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La energa nuclear es una forma de energa que se libera desde el ncleo o parte central de los tomos, que consta de protones y neutrones. Esta fuente de energa puede producirse de dos maneras: mediante fisin (cuando los ncleos de los tomos se dividen en varias partes) o mediante fusin (cuando estos se fusionan).La fisin nuclear es el mtodo que se utiliza hoy da en todo el mundo para producir electricidad a partir de energa nuclear, mientras que la tecnologa para generar electricidad a partir de la fusin se encuentra en fase de I+D. En el presente artculo se examina la fisin nuclear. Si desea saber ms sobre fusin nuclear, haga clic aqu. La fisin nuclear es una reaccin por la que el ncleo de un tomo se divide en dos o ms ncleos ms pequeos, liberando al mismo tiempo energa.Por ejemplo, cuando un neutrn golpea el ncleo de un tomo de uranio 235, este se divide en dos ncleos ms pequeos, por ejemplo, un ncleo de bario y un ncleo de criptn, y se liberan dos o tres neutrones. Estos neutrones adicionales golpearn otros tomos de uranio 235 colindantes, que tambin se dividirn y generarn, a su vez, ms neutrones en un efecto multiplicador, desatando as una reaccin en cadena en una fraccin de segundo.Cada vez que se produce esta reaccin se libera energa en forma de calor y radiacin. Ese calor puede transformarse en electricidad en una central nuclear, en un proceso similar al que se emplea para generar electricidad a partir del calor de combustibles fsiles como el carbn, el gas y el petrleo. Fisin nuclear (Grfico: A. Vargas/OIEA) Dentro de las centrales nucleares, los reactores nucleares y su equipo contienen y controlan las reacciones en cadena, por lo general alimentadas por uranio 235, a fin de producir calor mediante fisin. El calor aumenta la temperatura del refrigerante del reactor, que suele ser agua, para producir vapor. Este se encauza para hacer girar las turbinas, que activan un generador elctrico con el que se produce electricidad con bajas emisiones de carbono.Pueden consultarse ms detalles sobre los distintos tipos de reactores nucleares de potencia en esta pgina. Los reactores de agua a presin son los ms utilizados del mundo. (Grfico: A. Vargas/OIEA) El uranio es un metal que se encuentra en rocas de todo el mundo. Tiene varios istopos de origen natural, es decir, formas de un elemento distintas en trminos de masa y propiedades fsicas, pero con las mismas propiedades qumicas. Sus istopos primordiales son el uranio 238 y el uranio 235. La mayor parte del uranio que hay en el mundo es uranio 238, que no puede producir una reaccin de fisin en cadena, mientras que el uranio 235 s se puede utilizar para producir energa de fisin, pero representa menos del 1 % del uranio mundial.A fin de que el uranio natural tenga ms probabilidades de fisionarse, es necesario incrementar la cantidad de uranio 235 en una determinada muestra, mediante un proceso denominado enriquecimiento de uranio. Una vez enriquecido, el uranio puede utilizarse eficazmente como combustible nuclear en una central durante un perodo de entre 3 y 5 aos, tras lo cual sigue siendo radiactivo y ha de procederse a su disposicin final de acuerdo con unas directrices estrictas a fin de proteger a las personas y el medio ambiente. Asimismo, el combustible usado, que tambin recibe el nombre de combustible gastado, puede reciclarse para dar lugar a otros tipos de combustible y utilizarse como combustible nuevo en centrales nucleares especiales. Qu es el ciclo del combustible nuclear?El ciclo del combustible nuclear es un proceso industrial, integrado por varias etapas, por el que se produce electricidad a partir de uranio en reactores nucleares de potencia. El ciclo comienza con la extraccin del uranio y termina con la disposicin final de los desechos nucleares. La explotacin de centrales nucleares produce desechos de diverso grado de radiactividad, que se gestionan de manera diferente segn su nivel de radiactividad y su propsito. En esta animacin encontrar ms informacin sobre el tema. Gestin de desechos radiactivos Los desechos radiactivos constituyen una pequea parte de todos los desechos. Se trata de un subproducto procedente de los millones de procedimientos mdicos realizados anualmente, las aplicaciones industriales y agrcolas que emplean radiacin y los reactores nucleares que generan alrededor del 10 % de la electricidad mundial. En esta animacin explicamos cmo se gestionan los desechos radiactivos para proteger de la radiacin a las personas y el medio ambiente ahora y en el futuro. La prxima generacin de centrales nucleares, tambin llamadas reactores avanzados innovadores, generar muchos menos desechos nucleares que los reactores actuales. Se prev que estas centrales podran estar construyndose para 2030. La energa nucleoelctrica es una fuente de energa de bajas emisiones de carbono, ya que, a diferencia de las centrales de carbn, petrleo o gas, las centrales nucleares no producen prcticamente CO2 durante su funcionamiento. Los reactores nucleares generan cerca de una tercera parte del total mundial de electricidad sin emisiones de carbono y son cruciales para lograr los objetivos relacionados con el cambio climtico.Si desea saber ms sobre la energa nucleoelctrica y la transicin a una energa limpia, lea este nmero del Boletn del OIEA. El OIEA establece y promueve normas internacionales y orientaciones respecto del uso tecnolgica y fsicamente seguro de la energa nuclear para proteger a las personas y el medio ambiente.El OIEA presta apoyo a los programas nucleares existentes y nuevos de todo el mundo proporcionando apoyo tcnico y promoviendo la gestin del conocimiento. Mediante el enfoque de los hitos, el OIEA facilita conocimientos tcnicos especializados y orientaciones, tanto