

Nuclear Information and Resource Service (NIRS) is affiliated with World Information Service on Energy (WISE).
The non-governmental, grassroots based NIRS/WISE Network has offices on 5 continents.

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Externalized Costs and False Subsidies Associated with Nuclear Power

"Externalized" costs and the capture of assets from a public commons are hidden subsidies that, by definition, raise the "bottom line" profitability of an enterprise. Yet the costs, damages and losses remain, borne by taxpayers and consumers and on the local level, impacted communities. The **social cost** of an industry is stated: private enterprise costs + externalized costs + common assets taken + government subsidies. In the limited equation of profit and loss, the more costs that are "shed" and "free assets" captured, the greater the private profit margin. Nonetheless society suffers these costs, burdens and losses to the Commons; the result are losses of health, quality of life and degradation of shared resources and wealth. The Climate Crisis is the result of externalized costs of fossil fuels, and is appropriately spurring a transition away from carbon fuels. Nonetheless, the direct and indirect subsidy of nuclear power over other energy options that cost less and could be deployed much more quickly, including investment in systemic energy efficiency, will result in an enormous "opportunity cost" to the planet as timely attainment of climate goals becomes less viable.

Systemic tilt toward nuclear and new nuclear development is built into some legal structures:

- 1) The private capital costs of building new nuclear power plants are at the top of the energy portfolio, \$10 billion and more per unit; new reactor construction is highly attractive to enterprises where electric power monopolies are regulated by the government, such as the Southeastern region of the United States. These states offer a "guaranteed rate of return" on investment that creates a false economy where greater expenditure is more greatly rewarded. This regulated margin, charged to customers, would not typically be called an "externality"--but it certainly is legislated subsidy, resulting in an opportunity cost in an era where other forms of power generation, besides coal, are very much cheaper than nuclear per installed KW.
- 2) In the USA, and nearly all other countries building new nuclear reactors, heavy financial support is provided by statute in the form of technical research, federally-insured loans, grants, tax credits, and at the state level authority to collect and invest funds from customers before the reactor is built ("construction work in progress"), often receiving a "guaranteed rate of return on investment" even when the private enterprise is in fact "investing" public, or consumer dollars.
- 3) Ironically, a carbon-trading system as was proposed in the USA (not in the Kyoto Protocol), could result in enormous windfall subsidies for nuclear energy. This proposal failed to factor in carbon emissions resulting from uranium mining and the five additional steps (and transport links) required for nuclear fuel production (see [Sovacool 2008](#) study). As a result nuclear could be favored and a single corporate entity owning both coal and nuclear generation (many do) would essentially pay more on the coal side, but the nuclear side could capture carbon credit benefits. False presentation of nuclear as carbon-free, and the historic investment in nuclear (20% of U.S. electric power) would tilt trade in its direction rather than favoring even lower-carbon options like wind and solar, or investment in the lowest carbon, most cost-and-time effective measure for offsetting Greenhouse gas emissions in industrialized societies: systemic efficiency.
- 4) Provision of accident insurance by statute that include legislated liability caps for nuclear corporations and contractors. No independent insurance company in the world will insure nuclear fuel production or nuclear power operations; therefore legislation is passed that, after some level of corporate payment results in the balance of the costs falling either to the victims, the taxpayers, or both.

Interestingly, both coal and nuclear energy mirror each other in several respects: in routine operations, impacts (waste generation, health impacts, environment and water degradation) from production of the fuel are far greater; planet-altering externalities (CO₂/GHG emissions for coal and the potential for global distribution of mutagenic radiation for nuclear) arise from the power plant operations. Both have cumulative impacts, both rely on massive water use and both produce wastes/emissions that are not compatible with health, sustainability and environmental stabilization. What follows on the next two pages is a partial, annotated list of the externalized costs of nuclear power. See also short compilation of broad costs studies posted: <http://www.nirs.org/neconomics/neconomicshome.htm>

