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Energy Production Ethics Bibliography

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Description

This bibliography addresses general issues of energy production along with specific articles about Biofuels, Carbon Capture and Storage, Conservation, Fuel Cells, Geothermal Energy, Hydrogen, Hydroelectric Power, Nuclear Power, Solar Power, Tidal and Wave Power, and Wind Power.

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General Articles

Arent, Douglas. 2010. The Role of Renewable Energy Technologies in Limiting Climate Change. *The Bridge*. 40(3): 31-39.

This article provides a summary of renewable energy technologies, and discusses how they could play a major role in global energy supply in the future. The author discusses resource potentials for renewable energies in the United States, technology advancements and cost trends, investment trends, and the policy landscape for renewable energies. He finishes by discussing what needs to be done on the research and policy fronts to implement a coordinated action to increase the use of renewable energy on a national scale so this source of power may help limit climate change in the years to come.

BojiiÄ, Milorad. 2010. Will Renewable Energy Save Our Planet? *American Institute of Physics Conference Proceedings*. 1239(1): 12-21

This paper discusses some important fundamentals behind the application of renewable energy to evaluate its impact as a climate change mitigation technology. The author concludes, after reviewing many aspects of renewable energy solutions, that the future energy solution may not only come from renewable energies but be an energy mix that may contain nuclear energy, non-nuclear renewable energy, fossil fuel energy with carbon dioxide sequestration, energy saving, and an overall decrease in energy consumption.

Byrne, John, Cecilia Martinez, and Colin Ruggero. 2009. Relocating Energy in the Social Commons: Ideas for a sustainable energy utility. *Bulletin of Science, Technology & Society*. 29(2): 81-94.

This article discusses the drawbacks of two prominent proposals for solving climate change and rising energy costs, a nuclear power renaissance and mega-scale renewable energy development, and instead looks at a third approach, a Sustainable Energy Utility. This strategy would seek to reduce energy use and support remaining energy needs by community-scale renewable energy solutions. The author discusses how this plan could help move society from an energy commodity to an energy commons regime.

Evans, Robert L. 2007. *Fueling Our Future: An introduction to sustainable energy*. New York: Cambridge University Press.

This book provides a concise overview of current energy demand and supply patterns and a balanced view of how our reliance on fossil fuels can be changed over time so that we have a more sustainable energy system in the near future. Includes information on wind, solar, nuclear, ocean, and biomass energy.

Ferguson, Tom and Paul Weber. 2009. Educating Engineering Students on Energy Systems through Investor-Driven Class Projects. *ASEE Annual Conference and Exposition, Conference Proceedings, 2009. 14-17 June, 2009.*

This conference paper describes a project in an engineering class that introduces students not only to energy conversion technology, but also resource availability, energy delivery, policy, reliability, short and long term financial benefits, and social and environmental costs. The students are asked to choose a conversion technology for electric power generation and to write a paper discussing why they supported or opposed its implementation, and presented their research to their peers. Then, the entire class was split into groups of short and long term investors and given a pool of money to allocate to a variety of technologies and sources to create a true energy portfolio.

Jefferson, Michael. 2008. Accelerating the Transition to Sustainable Energy Systems. *Energy Policy. 36(11): 4116-4125.*

Discusses reasons for the slow pace of transition to sustainable energy and the need for the involvement of people at the grassroots level and for policies to adopt sound commercial and technical criteria when setting goal. Accountability also needs to be built into these sustainable energy policies and initiatives to ensure that progress is made, especially as fuel prices continue to rise.

Masters, Gilbert M. 2004. *Renewable and Efficient Electric Power Systems.* Hoboken, N.J. John Wiley & Sons.

This textbook discusses new trends in distributed power generation systems and renewable energy sources in electric power systems. It covers both fundamental concepts in this area, as well as giving an overview of major technologies in the renewable energy product area.

Hurtado, Omar and Carlos Hunte. 2007. Educating Engineers in Sustainable Energy Development: An interdisciplinary Approach. *International Journal of Engineering Education. 23(2): 266-275.*

The authors highlight the importance of teaching engineering students about sustainable energy development and the need for education initiatives of this kind to

encompass the three areas of economy, environment, and society. Sustainable energy education must be structured in an interdisciplinary manner whereby engineering modules are complimented with legal, social, economic, managerial and environmental coursework. A good way to develop skills in non-engineering areas is through group projects with non-engineering students.

Jennings, Philip. 2009. *New Directions in Renewable Energy Education. Renewable Energy. 34(2): 435-439.*

As the renewable energy industry continues to grow, there has been a rapid increase in the demand for renewable energy specialists who are able to design, install, and maintain such systems. Therefore, there is an urgent need to develop and implement new courses that prepare engineers, scientists, and energy planners to work with renewables to produce sustainable energy generation systems. This paper looks at the aims, philosophy, structure, and outcomes of several initiatives of this kind and describes some aspects of training engineers in cooperation with the renewable energy industry.

National Academy of Sciences, National Academy of Engineering, National Research Council. 2009. *America's Energy Future. Washington, D.C.: National Academies Press.*

Discusses the potential of a range of emerging energy technologies for addressing the U.S.'s energy needs in the future, including technologies for generating, distributing, and conserving energy. Including coal-fired power generation, nuclear power, renewable energy, oil and natural gas, and alternative transportation fuels. The report identifies the impacts and projected costs, as well as the timing of implementing each technology.

