



Power Grid K-12 Education

Who am I?



- Science, Math, Technology Educator
- Inventor
- Director/Founder KidWind Project, REcharge Labs, KidWind Challenge
- Effective translator who has helped 10,000s of teachers engage with energy concepts and wind and solar energy

REcharge⚡Labs®

KidWind[®]

PROJECT

- Wind energy curriculum dissemination and development
- Support, sponsoring and organize 30+ Regional KidWind Challenges and the National KidWind Challenge
- Annual master educator training - REcharge Academy - over 300 master trainers all over US to train on wind and solar
- Ongoing advisor on the DOE sponsored Collegiate Wind Competition
- Key K-12 leader in the DOE funded Wind for Schools program





REcharge ⚡ Labs[®]

REcharge Labs generates resources for learners to creatively explore wind and solar power. We engage and inspire today's K-12 students, educators, makers, and tinkerers to become the innovative renewable energy leaders of tomorrow by offering effective hands-on activities and kits, educator professional development, online engineering design challenges, and lessons.

- **Experienced:** Backed by over a decade of experience providing educators the knowledge and tools to successfully teach intimidating energy concepts.
- **Broad reaching:** REcharge Labs programming has been executed in all 50 US States and internationally, reaching over 700,000 students and more than 12,000 teachers.
- **Trusted:** Relied upon by teachers as the best resource for renewable energy education for their classrooms.

REcharge Labs was developed out of the educator training program from the KidWind Project. REcharge Labs builds off of 14 years of expertise, resources, and tools to effectively train educators and engage students in education about renewable energy.



Wind Energy Products

Kits

- MINI Wind Turbine with Blade Design
- Basic Wind Experiment Kit
- Advanced Wind Experiment Kit

Which KidWind kit should I buy?

Parts

Blade Parts

- Wind Turbine Hub (3 Pack)
- Dowels
- Balsa Blade Sheets
- Airfoil Balsa Blade Sheets
- Blade Design Consumables
- Chipboard Sheets

Turbine Parts

- Basic Turbine Building Parts
- Wind Turbine Generator with Wires
- High Torque Generator with Wires
- Drivetrain Set
- Gear Set
- GENpack
- Tower and Base Set
- Blade Pitch Protractor
- Red Blade Set
- Advanced Wind Experiment Kit Nacelle
- simpleGEN
- Basic to Advanced Experiment Kit Upgrade
- Nacelle
- Motor Mount Pack

Solar Energy Products

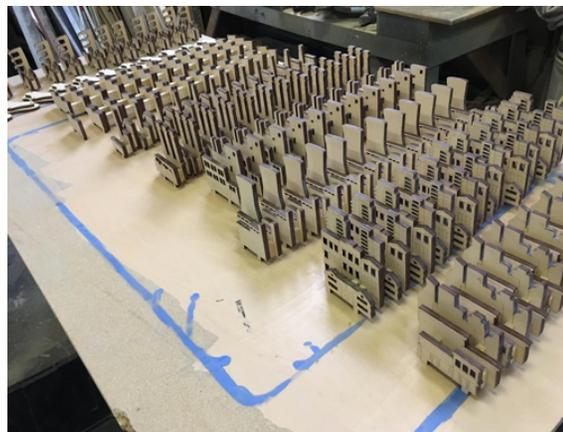
- 2V/400mA Solar Panel
- 12V/500mA Solar Panel
- Solar Thermal Exploration Kit
- Solar Energy Exploration Kit
- Investigating Solar Energy
- Renewable Energy with Vernier

