20 Power Grid

Power Grid

Power Grid is the English-language version of the second edition of the multiplayer German-style board game Funkenschlag, designed by Friedemann Friese - Power Grid is the English-language version of the second edition of the multiplayer German-style board game Funkenschlag, designed by Friedemann Friese and first released in 2004. Power Grid was released by Rio Grande Games.

In the game, each player represents a company which owns power plants and tries to supply electricity to cities. During the game, players bid on power plants and buy resources to provide electricity to the growing number of cities in their network.

Electrical grid

electrical grid (or electricity network) is an interconnected network for electricity delivery from producers to consumers. Electrical grids consist of power stations - An electrical grid (or electricity network) is an interconnected network for electricity delivery from producers to consumers. Electrical grids consist of power stations, electrical substations to step voltage up or down, electric power transmission to carry power over long distances, and finally electric power distribution to customers. In that last step, voltage is stepped down again to the required service voltage. Power stations are typically built close to energy sources and far from densely populated areas. Electrical grids vary in size and can cover whole countries or continents. From small to large there are microgrids, wide area synchronous grids, and super grids. The combined transmission and distribution network is part of electricity delivery, known as the power grid.

Grids are nearly always synchronous, meaning all distribution areas operate with three phase alternating current (AC) frequencies synchronized (so that voltage swings occur at almost the same time). This allows transmission of AC power throughout the area, connecting the electricity generators with consumers. Grids can enable more efficient electricity markets.

Although electrical grids are widespread, as of 2016, 1.4 billion people worldwide were not connected to an electricity grid. As electrification increases, the number of people with access to grid electricity is growing. About 840 million people (mostly in Africa), which is ca. 11% of the World's population, had no access to grid electricity in 2017, down from 1.2 billion in 2010.

Electrical grids can be prone to malicious intrusion or attack; thus, there is a need for electric grid security. Also as electric grids modernize and introduce computer technology, cyber threats start to become a security risk. Particular concerns relate to the more complex computer systems needed to manage grids.

North American power transmission grid

electrical power grid that powers Northern America is not a single grid, but is instead divided into multiple wide area synchronous grids. The Eastern - The electrical power grid that powers Northern America is not a single grid, but is instead divided into multiple wide area synchronous grids. The Eastern Interconnection and the Western Interconnection are the largest. Three other regions include the Texas Interconnection, the Quebec Interconnection, and the Alaska Interconnection. Each region delivers power at a nominal 60 Hz frequency.

The regions are not usually directly connected or synchronized to each other, but there exist some HVDC interconnectors. The Eastern and Western grids are connected via seven links that allow 1.32 GW to flow between them. A study by the National Renewable Energy Laboratory found that increasing these interconnections would save energy costs.

China Southern Power Grid

Guangdong Power Grid Company Guangxi Power Grid Company Yunnan Power Grid Company Guizhou Power Grid Company Hainan Power Grid Company Guangzhou Power Supply - China Southern Power Grid Company Limited (CSG; Chinese: ??????; pinyin: Zh?ngguó Nánf?ng Diànw?ng) is one of the two Chinese state-owned enterprises established in 2002 in a power system reform promulgated by the State Council, the other being the State Grid Corporation of China (SGCC). It is overseen by the State-owned Assets Supervision and Administration Commission of the State Council and it manages investment, construction and management of power transmission, transformation and distribution covering China's five southern provinces of Guangdong, Guangxi, Yunnan, Guizhou and Hainan, while power generation is done by five other power generation groups. The company is headquartered in Guangzhou, Guangdong.

China Southern Power Grid accounts for 20% of the Chinese grid while SGCC accounts for the remaining 80%.

Smart grid

three systems of a smart grid – the infrastructure system, the management system, and the protection system. Electronic power conditioning and control - The smart grid is an enhancement of the 20th century electrical grid, using two-way communications and distributed so-called intelligent devices. Two-way flows of electricity and information could improve the delivery network. Research is mainly focused on three systems of a smart grid – the infrastructure system, the management system, and the protection system. Electronic power conditioning and control of the production and distribution of electricity are important aspects of the smart grid.