Externality	References
<p>Waste, Routine / Ongoing Radioactive Releases Six industrial steps produce nuclear fuel; transport links these sites and each produces waste, releases radioactivity to air, water and exposes workers and the public to radioactivity. Full clean-up, including groundwater contamination has never been priced into the fuel cost. The wastes cannot be neutralized so clean-up is really "transfer" to another site, resulting in similar leaks to groundwater. The reactor converts fuel to lethal waste requiring remote handling and isolation from our environment for a million + years. Waste funds collected from customers cover a fraction of true waste cost; waste accidents and site failures are further externalized. It is not possible to project costs over a million years; even guard dog food is staggering.</p>	<p>Climate of Hope shows fuel cycle : http://www.youtube.com/watch?v=t_NLdRUEljo Radioactive waste categories and "Low-Level waste" management: http://www.nirs.org/factsheets/llwfact.htm High-level waste (irradiated fuel rods) http://www.state.nv.us/nucwaste/ enormous archive--State of Nevada including information on nuclear transport</p>
<p>Health Impacts There is no safe dose of radiation, and every link in the nuclear chain exposes worker and public. Children are most vulnerable; adult women have a 50% greater rate of cancer than men at the same radiation levels. Generally all health impacts are externalized. Thankfully rare, high radiation (hundreds of Rems) causes death in weeks. Lower exposure results in many diseases; typically regulators and researchers look at cancer and leukemia while actual harm includes reduced immunity, reduced fertility, increased heart disease, birth defects, other mutations (both heritable and not), spontaneous abortion and miscarriage. Internalized radioactivity from contaminated food, air and water inflicts more damage. These are all the "perfect crime" since the cause of any given illness cannot be proved. Contamination of ground water and land and biome is increasing exposures dramatically. Deaths, when projected over time from nuclear catastrophes are measured in thousands to millions depending on the parameters of the projection.</p>	<p>Radiation harm to children: http://www.ieer.org/campaign/ Women: http://www.nirs.org/radiation/radhealth/radiationwomen.pdf Non-cancer impacts: Gofman, John, "Radiation and Human Health" (Random House 1982) see also: http://www.ratical.org/radiation/overviews.html#CNR and Dr. Rosalie Bertell, Coauthor, ECRR reports: http://www.euradcom.org/ Yablakov, et al, 2010. "Chernobyl: Consequences of the Catastrophe for People and the Environment" New York Academy of Sciences.</p>
<p>Permanent Sacrifice of Land The exclusion zone at the exploded Chernobyl Reactor (1986) in Ukraine is 283 km² and today a 20 km radius around the Fukushima Dai-ichi site is closed. Decades to centuries of loss are forecast, if these sites are "cleaned up" it will result in permanent sacrifice of some other site for "disposal" -- which is, in fact, simply transfer.</p>	<p>The extensive off-site radiological contamination from Chernobyl has been mapped; most recent is a very large file 15 MB (caution) -- http://zerodegreeburn.com/chernobyl/</p>
<p>Water Nuclear requires more cooling water than any other thermal power generator. The systems range from billions of gallons a day (typically coastal sites), to billions of gallons per year (where cooling towers are used less is withdrawn, but the water does not return to the same watershed, leaving the site as steam). In some areas water for power plants is in direct competition with drinking water supplies for a region.</p>	<p>Union of Concerned Scientists: "Got Water? Nuclear Power Plant Cooling Water Needs" http://www.ucsusa.org/nuclear_power/nuclear_power_technology/got-water-nuclear-power.html</p>
<p>Thermal Discharge Hotter than fossil power plants reactors average 10,500 Btu/kWh . Fission is fission and the yield (both heat and radioactivity) from 1 year of reactor operation is 1000 times the atomic yield from the fission bomb that destroyed Hiroshima, Japan in 1945; that is a lot of heat. Aquatic ecosystems and marine life suffer from such discharges. The report "Licensed to Kill" has a detailed discussion of the impact of thermal discharges.</p>	<p>See calculations by John Gofman in the U.S. Congressional Record http://ratical.org/radiation/CNR/fission.html and NIRS "Licensed to Kill" http://www.nirs.org/reactorwatch/licensedtokill/licensed2kill.htm</p>
<p>Carbon While nuclear energy has a significantly smaller carbon footprint than coal, it is not carbon free. Six industrial steps from mining to fuel fabrication involve extensive transport links and fossil fuels. Some analysts point out the footprint will increase as over time uranium becomes more difficult to extract, projecting carbon emissions comparable to burning gas.</p>	<p>For survey see Benjamin Sovacool: http://www.nirs.org/climate/background/sovacool_nuclear_ghg.pdf For detailed projections of future carbon: Van Leeuwen http://www.stormsmith.nl/</p>
<p>Security/Loss of Civil Society Control/Democracy Every nuclear reactor either uses plutonium fuel, or produces plutonium as a by-product of the fission of uranium. This means that a power station is a nuclear weapons material shop. India, Pakistan, North Korea (and likely, but unconfirmed, Israel) have acquired nuclear weapons via the plutonium available to them in nuclear waste or uranium enrichment technology identical to that used to make civilian fuel. Transition to plutonium or MOX fuel under so-called GenIV development will only make such a cross-over to nuclear weapons easier. In addition, the core of a reactor is like a "pre-deployed" dirty bomb for a malicious actor. The private enterprise pays for security, however society must provide</p>	<p>For information on the link between nuclear power and plutonium see: http://www.ieer.org and http://www.ucsusa.org/nuclear_power/nuclear_power_risk/nuclear_proliferation_and_terrorism/nuclear-reprocessing.html NGO paper on NPT and nuclear energy: http://www.nirs.org/international/finale</p>

