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Ten Most Distortionary Energy Subsidies - Update[i]

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Complex security, environmental, and economic trade-offs remain the norm for the energy sector. Government intervention is the norm, and too often involves a torrent of energy plans, white-papers, and legislation. In an ideal world, government policies should work in tandem with market forces to achieve an adequate energy supply mix that is cleaner and more diverse than what preceded it. These synergies do not currently exist. Instead, there are thousands of government energy market interventions in place around the world – many of which act counter to stated energy security, diversification, and environmental protection objectives. Simply trying to figure out what subsidies are in place, who is receiving them, and how they are altering market behavior can be exceedingly difficult.

The ten distortionary energy subsidies discussed below represent policies that, if corrected, would materially realign price signals to more effectively achieve energy market end goals. Have comments or supplemental data? A subsidy you think should be on the list next time? Please send them along to comments@earthtrack.net.

i A shorter version of this paper appears in Cutler Cleveland and Christopher Morris, editors, *Handbook of Energy, Volume II, ©2014 Elsevier Inc.* http://dx.doi.org/10.1016/B978-0-12-417013-1.00051-0. Reposted with permission. Time in-press (original text was completed in April 2012) means that some data points have changed, though the severity of distortions for each of the items listed remain. This version updates Earth Track's 2007 list. All links contained here were functional as of April 2014.

ii Founder, Earth Track, Inc., Cambridge, MA. The author is grateful to Frans Oosterhuis (Vrjie University), Tim Searchinger (Princeton University), and Ron Steenblik (Organisation for Economic Cooperation and Development) for their input; and to Design Action Collective for their layout and design work. Final selection of policies to include, and any remaining errors, are the sole responsibility of the author.

Most Distortionary Energy Subsidies

1) Absence of Charges on Greenhouse Gas (GHG) Emissions

Despite the absence of perfect information on the precise pathway and timing of global climate change, the state of knowledge is sufficiently advanced — and the risks of inaction sufficiently dire — to begin placing constraints on worldwide emissions of greenhouse gases. The continued absence of such constraints generates a large subsidy to certain energy resources, primarily fossil fuels. The economic results are skewed price signals that slow the needed diversification of energy demand. One political result of muddled price signals and policy uncertainty is a slew of equally misguided subsidies that prop up competing energy resources such as nuclear and biomass. These polices prevent appropriate and much-needed market testing of frequent claims by proponents that they are the quickest and cheapest ways to provide energy services with a lower-carbon footprint.[1] Properly integrating GHG constraints into the pricing of goods and services would provide a far more neutral playing field on which the thousands of possible solutions to reduce emissions could compete.

The projected size of carbon markets with emissions constraints is one way to estimate the size of current subsidies. There has been some progress: global carbon markets have grown sharply from roughly $28 billion in 2006 to more than $140 billion in 2010.[2] However, trading remains dominated by the European Union, which comprised nearly 85% of total market value in 2010. Emissions fraud has also sometimes been a problem.[3] Even under the least stringent scenarios for greenhouse gas control in the United States, carbon constraints would boost carbon markets by tens of billions per year. More stringent targets, and applying targets to more countries, would both result in much larger carbon markets and commensurate reductions in emissions subsidies.[4]

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Tar Sands, Alberta, Canada. Subsidies to carbon-intensive fuels have slowed the transition to cleaner energy.

2) Oil Security

Pipelines, water transit chokepoints, and long supply lines all make global oil supplies vulnerable to disruption. Supply disruptions and price spikes in oil markets have often triggered major economic dislocations, suggesting that public investments to reduce the impact of disruptions are likely rational and economic. Because many other energy resources do not have these vulnerabilities, however, it is important that the cost of securing oil supplies be reflected in commodity prices and recovered from oil consumers. Often, it is not.

Oil stockpiling was initiated in the early 1970s as one way to provide some cushioning to the world's large importing markets, and is coordinated by the International Energy Agency (IEA). IEA's system relies on a combination of private, pooled, and public stocks, with government-owned public stocks comprising about 37% of the total.[5] Ten IEA member countries used taxpayer funding either to build the reserves, operate them, or both. Subsidies to stockpiling amount to billions per year in the United States alone.[6] Figures across the IEA have never been calculated.

