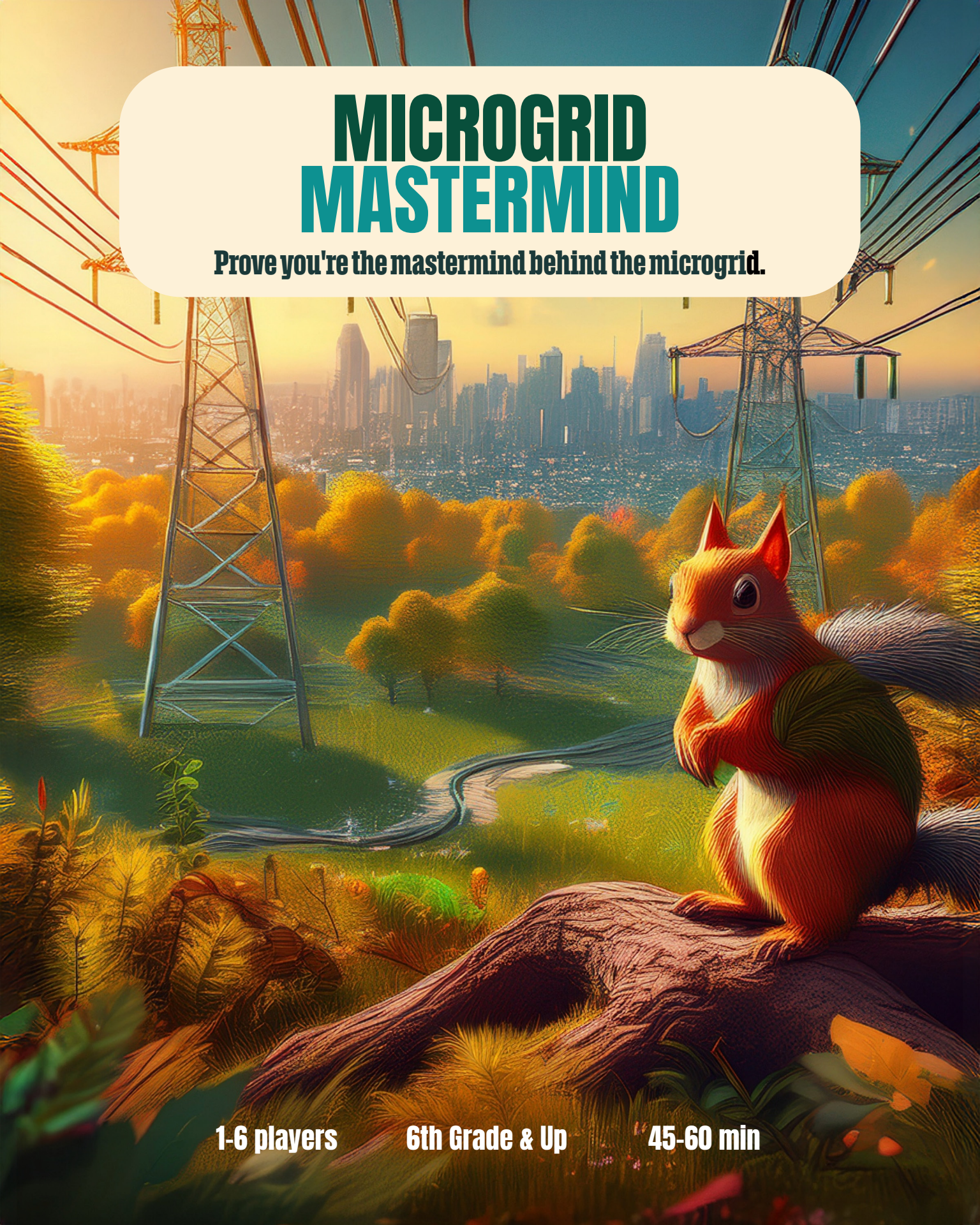

MICROGRID
MASTERMIND
Prove you're the mastermind behind the microgrid.
1-6 players
6th Grade & Up
45-60 min

The Grid Keepers

Energy systems across the U.S. are reaching a critical breaking point. Outdated infrastructure, increasing load, and growing threats from extreme weather are causing frequent blackouts, pushing communities to the edge. Amid the chaos, one brilliant systems engineer and community advocate emerged: Dr. Elia Voss, known to many as **The Grid Master**.