The smart grid represents the full suite of current and proposed responses to the challenges of electricity supply. Numerous contributions to the overall improvement of energy infrastructure efficiency are anticipated from the deployment of smart grid technology, in particular including demand-side management. The improved flexibility of the smart grid permits greater penetration of highly variable renewable energy sources such as solar power and wind power, even without the addition of energy storage. Smart grids could also monitor/control residential devices that are noncritical during periods of peak power consumption, and return their function during nonpeak hours.

A smart grid includes a variety of operation and energy measures:

Advanced metering infrastructure (of which smart meters are a generic name for any utility side device even if it is more capable e.g. a fiber optic router)

Smart distribution boards and circuit breakers integrated with home control and demand response (behind the meter from a utility perspective)

Load control switches and smart appliances, often financed by efficiency gains on municipal programs (e.g. PACE financing)

Renewable energy resources, including the capacity to charge parked (electric vehicle) batteries or larger arrays of batteries recycled from these, or other energy storage.

Energy efficient resources

Electric surplus distribution by power lines and auto-smart switch

Sufficient utility grade fiber broadband to connect and monitor the above, with wireless as a backup. Sufficient spare if "dark" capacity to ensure failover, often leased for revenue.

Concerns with smart grid technology mostly focus on smart meters, items enabled by them, and general security issues. Roll-out of smart grid technology also implies a fundamental re-engineering of the electricity services industry, although typical usage of the term is focused on the technical infrastructure.

Smart grid policy is organized in Europe as Smart Grid European Technology Platform. Policy in the United States is described in Title 42 of the United States Code.

Off-the-grid

off-grid building must be able to supply energy and potable water for itself, as well as manage food, waste and wastewater. Energy for electrical power and - Off-the-grid or off-grid is a characteristic of buildings and a lifestyle designed in an independent manner without reliance on one or more public utilities. The term "off-the-grid" traditionally refers to not being connected to the electrical grid, but can also include other utilities like water, gas, and sewer systems, and can scale from residential homes to small communities. Off-the-grid living allows for buildings and people to be self-sufficient, which is advantageous in isolated locations where normal utilities cannot reach and is attractive to those who want to reduce environmental impact and cost of living. Generally, an off-grid building must be able to supply energy and potable water for itself, as well as manage food, waste and wastewater.

Battery energy storage system

energy storage system (BESS), battery storage power station, battery energy grid storage (BEGS) or battery grid storage is a type of energy storage technology - A battery energy storage system (BESS), battery storage power station, battery energy grid storage (BEGS) or battery grid storage is a type of energy storage technology that uses a group of batteries in the grid to store electrical energy. Battery storage is the fastest responding dispatchable source of power on electric grids, and it is used to stabilise those grids, as battery storage can transition from standby to full power in under a second to deal with grid contingencies.

Battery energy storage systems are generally designed to deliver their full rated power for durations ranging from 1 to 4 hours, with emerging technologies extending this to longer durations to meet evolving grid demands. Battery storage can be used for short-term peak power demand and for ancillary services, such as providing operating reserve and frequency control to minimize the chance of power outages. They are often installed at, or close to, other active or disused power stations and may share the same grid connection to reduce costs. Since battery storage plants require no deliveries of fuel, are compact compared to generating stations and have no chimneys or large cooling systems, they can be rapidly installed and placed if necessary within urban areas, close to customer load, or even inside customer premises.

As of 2021, the power and capacity of the largest individual battery storage system is an order of magnitude less than that of the largest pumped-storage power plants, the most common form of grid energy storage. For example, the Bath County Pumped Storage Station, the second largest in the world, can store 24 GWh of electricity and dispatch 3 GW while the first phase of Vistra Energy's Moss Landing Energy Storage Facility can store 1.2 GWh and dispatch 300 MW. However, grid batteries do not have to be large — a high number of smaller ones (often as hybrid power) can be widely deployed across a grid for greater redundancy and large overall capacity.