Defense of shipping chokepoints such as the Persian Gulf and key pipelines are an even larger subsidy to oil security, costing tens to hundreds of billions of dollars per year.[7] Most of these costs are borne by the United States, though the benefits accrue to oil consumers and producers in other countries as well. Costs are difficult to tease out from general budgets, and controversial even when reasonable accounting has been done. As a result, allocations of joint costs to oil product markets have not been made, and important price signals to diversify energy resources and energy suppliers are lost.

US Navy

USS Enterprise and USS Cape St. George transitioning through the Strait of Hormuz in the Persian Gulf, May 2013. Defending oil shipping lanes has been a core US military mission for decades.

3) Liability Caps on Nuclear Fuel Cycle Facilities

Civilian nuclear power producers benefit greatly from shifting a substantial portion of their liability for radioactive releases from accidents or attacks away from owners and investors and onto the taxpayer and the surrounding population. Were they not able to do so, they would face higher insurance premiums and a higher cost of capital – both of which would then flow through the price of nuclear electricity. This subsidy has never been quantified comprehensively, but affects not only reactors but nuclear fuel cycle facilities and nuclear materials transport as well. On a global level, subsidies are likely to be well in excess of $10 billion per year.

Legislation stipulating mandated insurance coverage varies around the world, and efforts under the 1997 Convention on Supplementary Compensation for Nuclear Damage (CSC) attempt to set an international liability floor. However, mandated coverage levels worldwide all appear too low to address any reasonably-sized accident.[8] Even in the US, where coverage requirements under the Price-Anderson Act greatly exceed the CSC, total third party liability coverage is less than damages periodically caused by natural events such as large hurricanes. The situation is far worse in other countries. China, for example, has liability limits on plant operators of only US$44 million.[9]

Industry has long claimed that the caps did not constitute a subsidy because historical payouts had not exceeded them. This argument conflates historical payouts with actuarial risk, and has always been specious. However, the Fukushima accident in Japan eliminated even the payout claims. Government estimates of damages exceed $250 billion,[10] a risk premium of more than 3 cents for every net kWh generated by Japan's reactors up until that point.

Wikipedia/HJ Mitchell

Damaged Fukushima I nuclear reactor, Japan. Liability coverage levels for nuclear facilities around the world shift the financial and human cost of accidents onto taxpayers and plant neighbors.

The US nuclear industry has consistently lobbied to prevent cap increases or expiration, an unlikely occurrence were the caps really of only minimal economic value to producers. Review of insurance purchased by US reactor owners to protect their own operations (plant, equipment, and business continuity) is instructive. Coverage levels are more than ten times the maximum coverage they are required buy under Price-Anderson to cover damage to all people and property offsite in the case of an accident.[11]

4) Purchase Mandates, Tax Credits and Exemptions for Ethanol and Biodiesel

Sparking the imagination for oil independence, farm prosperity, and "green fuels," ethanol and biodiesel energy have been showered with subsidies around the world. Common policies included production tax credits and reduced fuels taxes. As of 2006, there were more than 200 different subsidies in place within the United States to bolster biofuels – and doing so at a cost of more than $500 per metric ton of CO2-equivalent displaced.[12] Unit subsidy costs were even higher in many European countries.[13] Biofuel supports were layered onto already existing subsidies to water and farmers, further accelerating the expansion of production.

Fiscal concerns and changing farm politics enabled the largest tax subsidy in the US to expire. However, its distortionary role has been largely replaced by purchase mandates. Worldwide, biofuel purchase mandates and tax breaks had an estimated value of $22 billion in 2010.[14]

The downsides of biofuels in the form of habitat loss, land conversion and erosion, water depletion and pollution, and food-fuel competition have received insufficient attention. Ongoing subsidies, particularly the mandates, continue to generate pressure for increased land conversion and loss of critical habitat and biodiversity.[15] Expansion of biofuels crops, largely to meet mandates in the developing world, are also among the largest drivers of land "grabs" where productive crop lands in Africa and Asia are converted to contract production for outside investors or speculators.[16]

Wikipedia/Aidenvironment

Sawn wood shipped from clearcut peat forest in Indragiri Hulu, Riau Province, Indonesia. Growth of industrial palm oil plantations, a key source of biodiesel, has driven widespread destruction of primary rainforest in many Asian countries.

