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GLOSSARY, REFERENCES AND CONTACTS

Back End	The back end of the nuclear fuel cycle describes the processes for managing spent fuel (whether by disposal or reprocessing).
Burnup	In the nuclear fuel cycle, "burnup" measures the amount of (thermal) energy released per unit of fuel. This is corollary to *miles-per-gallon* in a car. This tool reports burnup in gigawatt-days per metric ton of uranium (*GWd/MTU*). Burnup can also be reported as a percentage of atoms that have undergone fission in a reactor. Conversion between these values requires understanding the amount of energy released per fission. (Source: Nuclear Regulatory Commission (http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/bg-high-burnup-spent-fuel.html))
Capacity Factor	The capacity factor is the actual electricity output of a generator over a period of time divided by the output if the generator were always operating at full capacity. For example, across the United States in 2013, nuclear plants generated 789,016,510 megawatt-hours (MWh) of electricity. These plants had a total (summer) capacity of 99,125 megawatts of electric power (MWe). This yields an average capacity factor of about 90.9%. (Source: EIA (http://www.eia.gov/nuclear/generation/index.html))
Construction Time	The time (in years) for the construction of a new nuclear plant. The construction time affects the finance costs of these large projects. (Source: World Nuclear Association (http://www.world-nuclear.org/info/Economic-Aspects/Economics-of-Nuclear-Power/))
Economic Lifetime	Ostensibly, the economic lifetime of a nuclear reactor is the number of years that a plant can operate efficiently and safely. In the United States, this is in part a policy parameter, determined (or influenced) by the Nuclear Regulatory Commission's licensing procedure. Initial operating licenses were granted for a term of 40 years, and can be renewed in 20-year terms. Longer economic lifetimes can ameliorate very large initial capital costs. (Source and more details: NRC (http://www.nrc.gov/reactors/operating/licensing/renewal/overview.html))
Enrichment	A process which uses converted uranium hexafluoride (UF6) to concentrate the fissile isotope of uranium (U235) into the input of fuel fabrication. Natural uranium contains a very small amount of U235 relative to its more stable isotopes (most commonly U238). To be usable in reactors a greater proportion of U235 to U238 is needed. (More details: NRC (http://www.nrc.gov/materials/fuel-cycle-fac/ur-enrichment.html))
Feed Enrichment	Refers to the proportion of the fissile isotope of uranium, U235, to the more common isotope, U238, found in the input to the enrichment process (i.e., in the converted uranium hexafluoride). This is typically presented as a percentage. If converted natural uranium were used as a feedstock, the feed enrichment would be 0.72% (by weight). (Source and more detail: SIPRI (http://books.sipri.org/files/books/SIPRI83Krass/SIPRI83Krass05.pdf))
Fissile Product Conditioning	This process stabilizes high-level waste from reprocessing (including liquid waste). Typically these wastes are stored in glass, crystalline or ceramic form. For more information on fissile product conditioning in practice, see the website (http://www.hanfordvitplant.com/) for the under-construction Hanford Vitrification plant.
Front End	The steps of the nuclear fuel cycle that convert natural uranium into fuel that can be used in a reactor. The front end typically consists of uranium mining, milling, conversion, enrichment and fuel fabrication.
Fuel Cycle	A series of processes needed to produce electricity from a raw material (typically uranium) in a

