Magnet Dynamo - Princeton University EPICs

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My poster is about the dynamo, a form of electric generator created by Michael Faraday in 1831. The poster will include diagrams and schematics of how the dynamo generates electricity, an early design of the dynamo, and a laminated copy of the original research published by Faraday for historical context. The poster's purpose is to demonstrate how early dynamos generated power, which aids in understanding their historical importance and applications.

In short, the magnetic dynamo works by using rotating magnets to cut through the lines of flux created by magnetic wire (a "stator"). In other words, the dynamo generates electricity by rotating one magnet under the influence of a separate magnetic field. The moving magnetic field pushes electrons through the wire, which generates an electromotive force (a phenomenon described by Faraday's Law of Induction). As a result, electrons move through the wire, generating a current that can be used to power devices.

Dynamos also typically contain a commutator, which is a device that allows dynamos to produce a flow of direct current. When a dynamo rotates, its "armature" (the windings that cut through the stator's magnetic field) reverses direction every other rotation. The commutator is a switch that is turned on or off by rotation; when the

armature of the dynamo is rotating in the wrong direction, the commutator will be switched on (whose function is to disconnect the power). This prevents a unidirectional stream of current to be produced.

Dynamos were the first electric generators powerful enough for industrial use; although the first dynamos used permanent magnets as the stator, the first industrial dynamo used electromagnetic coils as their stator. Passing a current through a conductive coil creates a much stronger electromagnetic field than permanent magnets. This happens because the magnetic flux lines produced all pass through the coil's center and overlap to create a very strong field. This principle allowed the dynamos using electromagnetic coils to produce enough power to be industrially viable.

The first few dynamos used for industrial purposes were usually driven by steam engines, which performs work by harnessing the pressure-volume work done by the expansion of steam to move a piston. The work produced by this process can then be converted to electrical energy by the dynamo by providing a force that acts upon the rotor (which then is able to move, cutting through the lines of flux of the stator).

The dynamo also led to the creation of the electric motor, which (unlike a generator) converts electrical energy to work. This is because, since generators and motors perform the opposite actions, they can be reversed to perform different roles.

Because dynamos can easily convert electrical power to work (and vice versa, depending on the direction of the spin), they were also paired with rotors to easily convert direct current (produced by the dynamo) to alternating current, which periodically reverses direction and has different applications. However, mercury rectifiers tend to be used over dynamos and alternators today, simply because they cost less to maintain, are easier to produce, and tend to be more reliable.

Today, most power stations have phased out larger dynamos for alternators. Alternators are also a type of electric generator, but unlike dynamos, alternators produce alternating current, which, again, periodically switches direction. In contrast, dynamos only produce direct current . AC is now the way electricity is delivered to houses and businesses; this is because AC voltage is easier to control with a transformer, which makes the energy transfer more efficient. Nevertheless, the low-voltage DC current provided by dynamos is still often used in modern electronic devices, whose circuit boards only function with a unidirectional, constant current.

I've been working on this project for over two months at a program offered at Princeton University by Professor Littman, known as Engineering Projects In Community Service (EPICS). The purpose of EPICs is to merge community service and engineering; we do this by creating projects relating to electromagnetism and

presenting them at local schools and libraries during community events. Outside of EPICS, I'm a junior at Montgomery High School in Montgomery, New Jersey.