Power Measurement Products

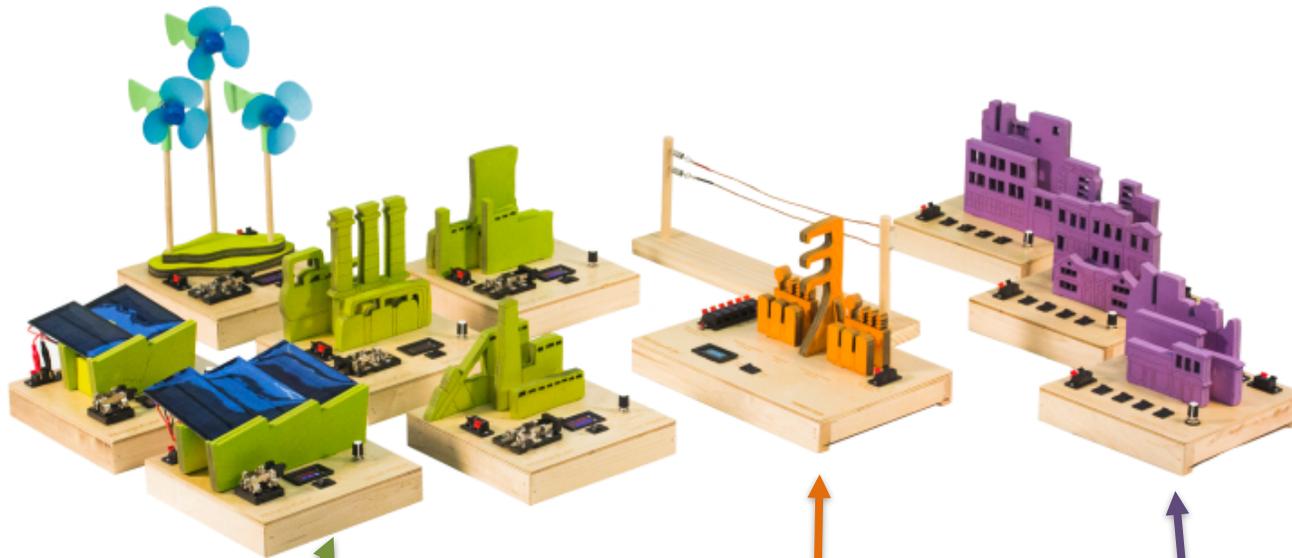
- Vernier Energy Sensor
- Vernier Variable Load
- KidWind Power Output Board
- Vernier Resistor Board
- KidWind Sound and Light Board
- KidWind Power Output Pack
- KidWind Small Water Pump with Tubing

Why develop a grid focused platform for K-12?

- More we ask students about where their electricity comes from the more confusion we see.
- Not much out there we like in terms of kits or curricula
- Great way to teach systems theory
- Great way to teach students the climatic impacts of electricity production and how renewable fit into the picture.
- Heavy workforce needs in the next 10-15 years. Develop the younger pipeline.



Power Grid Kit Platform



Generation Sources

- Coal
- Nuclear
- Gas
- Wind
- Utility Solar
- Community Solar

Transmission, Distribution, Measurement

Loads

- Residential
- Commercial
- Industrial

What is the Power Grid Kit?

The Power Grid Kit is designed to be an engaging platform to help students of all ages to learn about the power transmission grid. It is designed for applications in both formal and informal educational environments, and provides a hands-on exploration of core science concepts about energy consumption and generation.

The Power Grid Kit models the flow of electricity from nuclear, coal, natural gas, wind, and solar power sources through substations before being distributed to industrial, commercial, and residential consumers. It also models distributed generation in the form of community solar gardens and private residential wind turbines to demonstrate the broad range of energy options

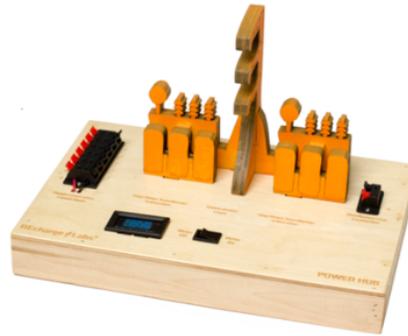
The Power Grid Kit is a functioning grid model that allows students to:

- **Learn the basics** - Master electrical concepts such as using meters, measuring voltage and current, and combining components in series and parallel.
- **Understand the entire system** - Combine individual components into an integrated miniature grid system.
- **Experiment and Discover** - Design a variety of scenarios based on real systems, then test to see the results.
- **Make it their own** - Add to your town by building your own structures to hook into your grid. See what happens for yourself!

Sample Parts



Natural Gas Plant



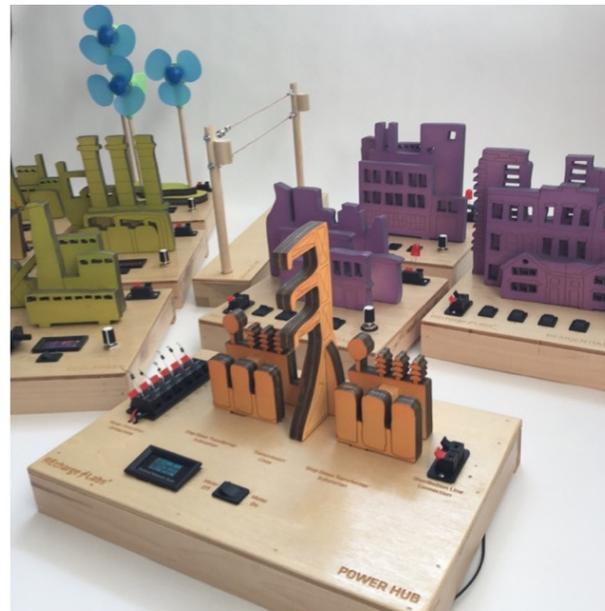
Power Hub – Transmission
& Measurement



Residential Load

Each component models an important part of the grid from generation to transmission and distribution to loads. All components have embedded meters to measure electricity flow through each segment of the grid.