National Academy of Engineering. 2010. *Electricity from Renewable Resources. Washington D.C.: National Academies Press.*

Reports on the findings of a committee of experts who were asked to review the technical potential of alternative energy sources such as wind, solar-photovoltaic, geothermal, solar-thermal, hydroelectric, and other renewable. The report provides clear characterization of these technologies, estimates of costs, performance, impacts, and barriers for future research and development.

Onat, Nevat, Haydar Bayar. 2010. *The Sustainability Indicators of Power Production Systems. Renewable and Sustainable Energy Reviews. 14(9): 3018-3115.*

Discusses a study in which the sustainability of hydrogen fuel cells, hydroelectric,

wind, solar, and geothermal sourced electricity systems, in addition to fossil fueled coal, natural gas, and power plants, were studied in order to see which had the highest sustainability indicators. Sustainability parameters included carbon dioxide emissions, land use, energy output, fresh water consumption, and social and environmental effects. The authors concluded that taking into account only technology currently available, overall, wind and nuclear energy had the highest sustainability indicators of all those researched. They also hypothesized that new research in the fields of renewable energy may change this alignment.

O'Neill-Carillo et al. 2008. Advancing a Sustainable Energy Ethics Through Stakeholder Engagement. *IEEE Energy 2030 Conference, 17-18 November 2008: Atlanta, Georgia.*

This paper focuses on responding to the challenge of energy sustainability by advancing a new energy ethics that seek to address many of the ethical issues raised when seeking to develop policy solutions to address climate change. It discusses a stakeholder engagement framework developed at the University of Puerto Rico, Mayaguez that can help produce a positive circular feedback loop between stakeholder involvement and the successful implementation of an energy ethics.

Pecen, R. T. Hall, F. Chalkiadkis, A. Zora. 2003. Renewable Energy Based Capstone Design Applications for an Undergraduate Engineering Technology Curriculum. *Frontiers in Education, 2003. 5-8 November, 2003. S1E*

Describes a capstone course taken by seniors of the Electrical and Information Technology Program at the University of Northern Iowa in which students learn about renewable energy applications, and work on design projects that promote environmentally friendly technologies for the Iowa region, including wind and solar power technologies.

Sarewitz, Daniel, et al. 2014. *The Rightful Place of Science: Government & Energy Innovation. Consortium for Science, Policy & Outcomes.*

Innovation in the energy sector is necessary to maintain economic competitiveness, meet ever-increasing energy demands, and limit the changes to our atmosphere caused by the burning of fossil fuels. Key to advancing the necessary innovations is an understanding of the vital role of the public sector. Government support has been crucial for transforming lower-carbon energy technologies, ranging from solar power to biofuels to efficient gas turbines, into fundamental components of a cleaner U.S.

energy sector. But the government role has been highly complex, and its contributions have been uneven. In a series of in-depth case studies, *The Rightful Place of Science: Government & Energy Innovation* examines the many ways in which government innovation policies and activities, often carried out in close partnerships with the private sector, have helped to create and steer the development and improvement of technologies that underlie the energy infrastructure of the future.

Tester, Jefferson W. et al. 2005. *Sustainable Energy: Choosing Among Options*. Boston, MA: MIT Press.

This reference book discusses the many different technologies that may play a part in finding a solution to the sustainable energy challenge we currently face. The book first discusses tools for making informed energy solutions, examines the broader aspects of energy use, and then goes on to examine the main energy sources of today and tomorrow, including wind energy, hydropower, biomass, nuclear power, wind and solar energy, geothermal energy, and fossil fuels. It looks at the technologies used for each power option, its environmental impacts, and its economics.

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Biofuels

Durusoy, I, M.F. Turker, S. Kelen, K. Kaygusuz. 2011. Sustainable Agriculture and the Production of Biomass for Energy Use. *Energy Sources Part A: Recovery, Utilization & Environmental Effects*. 33(10): 938-947.

Though modern bioenergy is seen as a promising option to curb greenhouse gas emission, a potential competition exists for the use of land and water between bioenergy and food crops, with another pressing issue being the need to change conventional agricultural practices to make using biomass for energy a more sustainable option. The authors point to the need to increase sustainability in agriculture via measures such as organic farming before bioenergy can be looked as a strategy to meet significant parts of the world energy demand.

Landeweerd, Laurus., Patricia Osseweijer, and Julian Kinderlerer. 2009. Distributing Responsibility on Sustainable Biofuels. *Science and Engineering Ethics*. 15(4): 531-543.

In the perception of technology innovation, two world views prevail: technical

determinism, that societal change is caused by technological developments, and social determinism, a view that holds that technological change is caused by societal developments. These two world views play a role in current social debates about technology development, and the authors look at this influence by using the case study about the debate about the implementation of biofuels as an example.

Mielenz, Jonathan. R. 2011. Biofuels from Protein. *Nature Biotechnology*. 29:327-328.

Discusses how rerouting nitrogen flux in bacteria allows for renewable production of biofuels from proteins. This strategy provides a new route to making biofuels and may address long standing problems in the field such as nitrogen recycling.

Pinentel, David. 2009. *Biofuels, Solar and Wind as Renewable Energy Sources*. Dordrecht: Springer.

Looking most closely at biofuels, the author discusses some of the major environmental problems associated with biofuels, wind and solar power, as well as the effectiveness and economics of renewable energy sources of this kind.