a aquellos pases que quieren desarrollar un programa de energa nucleoelctrica como a los que estn clausurndolo.A travs de sus actividades de salvaguardias y verificacin, el OIEA vigila que los materiales y tecnologas nucleares no se desven de los usos pacficos.Las misiones de examen y los servicios de asesoramiento dirigidos por el OIEA ofrecen orientaciones sobre las actividades que deben llevarse a cabo durante el ciclo de vida de produccin de energa nuclear: desde la extraccin de uranio hasta la construccin, el mantenimiento y la clausura de centrales nucleares y la gestin de los desechos nucleares.El OIEA gestiona una reserva de uranio poco enriquecido (UPE) en Kazajstn, a la que pueden acudir como ltimo recurso los pases que necesiten urgentemente UPE con fines pacficos. The articles and videos on this page offer easy-to-understand explanations of major topics in nuclear science and technology. The many peaceful uses of nuclear technology have a beneficial impact on our everyday lives from energy production and food security to health care and the protection of the environment. Nuclear energy is a form of energy released from the nucleus, the core of atoms, made up of protons and neutrons. This source of energy can be produced in two ways: fission when nuclei of atoms split into several parts or fusion when nuclei fuse together.The nuclear energy harnessed around the world today to produce electricity is through nuclear fission, while technology to generate electricity from fusion is at the R&D phase. This article will explore nuclear fission. To learn more about nuclear fusion, click here. Nuclear fission is a reaction where the nucleus of an atom splits into two or more smaller nuclei, while releasing energy.For instance, when hit by a neutron, the nucleus of an atom of uranium-235 splits into two smaller nuclei, for example a barium nucleus and a krypton nucleus and two or three neutrons. These extra neutrons will hit other surrounding uranium-235 atoms, which will also split and generate additional neutrons in a multiplying effect, thus generating a chain reaction in a fraction of a second.Each time the reaction occurs, there is a release of energy in the form of heat and radiation. The heat can be converted into electricity in a nuclear power plant, similarly to how heat from fossil fuels such as coal, gas and oil is used to generate electricity. Nuclear fission (Graphic: A. Vargas/IAEA) Inside nuclear power plants, nuclear reactors and their equipment contain and control the chain reactions, most commonly fuelled by uranium-235, to produce heat through fission. The heat warms the reactors cooling agent, typically water, to produce steam. The steam is then channelled to spin turbines, activating an electric generator to create low-carbon electricity.Find more details about the different types of nuclear power reactors on this page. Pressurized water reactors are the most used in the world. (Graphic: A. Vargas/IAEA) Uranium is a metal that can be found in rocks all over the world. Uranium has several naturally occurring isotopes, which are forms of an element differing in mass and physical properties but with the same chemical properties. Uranium has two primordial isotopes: uranium-238 and uranium-235. Uranium-238 makes up the majority of the uranium in the world but cannot produce a fission chain reaction, while uranium-235 can be used to produce energy by fission but constitutes less than 1 per cent of the worlds uranium.To make natural uranium more likely to undergo fission, it is necessary to increase the amount of uranium-235 in a given sample through a process called uranium enrichment. Once the uranium is enriched, it can be used effectively as nuclear fuel in power plants for three to five years, after which it is still radioactive and has to be disposed of following stringent guidelines to protect people and the environment. Used fuel, also referred to as spent fuel, can also be recycled into other types of fuel for use as new fuel in special nuclear power plants. What is the Nuclear Fuel Cycle?The nuclear fuel cycle is an industrial process involving various steps to produce electricity from uranium in nuclear power reactors. The cycle starts with the mining of uranium and ends with the disposal of nuclear waste. The operation of nuclear power plants produces waste with varying levels of radioactivity. These are managed differently depending on their level of radioactivity and purpose. See the animation below to learn more about this topic. Radioactive Waste Management Radioactive waste makes up a small portion of all waste. It is the by-product of millions of medical procedures each year, industrial and agricultural applications that use radiation and nuclear reactors that generate around 11 % of global electricity. This animation explains how radioactive waste is managed to protect people and the environment from radiation now and in the future. The next generation of nuclear power plants, also called innovative advanced reactors, will generate much less nuclear waste than todays reactors. It is expected that they could be under construction by 2030. Nuclear power is a low-carbon source of energy, because unlike coal, oil or gas power plants, nuclear power plants practically do not produce CO2 during their operation. Nuclear reactors generate close to one-third of the worlds carbon free electricity and are crucial in meeting climate change goals.To find out more about nuclear power and the clean energy transition, read this edition of the IAEA Bulletin. The IAEA establishes and promotes international standards and guidance for the safe and secure use of nuclear energy to protect people and the environment.The IAEA supports existing and new