5) Cross-Subsidies in Electricity Markets

Though by no means simple to address, electricity markets around the world continue to price retail power in ways that average costs across time, service nodes, and customer classes. Because total revenues often cover costs, these problems constitute cross-subsidies rather than direct subsidies. However, they mask important variation in the cost to produce and deliver electricity to particular customers at particular times. Often, it is variation in portions of a market that create niche opportunities for new technologies to gain a foothold and grow. Work by Lawrence Berkeley National Laboratory suggests that these pricing problems may impede demand response by electricity consumers,[17] and that real time pricing would be of great value in integrating variable generation sources (such as wind) into the grid.[18]

Correcting these problems could spur decentralized power generation, improved capital efficiency, and increased end-use conservation. However, additional work would also be needed to help customers identify and implement load response capabilities. A US Department of Energy study of transmission also notes the potential benefits of more accurate price signals to grid utilization, expansion, and growth of renewable energy.[19]

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Expensive power lines traversing wide areas with few people are one example of where cross-subsidies can hide the point at which distributed power or mini-grids are more economic.

6) Domestic Subsidies to Energy Consumption

Political efforts to keep domestic fuel prices low are common in energy-rich nations (to coopt opposition) and in developing consuming nations (ostensibly to reduce the hardships to poor citizens). The subsidies dampen fuel substitution and conservation, and are mostly captured by wealthier residents.[20] They primarily benefit fossil fuels, both through direct consumption, and subsidies to fuels used in power production.

Consumer subsidies are an inefficient wealth transfer mechanism: IEA data indicate that the poorest quintile in the countries evaluated received less than 15% of the total value of subsidies granted.[21] Particularly in countries with little other safety net, fuel subsidies can nonetheless be politically challenging to reign in.

As world energy prices rise, the fiscal cost of these policies can grow dramatically. Consumption subsidies in non-OECD countries reached $409 billion in 2010, up from roughly $250 billion in 2005.[22] Almost half was associated with oil products. The largest consumer subsidies were in Iran, where supports of $81 billion comprised more than 20% of its GDP. Saudi Arabia ($43 billion), Russia ($39 billion), as well as India, China, and Egypt (each in excess of $20 billion) were next.[23]

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Venezuelan gasoline is the cheapest in the world – almost given away. Consumption subsidies to fossil fuels worldwide cost hundreds of billions USD annually and strip funds from many human welfare programs.

In addition to the fiscal cost, a growing gap between domestic and border prices drives dramatic surges in corruption and smuggling. This results in domestic scarcity, domestic security problems, and increased resistance to price reform.

Countries sometimes provide special energy subsidies for consumption in particular industrial sectors. These targeted subsidies can be extremely damaging to environmental quality or the natural resource base of the nation. Subsidies to diesel or electricity used to fuel irrigation systems are one example, where heavy subsidization of pumping costs has been an important factor in excessive water depletion in both India and Yemen.[24] Subsidies to downstream industries such as basic chemicals can also raise trade and long-term competiveness issues, as in Saudi Arabia.[25]

7) Government Absorption of Disposal Risks for High-Level Nuclear Waste

Though light on carbon emissions, the nuclear fuel cycle leaves behind radioactive residuals that are extremely difficult to deal with and remain dangerous for thousands of years. In many countries, the government takes on this complex waste management task in return for a small fee. Were private operators responsible for managing their wastes until they were no longer hazardous — the norm for all other energy resources — the elevated risk to investors would result in higher interest and insurance costs.

At present there are no operating permanent repositories for high level nuclear waste anywhere in the world.[26] The United States provides a useful example of how nuclear waste management is subsidized. Power surcharges are too low to cover expected disposal costs; all cost and performance risk to build and maintain a repository have been shifted to taxpayers; and, despite the complicated nature of the service being provided and its estimated $100 billion lifecycle costs, taxpayers earn zero profit and no return on invested capital. These policies provide cost subsidies to operating reactors of between 0.3 and 1.1 cents/kWh. At the upper-end of the subsidy range, reform would more than eliminate the operating cost advantage of nuclear power relative to coal in the United States.[27]

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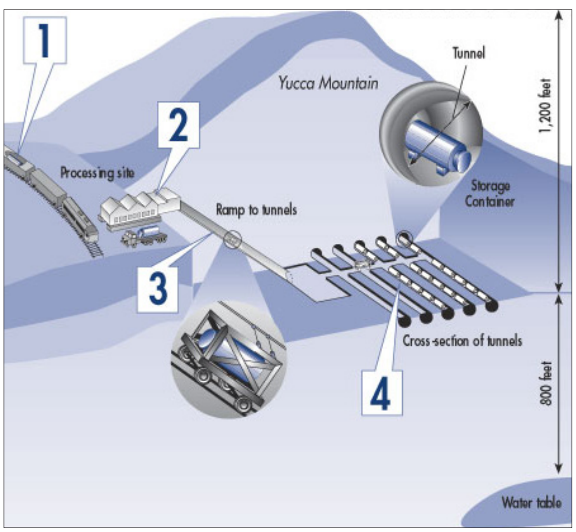