Pimentel, David et al. 2009. Food Versus Biofuels: Environmental and Economic Costs. *Human Ecology: An Interdisciplinary Journal*. 37(1): 1-12.

As the world population continues to grow, as does the need for energy. The ethical issues surrounding the use food crops such as corn to produce ethanol raises major ethical questions. Nearly 60% of humans in the world are currently malnourished, so the need for grains and other basic food is critical. Growing crops for fuel squanders land, water and energy resources vital for the production of food for human consumption. The authors of this article claim that growing crop for biofuels not only ignores the need to reduce fossil energy and land use, but exacerbates the problem of malnourishment worldwide.

Rulkens, Wim. 2010. Sewage Sludge as a Biomass Resource for the Production of Energy: Overview and assessment of the various options. *Energy and Fuels*. 22(1): 9-15.

Discusses how sewage sludge from the treatment of municipal wastewater could be used to produce energy, including anaerobic digestion, co-digestion, incineration in combination with energy recovery, co-incineration in coal fire plants or in combination with organic was focused on energy recovery, use as an energy source in the production of cement or building materials and many other potential uses.

Thomson, Paul B. 2008. The Agricultural Ethics of Biofuels: A first look. *Journal of Agricultural and Environmental Ethics*. 21(2): 183-198.

This article proposes two complimentary philosophical approaches to examining the questions that should be posed in connection with the increased use of biofuels to meet the growing demand for energy worldwide. The first stresses a critique of underlying epistemological commitments in the scientific models being developed to determine the feasibility of various biofuels proposals, and the second looks at the philosophical goals of agriculture and then looks at how a turn to biofuels might function within that philosophy.

United States National Research Council, Policy and Global Affairs Division, Science and Technology for Sustainability Program. 2010. *Expanding Biofuel Production: Sustainability and the Transition to Advanced Biofuels, Summary of a Workshop*. Washington, D.C.: National Academies Press.

Discusses the sustainability of biofuels and the need to make sure large-scale use does not compromise the needs of future generations. The report look at possible effects on water quality and quantity, soils, wildlife habitat and biodiversity, greenhouse gas emissions, public health and the economic viability of rural communities specifically in the U.S. upper Midwest region.

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Carbon Capture and Storage

Chalmers, Hannah and Jon Gibbins. 2010. Carbon Capture and Storage: More Energy or Less Carbon? *Journal of Renewable and Sustainable Energy*. 2(3): Article number 031006.

Discusses the potential for carbon capture and storage to help keep coal as an electricity generation fuel and examines related risks such as the potential for the long-term leakage. Despite these risks, the authors believe that carbon capture and storage is a valuable tool if projects of this kind are carbon-neutral or are able to capture around 90% or more of the fossil carbon of fuel used. The authors discuss various projects of this kind and their potential for adding to a sustainable energy solution for the future.

Haszeldine, R. Stuart. 2009. Carbon Capture and Storage: How Green Can Black Be? *Science Magazine*. 325(5948): 1647-1652.

Discusses the process of the capturing of carbon dioxide at the point of emission from gas or coal burning power plants and the many technical, commercial and political hurdles that will need to be overcome before a viable carbon capture and storage industry can be created between 2020 and 2030.

MacGill, Ian, Robert Passey, and Terry Dale. 2006. The Limited Role for Carbon Capture and Storage (CCS) Technologies in a Sustainable Australian Energy Future. *International Journal of Environmental Studies*. 751-763.

After laying out a simple technology assessment framework for policymakers to evaluate the different options for cutting global emissions, the authors apply this framework to carbon capture and storage and suggests that it should be considered as a promising but still somewhat unproven option. There are some questions regarding its effectiveness and safety, and it is unlikely to be able to make significant contributions for at least a decade.

Van Alphen, Klass, Paul M. Noorthout, Marko, Hekkert, Wim C. Turkenberg. 2010. Evaluating the Development of Carbon Capture and Storage Technologies in the United States. *Renewable and Sustainable Energy Reviews*. 14(3): 971-986.

Reviews the development of carbon capture technology from 2000 and 2009 and discusses policy recommendations for technology managers who wish to accelerate the deployment of carbon capture and storage development. The major needs are to stimulate technological learning, to facilitate collaboration and coordination in the field, to create financial and market initiatives for the technology, and to provide supportive regulation and sound communication on carbon capture and storage.

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Conservation

Blankinship, Steve. 2001. Can Power Producers Out-Recycle the Aluminum Industry? *Power Engineering*. 105(5): 10.

This short article discusses how the power industry can become an environmental champion by recycling the resources used to make energy.

Chou, M.-IM, V. Patel, S.-F.J Chou, and K.K. Ho. 2003. A Coal Combustion Byproduct, Fly Ashy, for Fired Building Brick Making : A preliminary

technical feasibility study. *Journal of Solid Waste Technology and Management*. 29(4): 217-22.

Discusses a study that sought to use fly ash from coal burning electricity plants, which usually is ponded or disposed in landfills, to make bricks. The study found that the bricks containing 20% to 40% fly ash instead of conventional raw materials, had better color, physical consistency and fired compressive strength than those of standard bricks.

Date, C. 2004. Successful Waste Water Reuse. *Pollution Engineering*. 36(9): 16-21.

Discusses how power plants can reuse municipal wastewater in their production of energy and new projects being built around the country that are effluent-fed power facilities. The authors discuss the success of one such plant in Lodi, California.

