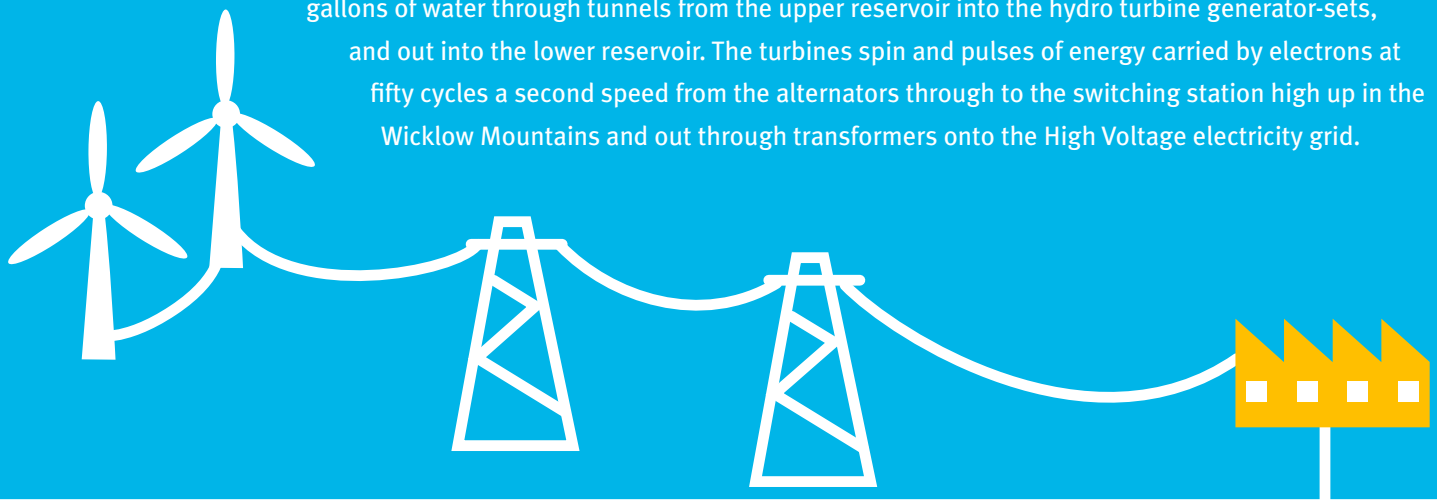
EIRGRID

THE *SPEED* OF LIGHT

It is 5.30 on a winter's evening...

Children around Ireland have returned from school. After their day's work, most people are on the way home. Televisions and heating systems are being switched on, immersion heater water-tanks start to warm as their time-clocks tick, and food preparation begins in homes all over Ireland. The build-up to the daily teatime peak in electricity use has started...

A shift operative is in the generating hall of the hydro-electric power station at Turlough Hill awaiting the call to produce additional electricity and carefully monitoring the equipment. When the electronic call on the station is made by the EirGrid National Control Centre extra power will be produced within seconds by sending hundreds of thousands of gallons of water through tunnels from the upper reservoir into the hydro turbine generator-sets, and out into the lower reservoir. The turbines spin and pulses of energy carried by electrons at fifty cycles a second speed from the alternators through to the switching station high up in the Wicklow Mountains and out through transformers onto the High Voltage electricity grid.



MATCHING DEMAND FROM CUSTOMERS EVERY SECOND

At 20 other major power stations – some owned by ESB and some by firms like Bord Gáis, Edenderry Power, Viridian and Endesa – skilled staff are also standing by, using different fuels such as coal and oil, gas and peat, with a range of different technologies to convert the fuel energy into electricity. Water and fuel flow are controlled, steam pressure and temperature are monitored, and many other sophisticated processes are carried out. Most counties have some generation, either from conventional power stations or wind farms.

Where necessary, stations can change the amount they are generating to match demand from customers nationally. Engineers in the EirGrid National Control Centre can direct the power station outputs to ensure that the overall amount of electricity produced precisely matches that needed by customers.

Depending on wind conditions, electricity is also being generated by a growing number of wind farms, stretching the length of the country. Firms like Airtricity/SSE, Bord na Mona and SWS have constructed turbines around Ireland. Turbines harness the renewable energy of the wind to produce electricity. Ireland has the best wind resource in Europe.

IRELAND HAS THE BEST WIND RESOURCE IN EUROPE

Well over sixty windfarms are now connected to the grid, and Ireland is on target for 15 per cent of generation to be met from renewable sources by the end of 2010 and progressing towards the further target of 40 per cent renewable electricity by 2020. While the output of the wind farms fluctuates, depending on the wind speed around Ireland, the energy they generate make a significant contribution to supplies of power. On a windy evening, they can generate power for several hundred thousand homes.

The electrical power from the generators passes along the transmission lines – the arteries feeding the nation's power needs – at high voltage. This includes levels of 400,000 volts, 220,000 volts and 110,000 volts. It will travel along tens of thousands of kilometres of transmission and distribution networks all over Ireland, supported by steel towers and over a million wooden poles. EirGrid, operates the high voltage transmission system and ESB Networks operates the distribution system.

At the EirGrid National Control Centre in Dublin, an engineer is at a bank of monitors showing, moment by moment, the increasing demand from all 2 million homes and businesses connected to the power system. The engineer has to match the need for more electricity precisely - electrical power of this nature cannot be stored and is needed the instant customers require it. A detection system gives her crucial information on lightning storms which could damage electricity lines or transformers, and a temperature gauge keeps her alerted to any cold snap which may increase demand.