As of 2019, battery power storage is typically cheaper than open cycle gas turbine power for use up to two hours, and there was around 365 GWh of battery storage deployed worldwide, growing rapidly.

Levelized cost of storage (LCOS) has fallen rapidly. From 2014 to 2024, cost halving time was 4.1 years. The price was US$150 per MWh in 2020, and further reduced to US$117 by 2023.

Power Rangers: Battle for the Grid

Power Rangers: Battle for the Grid is a fighting game developed by San Francisco-based game developer nWay, featuring characters from the Power Rangers - Power Rangers: Battle for the Grid is a fighting game developed by San Francisco-based game developer nWay, featuring characters from the Power Rangers franchise. It was released digitally for Nintendo Switch and Xbox One on March 26, 2019, for PlayStation 4 on April 2, 2019, for Microsoft Windows on September 24, 2019, and for Stadia on June 1, 2020. Limited Run Games released a standard physical version on the Switch and PlayStation 4 alongside a more expensive Mega Edition, which included a SteelBook case, 18" X 24" poster, and 5 coins in addition to the game. Pre-orders went up for sale in June 2019 with the game delivered in November 2019. In October 2020, Maximum Games published the "Collector's Edition" which included the character Lauren Shiba, both physically and digitally. A third version (physical and digital) the Super Edition containing all previous downloadable content was released digitally in May 2021 and physically in August 2021.

ASEAN Power Grid

The ASEAN Power Grid (APG) is a key initiative under the ASEAN Vision 2020 and has the goal of achieving regional interconnection for energy security, - The ASEAN Power Grid (APG) is a key initiative under the ASEAN Vision 2020 and has the goal of achieving regional interconnection for energy security, accessibility, affordability and sustainability. The APG is a regional power interconnection initiative aiming to connect the electricity infrastructure of the member states of the Association of Southeast Asian Nations (ASEAN).

The main goal of the ASEAN Power Grid is to ensure energy security in the ASEAN region by integrating the power infrastructure across different countries. This includes the construction of cross-border power interconnections, which would allow the sharing of excess power capacity among ASEAN countries. The APG initiative is expected to enhance electricity trade across borders, meet the rising electricity demand, and improve access to energy services in the region. It is also seen as a way to promote the use of renewable energy sources within the region.

Photovoltaic system

several tens of kilowatts to large, utility-scale power stations of hundreds of megawatts. Nowadays, off-grid or stand-alone systems account for a small portion - A photovoltaic system, also called a PV system or solar power system, is an electric power system designed to supply usable solar power by means of photovoltaics. It consists of an arrangement of several components, including solar panels to absorb and convert sunlight

into electricity, a solar inverter to convert the output from direct to alternating current, as well as mounting, cabling, and other electrical accessories to set up a working system. Many utility-scale PV systems use tracking systems that follow the sun's daily path across the sky to generate more electricity than fixed-mounted systems.

Photovoltaic systems convert light directly into electricity and are not to be confused with other solar technologies, such as concentrated solar power or solar thermal, used for heating and cooling. A solar array only encompasses the solar panels, the visible part of the PV system, and does not include all the other hardware, often summarized as the balance of system (BOS). PV systems range from small, rooftop-mounted or building-integrated systems with capacities ranging from a few to several tens of kilowatts to large, utility-scale power stations of hundreds of megawatts. Nowadays, off-grid or stand-alone systems account for a small portion of the market.

Operating silently and without any moving parts or air pollution, PV systems have evolved from niche market applications into a mature technology used for mainstream electricity generation. Due to the growth of photovoltaics, prices for PV systems have rapidly declined since their introduction; however, they vary by market and the size of the system. Nowadays, solar PV modules account for less than half of the system's overall cost, leaving the rest to the remaining BOS components and to soft costs, which include customer acquisition, permitting, inspection and interconnection, installation labor, and financing costs.