nuclear programmes around the world by providing technical support and knowledge management. Through the Milestones Approach, the IAEA provides technical expertise and guidance to countries that want to develop a nuclear power programme as well as to those who are decommissioning theirs.Through its safeguards and verification activities, the IAEA oversees that nuclear material and technologies are not diverted from peaceful use.Review missions and advisory services led by the IAEA provide guidance on the activities necessary during the lifetime of production of nuclear energy: from the mining of uranium to the construction, maintenance and decommissioning of nuclear power plants and the management of nuclear waste.The IAEA administers a reserve of low enriched uranium (LEU) in Kazakhstan, which can be used as a last resort by countries that are in urgent need of LEU for peaceful purposes. This article was first published on iaea.org on 2 August 2021. Unlike wind and solar, nuclear power plants and hydropower offer dispatchable energy, meaning they are able to adjust their output to meet electricity demand. Additionally, the expanded use of nuclear power for non-electric applications, including district heating, hydrogen production, desalination and heat for industrial processes, offers further options to reduce emissions.To support this increasing nuclear energy demand, the IAEA is actively assisting countries by providing technical expertise and capacity building to help them establish or expand nuclear power plants.Integrated Nuclear Infrastructure Reviews (INIR) are an example where the IAEA assists countries to assess the status of their national infrastructure as they embark on establishing nuclear power plants. INIR missions enable countries to engage in discussions and receive guidance from experts about recommendations and best practices in nuclear power infrastructure development.These missions ensure that the infrastructure necessary for the safe, secure and sustainable use of nuclear power is developed and implemented in a responsible and orderly manner.In 2009, the IAEA conducted the first INIR Mission to a country initiating the use of nuclear power. Since then, INIR missions have been hosted by various states including the United Arab Emirates, that has successfully establishedthe Barakah Nuclear Energy Plant. This year, it is expected to supply around 25 per cent of the UAEs electricity, up from its current contribution of 20 per cent, reducing the countrys carbon emissions by 22 million tonnes annually.Similarly, countries like Sweden, France and Finland have utilized nuclear energy combined with hydro and renewables to largely decarbonize their electricity production.France has an extremely low level of CO2 emissions from electricity generation, since over 90 per cent of its electricity is from low-carbon sources, 70 per cent of that from nuclear power.And 94 percent of Swedens electricity comes from low carbon sources in Sweden with more than a third coming from nuclear, according to the IEA. Reliable atomic and nuclear data are essential ingredients in a wide range of applications, including the design and operation of nuclear power plants, management of nuclear waste, production and uses of radioisotopes, medical dosimetry and diagnostics, the development and applications of lasers and accelerators, fusion energy research, environmental monitoring, plasma processing, materials inspections and nuclear safeguards.Nuclear structure and decay data describe the lifetimes and decay modes of unstable isotopes, as well as the spectrum of emitted radiation. Nuclear reaction data describe cross sections for fundamental collision processes, for example between a neutron and a nucleus or between two nuclei. Atomic data include cross sections for collisions among electrons, atoms and molecules. The Agency also includes data for plasma-material interaction.The Agency has established international networks of atomic and nuclear datacentres that ensure a high degree of consistency of the activities of the major data centres around the world. Nuclear power is a low-carbon source of energy. In 2018, nuclear power produced about 10 percent of the worlds electricity. Together with the expanding renewable energy sources and fuel switching from coal to gas, higher nuclear power production contributed to the levelling of global CO2 emissions at 33 gigatonnes in 20191/. Clearly, nuclear power as a dispatchable low carbon source of electricity can play a key role in the transition to a clean energy future.As part of the capacity building process for energy system analysis and planning, the IAEA provides assistance to Member States for the evaluation of the role of nuclear energy in national climate change mitigation strategies through the Technical Cooperation programme and Coordinated Research Projects. For this purpose, a comprehensive set of IAEA tools and methodologies are available to Member States._____1/ Articles on global CO2 emissions in 2019 El OIEA, centro mundial de cooperacin en el mbito nuclear, tiene por objeto promover la utilizacin de las tecnologas nucleares con fines pacficos y en condiciones de seguridad tecnolgica y fsica. Most of the accessible data are taken from the Evaluated Nuclear Structure Data File (ENSDF), which is the most authoritative and up-to-date database in this area. In addition, other data of interest, e.g. thermal neutron cross sections, nuclear moments and radii can also be displayed. The IAEA assists its Member States in using nuclear science and technology for peaceful purposes and facilitates the transfer of such technology and knowledge in a sustainable manner to Member States.

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