 2005, 33, (2), 209–219.

This study uses optimization modelling to study efficient ways to integrate renewable energy systems to provide electricity and heat in rural Japan. The model provides minimum cost system configuration and operation taking into account hour-by-hour energy availability and demand. Grid electricity is available to rural areas of Japan, but it is relatively expensive. Local renewable energy generation can be economic while using grid electricity to compensate for the intermittency of the renewable generation. In the model, renewable electricity can be provided by a combination of wind, photovoltaic, and biomass. Heat can be provided by petroleum, LPG, and geothermal heat pumps (GHPs). It was found that due to the relatively high cost of grid electricity, there is significant penetration of wind generation. In turn, the penetration of wind creates economic conditions that encourage GHP penetration. The integrated renewable system reduces the annual cost of the entire system by 31%, and reduces the carbon emissions by 50%.

05/01135 Development of an autonomous PV wind hybrid desalination systemTzen, E. and Sigalas, M. *Refocus*, 2004, 5, (3), 30–31.

The Centre for Renewable Energy Sources (CRES) in Greece in cooperation with two Greek companies, Photovoltaic and Advice is successfully working on an autonomous seawater desalination system driven by renewable energy sources.

05/01136 DynaMotive seeks to change fuels equationSmith, D. C. *Refocus*, 2004, 5, (4), 46–48.

A small Canadian-based company is seeking to establish itself as a major player in the green fuels sector. The company's aim is to make a major impression in global energy markets by developing and commercializing fuels produced from biomass. While it is too early to say whether it will be successful, the firm, DynaMotive, is attracting considerable attention from both the private and public sectors.

05/01137 Energy and the World Summit on Sustainable Development: what next?Spalding-Fecher, R. *et al. Energy Policy*, 2005, 33, (1), 99–112.

Given the importance of energy issues to sustainable development, energy was a priority issue at the World Summit on Sustainable Development in August 2002. The objective of this paper is to examine the outcomes of the Summit on energy, and to assess them against proposals to address the lack of access to modern energy and the need to move toward a cleaner energy system. The lack of political leadership from key countries was found to prevent agreement not only on targets for renewable energy, but also on a programme to promote access. The achievements of the Summit were limited to enabling activities such as capacity building and technology transfer, rather than substantive agreements. While WSSD put energy higher on the agenda than before, no institutional home or programme to take the issues forward has emerged. This therefore remains a critical challenge to be addressed. Achieving this broad goal will require building a coalition to promote cleaner energy, and committing resources to programme for energy access. Based on analysis of proposals and the negotiations, the study proposes several key areas where progress is still possible and necessary, including: shifting more international public and private energy financing toward access investments and cleaner energy investments, advancing regional approaches to access and renewable energy targets, and a range of mechanisms to strengthen institutional capacity for integrating energy and sustainable development.

05/01138 Energy consumption and ventilation performance of a naturally ventilated ecological house in a cold climateSimonson, C. *Energy and Buildings*, 2005, 37, (1), 23–35.

In this paper, the thermal and ventilation performance of an ecological house in Helsinki, Finland are presented. The single-family dwelling has a well-insulated, wooden frame construction with no plastic vapour retarder. The measured and simulated results show that the energy consumption of the house is low and that the outdoor ventilation rate is generally satisfactory based on the measured CO₂ concentrations. Extrapolating the measured ventilation data shows that, when the operable windows are closed, the ventilation rate is expected to be about 0.45 air-changes-per-hour (ach) in the winter and about 0.25 ach in the summer. The consumption of total primary energy and space heating energy were measured to be 30% less (162 kWh/(m² a)) and 36% less (76 kWh/(m² a)) than in typical Finnish houses, respectively. The paper also uses a numerical model to investigate the sensitivity of energy consumption to the insulation level, household electricity and domestic hot water consumption, window area, ventilation rate and heat recovery effectiveness.

05/01139 Global biomass fuel resourcesParikka, M. *Biomass and Bioenergy*, 2004, 27, (6), 613–620.