Dr. Voss believes power should be **smart, strong, and fair**. She designed the **Microgrid Mastermind Model**, a revolutionary energy system that combines **clean energy sources like hydro, solar, and wind** with **on-demand resources like coal, natural gas, and nuclear**.

Her system can work. But it needs one thing to succeed, a smart, fast-thinking team, to run it.

That's where you come in:

You are the **Grid Keepers**, a team trained to keep the power on, no matter what. Each of you holds a real-world energy job (just with cooler titles):

 Chief Operations Officer – Oversees the growth of the grid and sees the big picture

 Load Legend – Tracks and predicts how much power the city needs

 Volt Architect – Builds and repairs all kinds of power plants

 Line Specialist – Makes sure the grid is connected, and tackles infrastructure repairs

 Dispatch Officer – Handles surprise events like storms or squirrel attacks

 Energy Resource Manager – Manages fuel and system upgrades

Each round, you'll take actions like placing a power plant or buying fuel and use your role's special ability throughout the game to keep the grid running smoothly.

But watch out for blackouts that will push the blackout meter higher.

If the meter tops out, before the 6th round is finished... Game Over!

No power. No celebration. **YOU LOSE** ❌💡❌🎉❌

If you get through the 6th round without topping out the blackout meter, your grid avoids a complete shutdown and **YOU WIN**. 🎉

So... gather your team, spin the spinner, and brace for squirrel sabotage, **to prove you're the Mastermind behind the Microgrid**!

How it Works

Goal of the Game

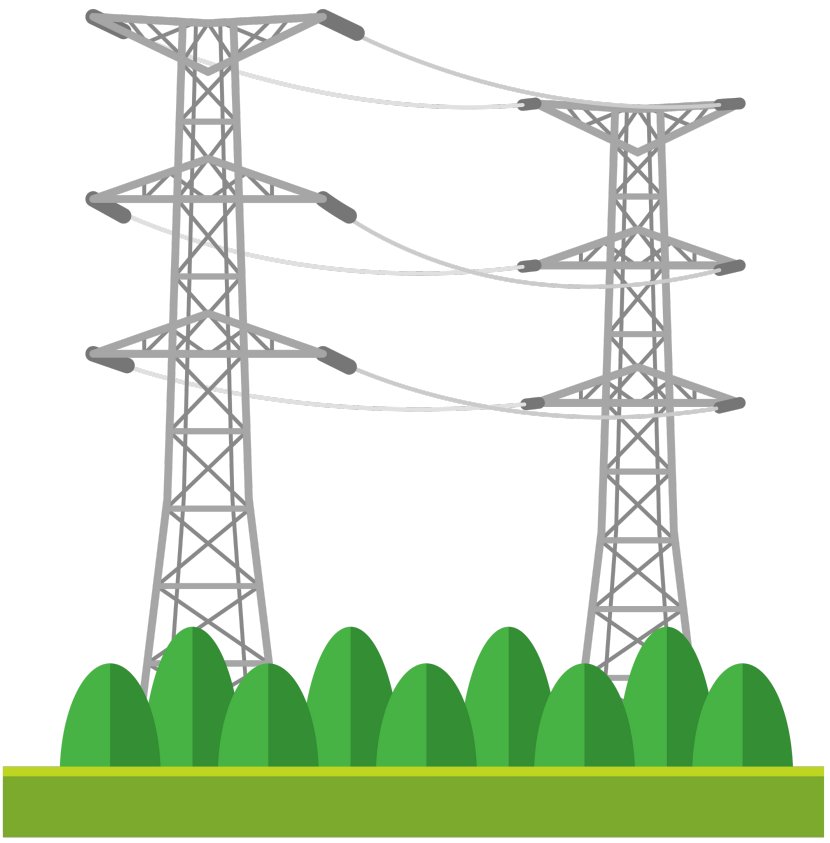
- Have fewer than 10 blackouts by the end of Round 6 will avoid a grid SHUTDOWN.
- Prove you are the mastermind behind your microgrid!