Dixon, Robert, Elizabeth McGowan, Ganna Onysko and Richard M. Scheer. 2010. US Energy Conservation and Efficiency Policies: Challenges and opportunities. *Energy Policy*. 38(11): 6398-6408.

Expanding energy conservation and efficiency in every sector nationwide is one of the most cost-effective instruments for reducing U.S. energy imports, the trade deficit and energy's environmental impact. This article reviews the history of U.S. energy conservation and efficiency policies, and discusses key provisions currently in law that will affect how engineering projects will be built and managed both now and in the future.

Lovins, Amory B. 2010. Profitable Solutions to Climate, Oil, and Proliferation. *Royal Swedish Academy of Sciences*. 39:236-248.

<http://www.rmi.org/cms/Download.aspx?id=2500&file=2010->

[18_ProfitableSolutionsClimateOil.pdf&title=Profitable+Solutions+to+Climate,+Oil,](#)

This article argues that protecting the climate is actually profitable if we approach the problem through the perspective that saving fuel costs is much more economical (as well as environmentally beneficial) than buying more fuel. The author argues that by investing in integrative design that captures multiple benefits from single expenditures, adopting and enforcing energy efficient standards for buildings and appliances, and rewarding utilities who cut people's bills rather than selling more electricity is the way to help control climate change and stop U.S. dependence on foreign oil.

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Fuel Cells

Adler, Stuart B. 2005. Fuel Cells: Current status and future challenges. *The Bridge*. 35(4); 28-32.

Fuel cells, which convert chemical energy directly into electricity, are more efficient than current means of energy conversion. The question is where they might fit in the broad spectrum of energy choices. This paper briefly reviews and compares polymer-electrolyte fuel cells (PEFCs) and solid-oxide fuel cells (SOFCs) and then describes significant scientific challenges that must be overcome before these technologies can become commercially competitive.

Briguglio Nicola, Et al. 2010. Renewable Energy for Hydrogen Production and Sustainable Urban Mobility. *International Journal of Hydrogen Energy*. 35(18): 9996-10003.

This article does an economic and environmental analysis and life cycle assessment on the feasibility of a start-up renewable energy plant located in Italy which will use renewable energy sources to produce hydrogen from an electrolyzer, which will then feed a fleet of buses using fuel cells as an energy source.

Hedstrom, Lars, et al. 2006. Key Factors in Planning a Sustainable Energy Future Including Hydrogen and Fuel Cells. *Bulletin of Science, Technology* 26(4): 264-277.

The authors discuss future energy systems that rely on hydrogen and look at energy storage, transportation and energy use of hydrogen in vehicles from a sustainability perspective. The authors point out the need to be aware of the losses implied by the product, packaging, distribution, storage, and end use of hydrogen, and look at how plug in or fuel cell hybrids might be a better option for some types of vehicles over a battery electric vehicle in which is the most energy efficient.

Lin, Jung-Chou, Russell, H. Kunz, James M. Fenton, and Suzanne S. Fenton. 2004. *Chemical Engineering Education*. 38(1): 38-47.

Describes how because of its safety and operational advantages, the proton exchange membrane fuel cell is a good choice for an undergraduate laboratory experiment in a chemical engineering course and as a way to introduce students to issues of renewable energies and energy ethics.

Rabaey, Korneel and Willy Verstraete. 2005. Microbial Fuel Cells: Novel biotechnology for energy generation. *Trends in Biotechnology*. 23(6): 291-298.

Discusses how bacteria in microbial fuel cells use an anode as an electron adapter, to what extent they generate electrical output, and compares microbial fuel cell technology to current alternatives for energy generation.

Watanabe, Kazuya. 2008. Recent Developments in Microbial Fuel Cell Technologies for Sustainable Energy. *Journal of Bioscience and Bioengineering*. 106(6): 528-536.

Microbial fuel cells are devices that exploit microbial catabolic activities to generate electricity from a variety of materials, including complex organic waste and renewable biomass. The author discusses the advantages this kind of fuel cell has over chemical fuel cells that can only utilize purified reactive fuel and discusses the technical advances and research that needs to continue so microbial fuel cells can be of practical use in the near future.

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Geothermal Energy

Axelsson, Gudni. 2010. Sustainable Geothermal Utilization: Case histories, definitions, research issues and modeling. *Geothermics*. 39(4) 283-291.

Discusses the successes of geothermal systems worldwide and how modeling studies indicate that geothermal energy can be used in a sustainable manner, and how long-term studies of its sustainability can be accomplished. It then presents the sustainability modeling studies for the Hamar and Nesjavellir geothermal systems in Iceland, the Beijing Urban system in China and the Olkaira system in Kenya as examples.

Balat, M. H. Balat, U. Faiz. 2009. Utilization of Geothermal Energy for Sustainable Global Development. *Energy Sources Part B: Planning & Policy*. 4(3): 295-309.

Discusses the possible role geothermal resources could play in contributing to sustainable energy use in many parts of the world. After examining the technology, economics, and environmental acceptability of geothermal energy, the authors go on to investigate how it can be used effectively in the near future.

Ghose, Mrinal K. 2004. Environmentally Sustainable Supplies of Energy with Specific Reference to Geothermal Energy. *Energy Sources*. 26(6): 531-539.

Discusses alternative energy sources available to India and the rest of the world and key environmental issues associated with each. The author concludes that geothermal energy has a promising future and discusses its potential, recovery, present scenario of utilization and its utility as a cleaner energy source in India and elsewhere.