more, or suffer the consequences. Nuclear requires "big government" for many reasons, security being the most urgent.	nergynpt2010notes.pdf
Cost to Other Energy Producers if "Stranded" Investments are Socialized Opening of previously regulated energy markets has, in some areas, resulted in state legislation that transfers "stranded" debt for nuclear reactors not yet paid off to all energy customers in the form of a "line fee." Thus in these areas people who are purchasing non-nuclear energy (like wind) help pay nuclear debt, lowering the "bottom line" of the wind, or other energy provider.	A true, but anecdotal story! Reports on externalized costs + "windfall" subsidies are posted on a November 2011 link at: http://www.nirs.org/neconomics/neconomicshome.htm
Time, Climate and Equity Not typically thought of a resource, climate stabilization forces the factoring of time in all in decisions. All power plants take some time to site, but nuclear licensing is extremely time consuming, as is construction of the enormously complex systems; 10 years is very optimistic for these two steps. It has been estimated that the carbon debt of the massive structure and fuel production requires another 12 -- 15 years of operation to off-set. Nuclear, more than any other industrial operation has trans-millennial equity issues. Radioactive waste, even if plutonium is removed, will remain a hazard for over a million years, requiring ongoing isolation. Historically, radioactive disposal sites have targeted low-income minority populations, in many areas, Native People. Generational equity is a concern: public funding means elders pay for a power plant they never receive power from.	See van Leeuwen above for discussion of carbon debt. Historic reactor licensing timeframes in the USA: http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1350/v23/sr1350v23-sec-7.pdf Grassroots perspective on waste on Native Lands: http://www.nirs.org/ejustice/nativelands/nativelands.htm Information on radioactive waste: http://www.ieer.org/pubs/index.html http://www.nirs.org/radwaste/radwaste.htm

Externalities + Windfall Subsidies of Nuclear Energy

Doug Coplow, EarthTrack, "Nuclear Power Still Not Viable Without Subsidies," 2011, Union of Concerned Scientists.
http://www.ucsusa.org/nuclear_power/nuclear_power_and_global_warming/nuclear-power-subsidies-report.html

Amory Lovins, "Nuclear Socialism: Energy Subsidies--of Any Kind--are Bad Business," originally published in the Weekly Standard, October 25, 2010, Vol. 16, No. 06. http://www.weeklystandard.com/articles/nuclear-socialism_508830.html

Mark Cooper, "Economics of Nuclear Reactors: Renaissance or Relapse?" June 2009, Vermont Law School.
[http://www.vermontlaw.edu/Documents/Cooper%20Report%20on%20Nuclear%20Economics%20FINAL\[1\].pdf](http://www.vermontlaw.edu/Documents/Cooper%20Report%20on%20Nuclear%20Economics%20FINAL[1].pdf)

National Research Council, (U.S.) National Academy of Sciences, "Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use" 2009. Sponsor: U.S. Department of Treasury. A complete download is available at no charge, but a sign-in must be created. http://www.nap.edu/catalog.php?record_id=12794. This hallowed body failed to review externalities from nuclear power operations, concluding (with no analysis whatsoever) that these are "quite low" -- while specifically ruling out the consequences of failure to isolate extremely radioactive waste that will remain a hazard, as was stated by the next author on this list for an "inter-civilizational period of time."

Karl Coplan, "The Externalities of Nuclear Power: First Assume We Have Can Opener," May 1, 2008. Pace University School of Law, Faculty Publications. Download available at: <http://digitalcommons.pace.edu/lawfaculty/489/>

Benjamin Sovacool, "Valuing the Greenhouse Gas Emissions from Nuclear Power: a Critical Survey" 2008.
http://www.nirs.org/climate/background/sovacool_nuclear_ghg.pdf

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