US Department of Energy

Schematic and tunnel detail of planned (though presently cancelled) underground repository for high-level radioactive waste at Yucca Mountain, Nevada (USA). Big engineering is the norm for repository proposals worldwide, though none are yet operating, opening dates keep slipping, and most financial risk remains with taxpayers.

8) Tax Exemptions for Petroleum Used in International Air and Water Transport

Worldwide taxation of oil is pervasive, though levies vary widely by geography. While often viewed primarily as revenue-raising tools, fuel taxes also offset public spending on oil and oil-related services (e.g., road infrastructure or environmental remediation) and help establish tax neutrality with other goods and services in the marketplace.

Special exemptions to baseline tax rates, such as those that apply to international shipping, distort inter-sectoral competition as well as reduce the incentive for improved efficiency. Although quite large, data on these exemptions are not collected or quantified systematically worldwide. Analysis of transport funding by the European Environment Agency found exemptions from VAT and fuel taxes within the EU to be worth between $50 and $80 billion per year, mostly associated with international shipping.[28]

A more recent modeling of revenues from applying a $25 per metric ton carbon tax on fuels used in international air and water shipping by the IMF and World Bank estimated revenues of $12 and $26 billion per year from each sector respectively.[29] Reduced VAT rates on household energy consumption in the EU remain a problem as well, with an estimated subsidy of roughly $7 billion per year. Most of this is associated with natural gas and electricity consumption.[30] Sales tax exemptions for energy consumption are also common at the state level in the US, providing subsidies in the hundreds of millions of dollars per state.[31]

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Container ships move an ever larger share of world cargo. Unlike domestic shipping, fuel used in international shipping and in international air, rail, and road transport, pay no fuel taxes.

9) Free Use of Cooling Water in the Thermal Power Sector

Discussions of energy security and supply focus on the fuels behind the power and usually forget about water. Yet cooling water is a critical element for all thermal power technologies (including centralized solar). In arid parts of the world, the water may be equally or more valuable than the power. Withdrawals for the power sector comprised more than 49% of all water uses in the United States, and were larger than those for irrigation and livestock watering combined.[32] Thermoelectric cooling is also the largest water use category in many European countries, exceeding 50% of total withdrawals.[33] Even when the cooling water is returned to river flows, the withdrawal of billions of gallons per day causes a great deal of ecosystem damage. Return flows are similarly problematic, bringing pollution into the receiving waters and altering ambient temperatures.

While power users do generally have to be permitted, rarely do they pay anything for the water they use – despite often having senior rights even during times of drought. Efforts to quantify this subsidy for particular segments of power markets (e.g., US nuclear) indicate subsidies above $600 million per year.[34] Global values for all thermal energy resources would be tens of billions. Proper price signals would materially affect water use patterns and power supply options in arid regions, and support investment into more advanced cooling technologies.

US Nuclear Regulatory Commission with permission of Florida Power & Light

St. Lucie nuclear units 1 and 2 (Florida, USA) are cooled using large water intake canals; most thermoelectric plants rely on massive canals or pipes to supply their below-market cooling water.

10) Feed-in Tariffs and Purchase Mandates for Renewable Energy

Government policies to buy renewable energy at a premium have scaled dramatically over the past five years. In Europe, feed-in-tariffs are common. The policies guarantee a price premium per unit energy, with the highest rates (sometimes in excess of 50 eurocents/kWh) for photovoltaic installations.[35] In the US, state-level renewable portfolio standards (RPS) mandate pre-set quantity purchases at above market prices. As of 2010, renewable electricity power subsidies reached $44 billion according to the IEA (WEO 2012, 530), and are expected to continue rising sharply. The main beneficiary sectors are wind energy and solar photovoltaic, though support for biomass-fired electricity also remained strong.