	nuclear power reactor. The fuel cycle can be arranged in different ways. This calculator (/nuclear-fuel-cycle-cost-calculator/model) explores the economics of different configurations of the back end of the fuel cycle including once-through, limited recycle, and full recycle. (For more see: NRC (http://www.nrc.gov/materials/fuel-cycle-fac/stages-fuel-cycle.html))
Fuel Fabrication	A process that converts enriched heavy metals (e.g., uranium) into fuel that is usable by a nuclear reactor. This process can use the output of enrichment or can use the output of a reprocessing procedure (e.g., MOX). (More details: NRC (http://www.nrc.gov/materials/fuel-cycle-fac/fuel-fab.html))
Full Recycle	One of the three configurations of the fuel cycle we evaluate. The used fuel from a light water reactor (LWR) is reprocessed, then arranged in a fashion to produce fuel for a fast neutron spectrum reactor (called variously a "burner" or "breeder" reactor and typically sodium-cooled). A small portion of used fuel is disposed of as waste. Sometimes called the "closed fuel cycle." (More details: Scientific American (http://www.scientificamerican.com/article/how-do-fast-breeder-react/))
Geologic Disposal	Direct disposal is one method of storing high-level waste (HLW). Waste can be stored in stable geological formations. In the past, the United States has proposed to store HLW at Yucca Mountain, Nevada. The United States is currently home to a test geological repository, the Waste Isolation Pilot Plant (WIPP), located in New Mexico. The cost cited in the calculator is a "policy parameter" determined by the Nuclear Waste Policy Act (see National Blue Ribbon Commission on America's Nuclear Future (http://energy.gov/sites/prod/files/2013/04/f0/brc_finalreport_jan2012.pdf) page 20). (More details: World Nuclear Association (http://www.world-nuclear.org/info/Nuclear-Fuel-Cycle/Nuclear-Wastes/Radioactive-Waste-Management/))
High-Level Waste Disposal	High-level waste (HLW) is spent fuel (or waste from reprocessing) that contains fission products and other radioactive elements. HLW must be stored in a safe location to isolate its decay products from the environment. The United States does not currently have a centralized facility for HLW storage. (More details: World Nuclear Association (http://www.world-nuclear.org/info/Nuclear-Fuel-Cycle/Nuclear-Wastes/Radioactive-Waste-Management/))
Inventory	The amount of fuel needed (in kilograms) per megawatt of electrical power (MWe) of capacity to operate a given reactor.
Levelized Cost of Electricity	This estimate of the per-unit cost of electricity for a given technology accounts for all of the cost parameters listed on this site. This measure can be useful for comparing different configurations of a technology, or comparing the relative costs and benefits across technologies. (Source: Energy Information Administration (http://www.eia.gov/forecasts/aeo/electricity_generation.cfm))
Limited Recycle	One of the three configurations of the fuel cycle this calculator (/nuclear-fuel-cycle-cost-calculator/model) evaluates. The plutonium from used fuel is extracted and blended with "new" uranium fuel to form “mixed oxide fuel” (MOX). MOX fuel is then used to produce electricity in a light water reactor (LWR). Non-plutonium used fuel is disposed of as waste.
MOX Fuel	Mixed oxide fuel. Fuel is fabricated not only from enriched uranium, but from a combination of uranium and plutonium (which is created in a reactor). (More details: NRC (http://www.nrc.gov/materials/fuel-cycle-fac/fuel-fab.html#mixed))
Once-through	One of the three configurations of the fuel cycle this calculator (/nuclear-fuel-cycle-cost-calculator/model) evaluates. After being used to create electricity, all spent fuel is disposed of as waste.
Overnight Cost	The capital cost of constructing a nuclear power plant if no interest accrued during the construction period. This is the cost as if the plant were built “overnight”. To account for different capacity plants, this cost is presented in the units $/kWe.
Reactor Capacity	This value refers to the maximum amount of electricity a plant can produce in a given hour. Plants rarely operate at this level in practice (see Capacity Factor).
Reprocessing	Reprocessing refers to the process (e.g., PUREX) of seperating used nuclear fuel into material that is still usable in a reactor and material that should be discarded as waste. Reprocessing carries some risk of proliferation, as the process has been used to recover plutonium for weapons production. The United States does not currently reprocess used nuclear fuel. Other countries (e.g., France, Japan) have active reprocessing programs. (Source: NRC (http://www.nrc.gov/materials/reprocessing.html))
Spent Fuel Interim Dry Storage	After spent nuclear fuel has been allowed to cool in a pool (http://www.nrc.gov/waste/spent-fuel-storage/pools.html), it is often stored in casks made of steel and concrete. These casks are typically kept on site at a nuclear power facility. (More details: NRC (http://www.nrc.gov/waste/spent-fuel-storage/dry-cask-storage.html))
Tails Enrichment	Refers to the proportion of the fissile isotope of uranium, U235, to the more common isotope,

U238, found in the waste product of the enrichment process. Economically, this parameter can be adjusted to reflect relative costs of the inputs (i.e., uranium) to production and the costs of enrichment (i.e., separative work). (Source and more detail: SIPRI (http://books.sipri.org/files/books/SIPRI83Krass/SIPRI83Krass05.pdf))

Thermal Efficiency

The thermal efficiency of a plant relates the amount of heat energy produced by the reactor (in the form of steam, MW) to the amount of electrical energy (MWe) that can be sent to the grid. Depending on the reactor type, this value can vary between 30 and 40%.

TRU Waste

Material that includes or has been contaminated with transuranic elements (i.e., those elements that have a higher atomic number than uranium, such as neptunium, plutonium, and americium). (Source: NRC (http://www.nrc.gov/reading-rm/basic-ref/glossary/transuranic-waste.html))

UF6 Conversion

A chemical process in which milled uranium is combined with fluorine to create uranium hexafluoride (UF6) gas. UF6 is the input into a typical enrichment process (gaseous diffusion). (Source: NRC (http://www.nrc.gov/materials/fuel-cycle-fac/ur-conversion.html))

REFERENCES AND ACKNOWLEDGEMENTS

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Advanced Fuel Cycle Economic Tools, Algorithms, and Methodologies (D.O.E. 2009) (/third-party/nuclear-fuel-cost-calculator/assets/Shropshire_2009_Methods.pdf)

Update of the MIT 2003 Future of Nuclear Power (2009) (/third-party/nuclear-fuel-cost-calculator/assets/MIT_2009.pdf)

Values used to construct the "U.S. 2012" dataset were provided courtesy of the Nuclear Engineering Division at the Department of Energy's Argonne National Lab. We thank them for their advice and assistance.

The MacArthur Foundation provided significant funding in support of this project.

Contact

In the future we hope to include cost parameters for other countries in this calculator. If you would like submit new cost estimates or would like to submit other feedback, please contact:

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