An overview of biomass for production of densified biofuels on a global scale is given. Bioenergy production as heat, electricity, and liquid fuels represents about 14% of the World's primary energy supply. About 25% of the usage is in industrialized countries and the other 75% is used in developing countries. There is an estimated 3870 (10^6) ha of forest worldwide. The average area of forest and wooded land per inhabitant varies between 6.6 ha in Oceania, 0.2 ha in Asia, and 1.4 ha in Europe. The world's total above-ground biomass in forests amounts to 420 (10^9) tonnes, of which more than 40% is located in South America. Estimates by FAO (2000) show that global production and use of woodfuel and roundwood reached about 3300 (10^6) m³ in 1999. About 55% is used directly as fuel, e.g. as split firewood, and about 90% of this is produced and consumed in the developing countries. The remaining 45% is used as industrial raw material, but about 40% of this is used as primary or secondary process residues, suitable only for energy production. The total sustainable worldwide biomass energy potential is about 100 EJ/a (the share of woody biomass is 41.6 EJ/a), which is about 30% of total global energy consumption today. About 40 EJ/a of available biomass is used for energy. Nearly 60% of this biomass is used only in Asia. A comparison between the available potential with current use shows that on a worldwide level about two-fifths of the existing biomass potential is used, and in most areas of the world the current biomass use is clearly below the available potential. Only in Asia does the current use exceed the available potential. Therefore, an increased biomass use is possible, e.g. for production of densified biofuels, in most countries.

05/01140 Global, direct and diffuse solar-radiation in Syria
Al-Mohamad, A. *Applied Energy*, 2004, 79, (2), 191–200.

Solar-radiation components, namely global, diffuse and direct, were calculated over the Syrian landmass using several mathematical equations starting from the Angström formula. An appropriate theoretical method and a computer program were specially designed and developed for these calculations. The program provides fast, direct and accurate information about the global, diffuse and direct solar-radiations on any site in the country. In addition, the applicability, precision and the accuracy of this method has been statistically tested. The relative percentage error between the calculated values and the meteorological data was found to be in the range of $\pm 3\%$ in the worst case (i.e. for winter time).

05/01141 Modeling hourly diffuse solar-radiation in the city of São Paulo using a neural-network technique

Soares, J. *et al. Applied Energy*, 2004, 79, (2), 201–214.

In this work, a perceptron neural-network technique is applied to estimate hourly values of the diffuse solar-radiation at the surface in São Paulo City, Brazil, using as input the global solar-radiation and other meteorological parameters measured from 1998 to 2001. The neural-network verification was performed using the hourly measurements of diffuse solar-radiation obtained during the year 2002. The neural network was developed based on both feature determination and pattern selection techniques. It was found that the inclusion of the atmospheric long-wave radiation as input improves the neural-network performance. On the other hand traditional meteorological parameters, like air temperature and atmospheric pressure, are not as important as long-wave radiation, which acts as a surrogate for cloud-cover information on the regional scale. An objective evaluation has shown that the diffuse solar-radiation is better reproduced by neural network synthetic series than by a correlation model.

05/01142 Multi-impact evaluation of new medium and large hydropower plants in Portugal centre region

de Almeida, A. T. *et al. Renewable and Sustainable Energy Reviews*, 2005, 9, (2), 149–167.

Traditionally, the decision criteria when analysing hydropower plants projects, has been based mostly on technical and economical analyses focused on the electric production aspects. Nowadays a broader approach is necessary, which takes into consideration multiple impacts such as: energy impacts, water resources impacts, social-economics development impacts, agricultural sector impacts, environmental impacts. In order to establish a ranking of the 14 new medium and large (power above 10 MW) hydropower plants identified in the Centre Region of Portugal, a multi-disciplinary team of Coimbra University carried out a study about the impacts associated to each of the hydropower plants. The analysis considered the different aspects associated to the multi-functional character of the hydropower plants. The overall ranking of the hydropower plants was achieved using a methodology that integrates the different aspects using a weighing function.

05/01143 Pell-Sim-dynamic model for forecasting storage and distribution of wood pellets

Vinterbäck, J. *Biomass and Bioenergy*, 2004, 27, (6), 629–643.