Proponents point out that these subsidies continue to be well below aggregate subsidies to conventional forms of energy. Nonetheless, a combination of very high subsidies per unit energy and growing total expenditures indicate a need for increased scrutiny and performance measurement. Some supported fuels, including many types of biomass, landfill gas, and trash burning are not particularly green, and eligibility should be eliminated. In other cases, production levels are sensitive to geography, and subsidies could be more effectively targeted to regions offering higher capacity and productivity factors. Increased competition to access the available funds would also help make these subsidies more efficient.

Wikipedia/mikemccaffrey

Political pressure often extends eligibility for green power subsidies to energy technologies that have limited environmental benefits. Producing power from landfill methane or burning solid waste both undermine increased source reduction and recycling, and should receive no subsidies.

End Notes

1 It is unlikely that either nuclear power or corn-based ethanol would do well in such a competitive environment. See Doug Koplow. *Biofuels - At What Cost? Government Support for Ethanol and Biodiesel in the United States*, (Geneva: Global Subsidies Initiative), October 2006; Amory Lovins, "Mighty Mice," *Nuclear Engineering International*, December 2005; and Doug Koplow, *Nuclear Power: Still Not Viable without Subsidies* (Cambridge, MA: Union of Concerned Scientists), February 2011.

2 Kjetil Roine *et al.*, Point Carbon, "The Global Carbon Market in 2006 - An Overview of Prices and Volumes," in the International Emissions Trading Association, *Greenhouse Gas Market 2006*, pp. 30-35, 2006; World Bank, *State and Trends of the Carbon Market 2011*, June 2011, p. 9.

3 See, for example, "Green fleeces, red faces: a theft of carbon credits embarrasses an entire market," *The Economist*, 3 February 2011.

4 Stanford's Energy Modeling Forum modeled greenhouse gas emissions and carbon prices associated with linear reductions between 2012 and 2050 reach levels of 176, 203, and 287 GtCO2-e in 2050. See Allen Fawcett et al., "Overview of EMF 22 U.S. transition scenarios," *Energy Economics,* v. 31 (2009) pp. S198-S211. Earth Track calculations from the associated data tables took an average of model results for each scenario and found the lower-bound value for a US carbon market of $23 billion in 2020. Constraints that include all greenhouse gases, all sectors, and lower emissions by 2050 indicate significantly larger carbon markets (hundreds of billions of dollars per year) to reach them.

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9 Ximena Vásquez-Maignan, "Nuclear Liability in China," *Asian Power*, February 2010.

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12 See Koplow, *Biofuels - At What Cost? Government Support for Ethanol and Biodiesel in the United States*, 2006.

13 Géraldine Kutas, Carina Lindberg and Ronald Steenblik, *Biofuels at What Cost? Government support forethanol and biodiesel in the European Union*, (Geneva: Global Subsidies Initiative), October 2007.

14 International Energy Agency, *World Energy Outlook 2011,* 2011, p. 530.

15 See, for example, Patrick Barta and Jane Spencer, "Crude Awakening: As Alternative Energy Heats Up, Environmental Concerns Grow," *Wall Street Journal*, December 5, 2006, p. A1. More recent analysis has demonstrated that biofuels mandates continue to pressure land conversion, and that such conversions undermine the environmental profile of the fuels. See David Laborde, *Assessing the Land Use Change Consequences of European Biofuel Policies*, International Food Policy Research Institute, October 2011. Earlier modeling of land use impacts in Brazil indicated that additional cropland to produce fuel crops might come mostly from livestock production rather than rainforests, though noted that absent better regulatory controls livestock producers could replace their lost acreage through additional deforestation. See Perrihan Al-Riffai, Betina Dimaranan, and David Laborde, *European Union and United States Biofuel Mandates: Impacts on World Markets,* prepared for the Inter-American Development Bank, December 2010, p. 49.

16 Ward Anseeuw, Liz Alden Wily, Lorenzo Cotula, and Michael Taylor, *Land Rights and the Rush for Land: Findings of the Global Commercial Pressures on Land Research Project,* IIED, Cirad, and the International Land Coalition, January 2012.

17 See, for example, G. Barbose *et al.*, *Real Time Pricing as a Default or Optional Service for C&I Customers: A Comparative Analysis of Eight Case Studies*, Lawrence

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22 International Energy Agency, *World Energy Outlook 2006*, p. 278 and *World Energy Outlook 2011*, p. 513.

23 International Energy Agency, *World Energy Outlook 2011, p.* 519.

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