It all WORKS!

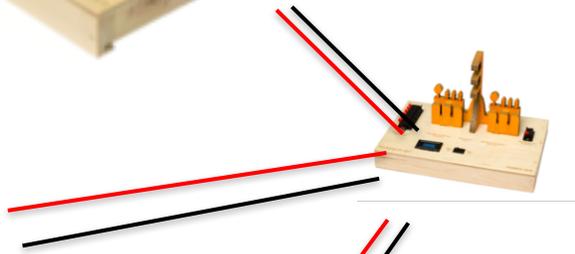


All generation and loads work in this system. We can measure current, voltage, power and energy flows. We can see what happens when the loads are high or low.

Kids can use hand-crank generators to generate power or we can use batteries --- or the solar or wind farms.

The Power Hub combines power from all the power plants and provides instant data on what is happening with loads.

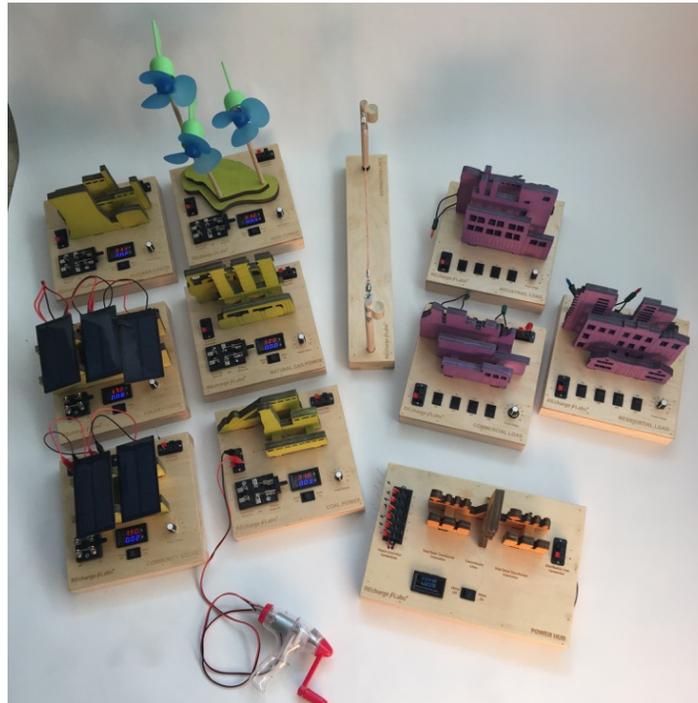
Make it their own!



2017 Project Goals

- Develop and manufacture a reproducible Power Grid Kit that allows learners in formal and informal education settings to explore the power grid and its components from a systems level approach.
- Produce curriculum to help educators effectively use the Power Grid Kit to teach science standards in 6-12th grade classrooms.
- Produce a suite of open source manuals and files that can be used by educators to construct their own power grid for use in classrooms and other environments.
- Develop an in-person and online training course for educators on how to use Power Grid Kit in the classroom.
- Develop an Advisory Team comprised of individuals from industry, universities, museums and educational institution who will provide feedback on the quality and nature of the content being covered.
- Attract sponsors and investors to fund the development of these tools so REcharge Labs can keep tools open source

Next Steps – July 2017



We are currently developing the following:

- videos on how to use the kit
- a week- long High School lesson set and experiment manual
- games that use the Power Grid Kit to explore time of day pricing, carbon impacts and production and load variability.
- open sources files for laser cutting and wiring your own kit.
- One day workshops for educators in the summer of 2017 for educators
- loaner program

Interested? Want to collaborate?

- Collaborating with interested GEARED Partners would help to make the Power Grid Kit as accurate as possible and work towards a long-term goal of educating K-12 students about the Grid and careers in this field.
- Collaborating with REcharge Labs would help the GEARED team meet K-12 impact goals with an established leader in K-12 teacher training and education space >> Saving time, \$\$ and having a much better product in the end.
- Collaborating with REcharge Labs to create an accurate, engaging and commercially viable platform helps the GEARED team have long lasting impact in the K-12 educational space – long after grants are gone.
- Collaborating with GEARED gives our project credibility as we seek to fundraise for teacher workshops, more curricula development and product improvements.



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Thanks for listening!