Kömürcü, Murat İsan, and Adem Akpınar. 2009. Importance of Geothermal Energy and Its Environmental Effects in Turkey. *Renewable Energy: An International Journal*. 34(6): 1611-1615.

Discusses the important role geothermal energy has the potential to play in resolving energy issues in Turkey and its potential environmental benefits.

Rybach, Ladislaus. 2003. Geothermal Energy: Sustainability and the environment. *Geothermic*. 32(4): 463-470.

Discusses the sustainability of geothermal energy as compared with fossil fuels and discusses the minor, controllable environmental impacts of this source of energy. However, for the responsible use of geothermal energy, there must be full compliance with environmental regulations, which may vary from country to country, and environmental effects must be monitored and documented, rated, and if necessary, reduced.

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Hydrogen

Blekhman, David et al. 2010. National Hydrogen and Fuel Cell Education Program Part I: Curriculum, and Part II: Laboratory Practicum. *ASEE Annual Conference and Exposition, Conference Proceedings, 2010. June 20-23, 2010*.

Describes the results from a project funded by the Department of Energy that sought to develop and expand education programs in hydrogen and fuel cells. The paper present the educational efforts and models being developed at five different engineering schools around the country, and shares the wealth of approaches taken and the challenges and accomplishment of developing this curriculum. The second

article discusses the integrated laboratory practicum associated with these courses that support student learning and how equipment available on the market and custom-built laboratory units are being utilized in the laboratory practicum.

Edwards, P.P., V.L. Kuznetsov, W.I.F. David, and N.P. Brandon. 2008. Hydrogen and Fuel Cells: Towards a Sustainable Energy Future. *Energy Policy*. 36(12): 4356-4362.

Discusses how hydrogen and fuel cells are likely to be one of the key energy solutions for the 21st century and how they will contribute significantly in environmental impact, enhanced energy security, and the creation of new energy industries. This paper discusses key scientific and technical challenges that hydrogen and fuel cells must overcome before they can make a significant impact to cleaner and more efficient energy production processes.

Granovskii, Mikhail, Ibrahim Dincer, and Marc A. Rosen. 2006. Environmental and Economic Aspects of Hydrogen Production and Utilization in Fuel Cell Vehicles. *Journal of Power Sources*. 157(1): 411-421.

This article considers three technologies for hydrogen production: hydrogen from natural gas reforming, and the use of wind and solar energy generation to produce hydrogen via water electrolysis. The authors found that in the case of all three, a decrease of environmental impact (air pollution and greenhouse gas emissions) is accompanied by a decline in the economic efficiency. However, the authors conclude that hydrogen production from wind energy via electrolysis is more advantageous for mitigating greenhouse gas emission and that traditional gas reforming is more favorable for reducing air pollution.

Kumar, P, Britter, R. and Gupta N. 2009. Hydrogen Fuel: Opportunities and Barriers. *Journal of Fuel Cell Science and Technology*. 6(2): 021009.

Discusses how hydrogen fuel could be the fuel for the future because of its clean nature and ubiquitous presence. However, a number of hurdles exist that need to be overcome before it can become a viable energy option. This paper discusses the economic, social and technological implications on the use of hydrogen as a future transport fuel.

Whitmarsh, Lorraine and Martin Wietschel. 2008. Sustainable Transport Visions: What role for hydrogen and fuel cell vehicle technologies? *Energy and Environment*. 19(2): 207-226.

Increasing attention is being focused on hydrogen transport technologies as a possible means of achieving more sustainable transport. The authors of this paper

investigated the wider literature to identify criteria for sustainable transport and sought to determine which hydrogen transport technologies can meet these criteria. While they found that hydrogen could alleviate some of the problems in the transport sector, other problems are not solved and might even be exacerbated by hydrogen use. They end by highlighting the need for integrated transport policies and argue for more reflexive and inclusive societal debates about the impacts and asks who will benefit from these new technologies.

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Hydroelectric Power

Childress, Vincent W. 2009. Energy Perspective: Is Hydro Electric Green? *Technology Teacher*. 68(4): 4-9.

Discusses the impact of energy sources and waste on the environment and the sustainability of hydroelectric power. The author discusses the energy output and environmental concerns associated with different configurations for producing hydroelectric power and ends by giving an example of how hydroelectric power as a potential source for sustainable power can be incorporated into technology, science and mathematics classes.

Harrison, G.P. and H.W. Wittington. 2002. Vulnerability of Hydropower Projects to Climate Change. *IEEE Proceedings in Generation, Transmission and Distribution*. 149(3): 249-255.

While hydroelectric power and other renewable resources are likely to help mitigate the extent of climate change, climate change itself might alter the availability of natural resources like water and adversely affect the financial viability of both existing and potential schemes for renewable power generation. The article looks at a model to assess relationships between changes in climate and the viability, technical and financial, of hydropower development, using a case study from a potential hydroelectric project in South Africa as an illustration.

Ibrahim, Gusri Akhyar, Che Hassan Che Haron, Che Jusna Azhari. 2010. Sustainable Rural Energy: Traditional Water Wheels in Padang (PWW) Indonesia. *AIP Conference Proceedings* 6/28/2010. 1225(1): 467-474.

Discusses the effective use of water wheels in Padang Indonesia which is easily constructed using local resources and is used to irrigate rice fields. The wheel has

had a big impact on the region's economy, increasing the productivity of the rice fields and is easily accepted by the local community. The authors look at how water wheels of this kind are an effective sustainable energy choice for regions of this kind and have relevance in the modern world.