This study examined the system of wood pellet distribution to residential consumers. The distribution cost for a residential pellet consumer typically represents 30% of the per tonne price and of this share, the inventory cost could be more than 50%. Important administrative activities in physical distribution are forecasting demand and inventory control. One way to improve distribution systems would be to optimize inventory management for pellet distributors. The aim of this study was to propose improvements in pellet distribution management by using tools from systems analysis. The ultimate goal was to present an optimized storage level curve adapted to the mid-Swedish community of Avesta. An internal model for optimising inventory management, *Pell-Sim*, was constructed, composed of two integrated parts: a simulation unit to forecast residential wood pellet demand and a spreadsheet unit with inventory-related functions. Daily outdoor temperatures basically regulated the simulation unit. An order point system was chosen for reordering. The residential customers of a distribution company were divided into two groups, delivery and collecting customers, which were statistically treated separately. When collecting and delivery customer input inventories were normally distributed in the intervals from 0 to 3500 kg and 6500 kg, respectively, their annual means of total delivery were both about 7000 kg/customer, which was the desired and empirical level. The expected pellet customer orders were negatively correlated to mean daily temperatures, lagging behind about 1 month. Sensitivity analyses showed that monthly results for ordered quantity and total cost were particularly sensitive to ordering and carrying costs. The *Pell-Sim* programme can easily be adapted for distributors in other geographical regions.

05/01144 Pricing sustainable development

Gauthier, C. *International Journal of Environmental Technology and Management*, 2004, 4, (4), 291–299.

One of the difficulties in sustainable management is pricing non-market elements of a management strategy so that they can be weighted and prioritized correctly. Contingent valuation appears to be one approach to solving this problem. The Contingent Valuation Method is based on consumers' direct revelation in contingent scenario situations. This permits revealing people's willingness to pay for a non-marketed good, like more fresh air or a programme of environmental preservation. This paper presents an application of the Contingent Valuation Method to a public sector case on environmental preservation. A contingent valuation survey was carried out on a local sample of 402 individuals to reveal the value they give to a particular biodiversity programme. Methodology and results are explained with the view to providing a tool for managers involved in developing policies that have a sustainable advantage.

05/01145 Radiational panel cooling system with continuous natural cross ventilation for hot and humid regions

Song, D. and Kato, S. *Energy and Buildings*, 2004, 36, (12), 1273–1280.

This paper investigates a hybrid cooling system, utilizing wind-driven cross ventilation and radiational panel cooling in an office setting. The characteristics of the indoor environment are examined using computational fluid dynamics (CFD) simulation, which is coupled with a radiation heat transfer simulation, and HVAC control in which the PMV value for a human model in the centre of the room is controlled to attain the target value. The system is devised with an energy-saving strategy, which utilizes stratified room air with a vertical temperature gradient. The cooled air settles down within the lower part of the room, while the hot and humid air passes through the upper region of the room, sweeping out the heat and contaminants generated indoors. This strategy is found to be quite energy-efficient in the intermediate seasons of spring and autumn in Japan. Even under hot and humid outdoor conditions, the hybrid system coupled with radiational cooling would bring significant energy savings are possible compared with a hybrid system coupled with underfloor air-conditioning.

05/01146 Renewable energy and food supply: will there be enough land?

Nonhebel, S. *Renewable and Sustainable Energy Reviews*, 2005, 9, (2), 191–201.

The use of renewable energy sources like photovoltaic systems and biomass plantations require land to intercept incoming solar radiation. This implies that the total amount of energy that can be obtained from these sources is limited. Next to this land is also in use for other purposes, of which food production is the most important. The area required for both food and energy supply depends on one hand on the consumption and on the other on the production per m². Large differences in both production and consumption are observed globally. In this analysis distinction is made in land use requirements in so-called 'poor' and 'rich' circumstances. It is shown that in poor circumstances there is not enough land to fulfil the needs for food and energy when biomass is used as and energy source. In the rich situation prospects seem to be better, but in that case a large-scale transformation is required of woodlands and forests into intensive energy crop