Following the electricity market schedules from the Single Electricity Market Operator, the Grid Controller calls in the generating stations to provide the electricity needed and ensures that the power system remains balanced and secure. The grid controller also liaises with System Operator Northern Ireland, which operates the transmission system in Northern Ireland.

DEMAND IN WIND EQUIVALENT TO 50 MILLION LIGHT BULBS

The engineer knows that demand tonight at midwinter is likely to top 5,000 megawatts - the equivalent of more than 50 million 100 watt electric light bulbs all being switched on at once. In the longterm demand is anticipated to increase and a major plan called Grid25 has been put in place by EirGrid. New power plans and powerlines and substations are needed and are being constructed. While energy efficiency campaigns are ongoing, investment in reliable economic power is needed for the future. Occasionally demand can even be altered by something like a major rugby or soccer international.

The Grid Controller in EirGrid takes a call – a boiler has developed a fault at a power station. A generating unit will have to be switched out for repairs. The NCC makes contact with the Shift Managers at other power station to provide the increased power. An increase in output is called for by the NCC engineer, via a micro-wave or fibre-optic link to the power stations. A lightning strike has affected some wind farms, and action to bridge this shortfall is also taken.

On a complex, dynamic system, different events can take place. An engineer with ESB Networks in Cork receives a call on his mobile phone. A fault on a high voltage cable has caused a 38,000 volt transformer station to disconnect. He moves to quickly send staff to switch electricity lines out to divert power and balance the system.

Following the changes, the power continues to pass through Ireland's main power arteries – what some people describe as the "motorways of power", branching across the country along the network, gradually being reduced in voltage. It has started at 400,000 or 220,000 volts from the power station and then been reduced to 110,000 volts, then via more lines and transformers to 38,000 volts. Some large customers – including computer and pharmaceutical plants – use electricity at high voltage and this is transferred to them.

HIGH QUALITY POWER VITAL IN ATTRACTING AND RETAINING JOBS

High quality reliable power is vital for attracting and keeping jobs in Ireland in high tech industries and in small and medium-sized businesses. Customers like farms and workshops use three-phase power and that is brought to them. Consumers can purchase the electricity from different electricity suppliers. These suppliers can purchase power on a wholesale basis and resell it. But it is all transported over the same power system – the transmission and distribution networks.

The high voltage transmission networks have to be upgraded and redeveloped to connect customers and generators, and to ensure that power is transferred to each region, supporting jobs and providing essential services. Network planners, engineering designers and project managers are busy in the EirGrid offices working on developing new power lines, and on the development of the new East West Interconnector linking Ireland to Wales.

Back on the power system, as the electricity moves towards the final customers, it travels via a mixture of overhead lines supported by sturdy steel and wooden structures or by underground cables to be passed around regions all over Ireland, being reduced further along the way to 20,000 volts, then 10,000 volts, and onwards at low voltages to be transferred along suburban streets and through villages. Now the electricity is being carried in the “arterioles” and “capillaries” of the power system.

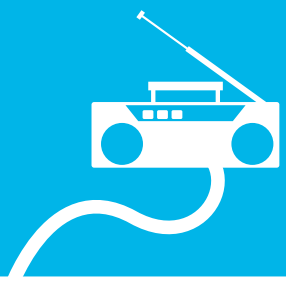
An ESB Networks technician is using his “climb-safe” equipment to scale an electricity pole at the end of your road. Stormy conditions have caused the branches of a tree to come in contact with the electricity line, making a short circuit and overloading the fuse in the milk churn-shaped local transformer.

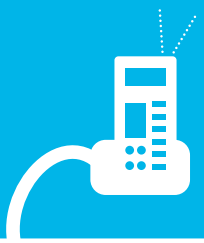
The ESB Networks Call Centre agent took the call from the customers affected and was in touch with him from the response centre in Wilton, Cork. He replaces the fuse and, when it is safe to do so, his colleague, a network supervisor, makes the line live again. The electricity, now at 220 volts, passes into your home as you return from work and press the switch on the kettle.

Passing through your electricity meter, the energy for a cup of tea will add less than one cent to your bill from your electricity utility over the next two months, covering the cost of generating and delivering the power for this pot of tea to your home.

Instantly, the power to heat, to cook, to view the internet on your PC, to keep the milking-machine running, is available to you.

Even though the electricity has passed through the power system and so much work has gone on, it is still 5.30pm. Because of the speed of the power – the electricity has passed at more than half the speed of light through the transmission grid, along high voltage lines and cables, across medium voltage lines and via the local distribution system.





EIRGRID

TEAM FROM ELECTRICITY INDUSTRY WORKING TO KEEP LIGHTS ON

A team of men and women from the Irish electricity industry – power production staff in power stations, grid controllers, contact centre agents, and network repair and construction personnel – are on-duty or on-call 24 hours a day. Their mission is to ensure that power is there for you to use at all times. From power station shift workers and engineers and wholesale market designers, to network technicians, to those running the remote telecommunications systems, and those planning and building new electricity lines, a wide variety of skills are needed to bring the power home when and where it is needed – demonstrating "the speed of light."*

* A pulse of electric power travelling though the metal conductors on the power system is estimated to travel at up to 0.6 of the speed of light in a vacuum. The speed of light is just under 300,000 kilometres per second.

This piece is produced for illustrative purposes, demonstrating what is involved in bringing power to our homes and businesses. If you would like to comment on the piece, or to suggest further general information on electricity which we could place on our website, please email us at info@eirgrid.com. EirGrid is the independent transmission system operator in the Republic of Ireland. It is responsible for the operation, development and maintenance of the high voltage transmission system. It is also the Market Operator of the wholesale power market. It is entirely separate from any other company in the electricity industry.