Kaygusuz, Kamil. 2002. Sustainable Development of Hydroelectric Power. *Energy Sources*. 24(9): 803-815.

Discusses policies to meet increasing demand for electricity in Turkey and elsewhere and how the building of large-scale dams is likely to create environmental problems as they have in Canada, Egypt, and the USA. Instead, the authors recommend that small scale dams be used to ensure the sustainability of this energy source.

Schiermeier, Quirin et al. 2008. Energy Alternatives: Electricity without carbon. *Nature* 454(7206): 816-823.

Discusses the potential for carbon-free sources of electricity, including hydropower and biomass. The authors favor hydropower electric systems as they need no fuel or fuel-extracting infrastructure and save the carbon costs of mining and transporting coal. While biomass has the potential to generate much power, the authors worry that the use of waste and residues may cause the removal of carbon from the land that would have enriched the soil, indicating that long-term sustainability may not be achievable.

Yuksel, I. 2009. Hydroelectric Power in Developing Countries. *Energy Sources Part B: Economics, Planning & Policy*. 4(4): 377-386.

Discusses the technical, economic, and environmental benefits of hydroelectric power and how it is likely to be an important contributor to the future world energy mix, particularly in developing countries. This article deals with policies to meet increasing energy and electricity demand for sustainable energy development in some developing countries such as Brazil, China, India, and Turkey.

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Nuclear Power

Forsberg, Charles. 2009. The Real Path to Green Energy: Hybrid Nuclear-Renewable Power. *Bulletin of the Atomic Scientists*. 65(6): 65-71.

The author discusses the possibility of the targeted use of nuclear power to solve the major problems of renewable energy sources by providing carbon-emission-free

power for biofuel refineries and backup energy for solar, wind, and other renewable sources.

Forsberg, Charles W. 2009. Sustainability by Combining Nuclear, Fossil and Renewable Energy Sources. *Progress in Nuclear Energy*. 51(1): 192-200.

The author proposes a solution to meet the need to avoid climate change and the need to replace traditional crude oil as the basis of our transport system by integrating different energy sources, rather than considering them separate entities that compete. He first describes several examples of combined-energy solutions and explains how these might meet much of the world's electric demand.

Mahaffey, James A. 2009. *Atomic Awakening: A new look at the history and future of nuclear power*. New York: Pegasus Books.

Evaluates the potential of nuclear technology as a non-polluting, renewable energy source while describing how nuclear energy's negative association with weapons development and the Cold War has stymied the progress of its beneficial uses.

Mizuo, Junichi. 2008. The Social Responsibility of Nuclear Energy. *Progress in Nuclear Energy*. 50 (2-6): 694-699.

This article discusses the social responsibility of nuclear energy that involves two responsibilities: the primary responsibility being an obligation to society, and the secondary responsibility being a positive contribution to society. Seen from the same perspective, Nuclear energy is expected to make a positive contribution to the advancement of society and to encourage a safety culture that prevent serious accidents while also encouraging the sound development of organizations and society.

Perrow, Charles. 2011. [Fukushima and the inevitability of accidents](#). *Bulletin of the Atomic Scientists*. 67(6): 44-52.

The author discusses the disaster at the Fukushima Daiichi Nuclear Power Station in March of 2011 and examines the ability of government and business to prevent such accidents in the future. He concludes that, "some complex systems with catastrophic potential are just too dangerous to exist, because they cannot be made safe, regardless of human effort."

Shrader-Frechette, Kristin Sharon. 2009. Data Trimming, Nuclear Emissions, and Climate Change. *Science and Engineering Ethics* 15(1)" 19-23.

The author discusses how many scientists, government leaders, and industry

representatives support the tripling of global-nuclear-energy capacity on the grounds that nuclear fission is “carbon free” and “releases no greenhouse gases.” The author discusses how these claims are scientifically questionable, and he discusses three reasons why this is so. They include: (i) They rely on trimming the data on nuclear greenhouse-gas emissions (GHGE), perhaps in part because flawed Kyoto Protocol conventions require no full nuclear-fuel-cycle assessment of carbon content. (ii) They underestimate nuclear-fuel-cycle releases by erroneously assuming that mostly high-grade uranium ore, with much lower emissions, is used. (iii) They inconsistently compare nuclear-related GHGE only to those from fossil fuels, rather than to those from the best GHG-avoiding energy technologies.

Shrader-Frechette, Kristin Sharon. 2005. Mortgaging the Future: Dumping Ethics with Nuclear Waste. *Science and Engineering Ethics*. 11(4): 518-520.

On August 22, 2005, the U.S. Environmental Protection Agency issued new regulations for radiation releases from the planned permanent U.S. nuclear-waste repository in Yucca Mountain, Nevada. The author discusses the goal of these new standards - to provide public-health protection for the next million years, while he examined the major flaws in these standards, which threaten equal protection offered by older standards, ignore the needs of the most vulnerable, allow many fatal exposures, and sanction scientifically flawed dose calculations.

Stoett, Peter. 2003. Toward Renewed Legitimacy? Nuclear Power, Global Warming, and Security. *Global Environmental Politics*. 3(1): 99-116.

The largest problem facing the global nuclear power industry has not been one of technical or even cost difficulties, but one of public acceptance. The resolution of this image problem has been detaching in the popular imagination nuclear power from nuclear weapons proliferation fears and promoting the industry as a way to mitigate global warming. The author gives a brief history of the evolution of global nuclear commerce and examines the current situation with emphasis on the global warming argument and the problematic securitization issue in the post September 11th context.

Taebi, Behnam, Jan Ileen Kloosterman. 2008. To Recycle or Not to Recycle? An Integrated Approach to Nuclear Fuel Cycles. *Science and Engineering Ethics*. 14(2): 177-200.

This paper discusses how to make the choice between using open and closed nuclear fuel cycles as a matter of intergenerational justice. The closed fuel cycle improves sustainability in terms of the supply certainty of uranium and involves less

long-term radiological risks and proliferation concerns. However, it compromises short-term public health and safety and security, due to the separation of plutonium. The authors discuss the extent to which we should take care of our nuclear waste and to what extent we should accept additional risks to the present generation, in order to diminish the exposure of future generations.

Verbruggen, Aviel. 2008. Renewable and Nuclear Power: A common future? *Energy Policy*. 36(11): 4036-4047.

This article argues that nuclear power should not be considered one of the main options to bring down the carbon intensity of commercial energy supply along with renewable energy. Unlike renewable energy, it falls short on sustainability criteria and its public acceptance is low.

Von Hippel, Frank N. 2008. Rethinking Nuclear Fuel Recycling. *Scientific American* 298(5): 88-93.

This article discusses the dangers of attempting to recycle nuclear reactor fuel, a concept that the U.S. Department of Energy has advocated. Reprocessing used nuclear fuel to extract its plutonium is highly expensive and gives off dangerous radiation. Reprocessing also has the potential to make it easier for terrorists to steal plutonium for building an atomic bomb, as the plutonium coming from recycling is relatively safe.

Wang, Shin-Laing. 2008. Elective Courses on Nuclear Energy. *ASEE Annual Conference and Exposition, Conference Proceedings 2008. June 22-24, 2008.*

Through a grant received through the Nuclear Regulatory Commission, North Carolina State A&T University has begun to develop course modules and elective courses on nuclear energy to raise awareness of nuclear power and its related issues in security, safety, and environmental protection.

Yim, Man Sung. 2006. Nuclear nonproliferation and the future expansion of nuclear power. *Progress in Nuclear Energy*. 48(6): 504-524.

Discusses the relationships between the future expansion of nuclear power and the prospect for world nuclear nonproliferation. The author attempts to answer the question, "What should be done for future nuclear power development to not result in further increase in proliferation risk?"

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Solar Power

Abott, D. 2010. Keeping the Energy Debate Clean: How do we supply the world's energy needs? *Proceedings of the IEEE*. 98(1) 42-66.

The author asks the question of what would happen if each energy source was given as a single supply for the world and concludes that a solar hydrogen economy would be the one answer to the world's energy needs. The author discusses how solar thermal collection via parabolic reflectors would help gather the power, and discuss methods for storing and using gaseous and liquid hydrogen in internal combustion engines for mobile energy use. He discusses why other energy solutions are less feasible, and concludes that a solar future by far the most practical solution for our energy needs.

Kalaani, Youakim. 2005. A Solar System Project to Promote Renewable Energy Education. *ASEE Annual Conference and Exposition, Conference Proceedings. June 12-15, 2005*, p. 12857-12861.

This paper presents preliminary efforts and a proposal to implement green energy technical education by developing, testing, and disseminating a 1-kW photovoltaic power production system recently acquired through a grant. The project is meant to both raise public awareness of the requirement to protect the environment by promoting the use of green energy, as well as help teach about renewable energy by developing curriculum material with applied projects for engineering students that will help foster creativity in students at all levels.

Kalgirou, S.A. 2004. Environmental Benefits of Domestic Solar Energy Systems. *Energy Conservation and Management*. 45(18-19): 3075-3092.

After reviewing the amount of pollution caused annual by the burning of fossil fuels, the author discusses the environmental benefits offered by the two most widely used renewable energy systems: solar water heating and solar space heating.

Kaygusuz, K.2009. Environmental Impacts of Solar Energy Systems. *Energy Sources Part A: Utilization & Environmental Effects*. 31(15): 1376-1386.

Discusses the benefits of solar energy, as well as how the wide scale deployment of solar may present some potential negative environmental implications which could include noise and visual intrusion, greenhouse gas emissions, water and soil pollution, energy consumption, labor accidents, impact on archaeological sites or on

sensitive ecosystems, as well as both negative and positive socio-economic effects.

Lewis, Nathan. 2007. Towards Cost-Effective Solar Energy Use. *Science Magazine*. 315(5813): 798-801.

For solar energy to become a primary energy source, it must be captured, converted, and stored in a cost-effective fashion. This article discusses new developments in nanotechnology, biotechnology and the materials and physical sciences which may help make this possible in the near future.

Service, Robert. 2005. Is it Time to Shoot for the Sun? *Science Magazine*. 309(5734): 548-551.

Discusses a new push by the U.S. Department of Energy to transform solar energy into a leading power source. The author looks at why solar energy is a promising solution to the world's rising demand for energy.

Thirugnanasambandam, Mirunalini; S. Iniyar, Ranko Goic. 2010. A Review of Solar Thermal Technologies. *Renewable and Sustainable Energy Reviews*. 14(1):312-322.

Discusses present day solar thermal technologies, presents ideas for improvements and development, and outlines the potential role solar power could play as the economic and environmental cost of fossil fuels continue to rise.

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Tidal and Wave Power

Clark, Robert. H. 2007. *Elements of Tidal-Electric Engineering*. Hoboken, N.J.: Wiley-Interscience.

This book discusses how engineers can approach doing a feasibility study for a proposed tidal power development plan, first looking at the history of this field, and then looking at current technologies in use. The author also looks at how to do an economic evaluation and risk assessment of tidal power systems, as well as an environmental impact assessment of proposed construction and operation of the project over the short and long term. The book concludes with an examination of commercially operating plants and a brief review of the sites that have been the subject economic and environmental impact investigations over the last half century.

Clement, Alain, et al. 2002. Wave Energy in Europe: Current Status and Perspectives. *Renewable and Sustainable Energy Reviews*. 6(5): 405-431.

Discusses progress in wave energy in Europe during the past ten years, looking at both the technical and economic status of wave energy conversion and its potential environmental benefits and risks.

Inger, Richard, et al. 2009. Marine Renewable Energy: Potential benefits to biodiversity? An urgent call for research. *Journal of Applied Ecology*. 46(6): 1145-1153.

The marine environment presents a relatively untapped energy source and offshore installations are likely to produce a significant proportion of future energy production. The article discusses concern over the potential negative effects of wind power offshore installations, as well as wave and tidal energy conversion devices, may have on the biodiversity of marine life. The authors claim that though worries over habitat loss, collision risks, noise, and electromagnetic fields are valid, if appropriately managed and designed, these offshore installations have the potential to actually increase local biodiversity and to benefit the wider marine environment if they are designed to act as artificial reefs and fish aggregation devices.

Langhamer, Olivia, Kalle Haikonen, Jan Sundberg. 2011. Wave Power : Sustainable Energy or Environmentally Costly? A review with special emphasis on linear wave energy converters. *Renewable and Sustainable Energy Reviews*. 14(4): 1329-1335.

Generating electricity from waves is predicted to be a new source of renewable energy with a global potential in the range of wind and hydropower. This article discusses some examples of wave power experiments, the potential environmental impacts and areas of study needed to help mitigate these impacts.

O’Roarke, Fergal, Fergal Boyle, and Anthony Reynolds. 2010. Tidal Energy Update 2009. *Applied Energy*. 87(2): 398-409.

Tidal energy has the potential to play a valuable role in a sustainable energy future as it is an extremely predictable energy source that depends only on the gravitational pull of the moon and sun and the centrifugal forces created by the rotation of the earth-moon system. This article discusses the current status of tidal energy technology and identifies key barriers challenging the development of tidal energy, as well as the importance of a supportive policy to assist development.

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Wind Power

Briggle, Adam. 2005. Visions of Nantucket: The Aesthetics and Policy of Wind Power. *Environmental Philosophy*. 2(1): 54-67.

This paper uses the case study of a proposed wind farm to examine the relationships between the humanities, sciences, and stakeholders in environmental decision making. After providing background on wind power and the proposed Nantucket Sound wind farm, it addresses four questions: What does "aesthetics" mean? How were aesthetic concerns expressed in the Environmental Impact Statement (EIS), and what were the shortcomings of the EIS process? How could it be improved? This last question raises issues about how to rationally adjudicate matters of aesthetics in environmental policy making. The paper concludes with some thoughts on why this is such an important (and thorny) issue and what role humanists should play in environmental disputes.

Boone, Jon. 2005. The Aesthetic Dissonance of Industrial Wind Machines. *Contemporary Aesthetics*. 3:1-9.

This essay searches for the right aesthetic justification for wind plants in the ocean as well as on shore. Wind power does offer an appealingly clean, renewable source of energy as opposed to fossil fuels, but its central problem is the enormous energies that are likely to be wasted in the process of producing and channeling a relatively small amount of power.

Haggett, Claire. 2011. Understanding Public Responses to Offshore Wind Power. *Energy Policy*. 39(2): 503-510.

Discusses the literature available looking at public responses to offshore wind power projects and recommends that the public should be included in decisions about offshore wind farms and explains that they play a key role that should not be underestimated.

Pasqualetti, Martin J., Paul Gipe, and Robert W. Righter. 2002. Wind Power in View: Energy Landscapes in a Crowded World.

Though wind power is generally perceived as environmentally friendly, locally, wind turbines are often seen as environmentally unfriendly because they are such a visible, intrusive part of the landscape. This book discusses the complexity of arguments between proponents and opponents of wind power from a historical, philosophical,

engineering, and industrial perspective.

Veganzones, Carlos et al. 2009. New Platform for Experimental Education in Electrical Generation Based on Wind Energy Systems. *International Journal of Engineering Education*. 25(4): 841-848.

In a course taught at the Universidad Politecnica de Madrid entitled, "Electrical Generation with Renewable Energy Sources" students experiment with wind energy electrical generation with a reduced-size wind turbine to which different types of scaled size electrical generation systems can be coupled.

Welch, Jonathan B. Anand Venkateswaran. 2009. The Dual Sustainability of Wind Energy. *Renewable and Sustainable Energy Reviews*. 13(5):1121-1126.

Reviews how wind energy can provide the best of both worlds by not only providing sustainable energy from an environmental perspective but also by being sustainable financially. The authors review why this is so and make public policy suggestions to help make wind energy better and cheaper without requiring extensive federal government support.

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Notes

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