Game Overview

- Up to 6 people per grid
- A full game = 6 Rounds
- This is a cooperative game - either everyone wins or everyone loses
- Blackouts => tick in the meter => At 10 ticks, game over, you lose!

Game Play

- Load Phase
- Predicted Phase
- Building/Action Phase
  - Each player has a choice between 6 actions to perform during their turn
    - Get a power plant
    - Place a nature tile
    - Purchase fuel
    - Get a transmission line
    - Get a distribution line
    - Get a substation
- Event Phase
- Exchange fuel
- Actual Phase
- Fufill Load



Player Roles

Each player chooses a role card at random, at the start of the game.

Note: If playing with fewer than 6 players, only use the same number of roles as there are players (e.g., five players = five role cards drawn).

Chief Operations Officer

Special Power (once per game)
Look through ALL nature tiles and choose one tile to place. Shuffle after choosing.
Other Power (once per round, For an Action)
Draw the TOP 3 nature tiles and choose one to place. Shuffle after choosing.

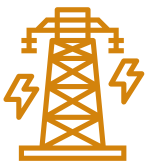
Load Legend

Special Power (once per game)
Remove up to 3 load stackers to while fulfilling load to prevent blackout.
Other Power (once per round, For an Action)
Add 1 generation stacker to a renewable plant, up to capacity.

Volt Architect

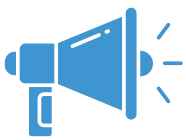
Special Power (once per game)
Place a power plant for one less action than required.
OR
Replace a coal plant with a natural gas plant and gain an extra action next round.
Other Power (once per round, For an Action)
Repair a power plant that was destroyed in the previous round.

Line Specialist



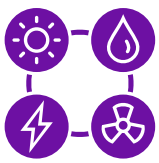
Special Power (once per game)
Prevent damage/destruction of up to 3 pieces of infrastructure(*transmission/distribution line or substation*).
Other Power (once per round, For an Action)
Bury a transmission line to protect it.

Dispatch Officer



Special Power (once per game)
Look at the top 6 event cards, remove 1 permanently. Place the rest back on top of the deck in any order.
Other Power (once per round, For an Action)
Draw 5 event cards, choose 3 and place the others back on top of the deck.

Energy Resource Manager

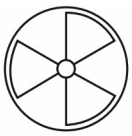


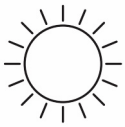
Special Power (once per game)
Exchange coal & natural gas fuel at a doubled rate (*1 fuel = 2 generation stackers*).
Other Power (once per round, For an Action)
Increase generation capacity of a non-renewable plant by +1 for the round.

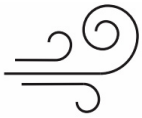
Components

Power Plant Icons

Nature Tiles are equipped with icons to show what power plants can be placed on a specific type of tile.


NUCLEAR

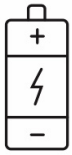

SOLAR


WIND


HYDRO


NATURAL GAS


COAL

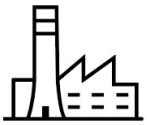

BATTERY STORAGE

City Tile Regions

The city tile is split into 4 regions.


RESIDENTIAL


MARKET


INDUSTRIAL


DOWNTOWN

How the Grid Works

Your grid is similar to the electrical grid in real life. Here are some of the basics.


GENERATION STACKER:
Green stackers represent the energy output of your power plant.


LOADS:
Think of loads as light bulbs. Light bulbs use energy and that energy has to be provided some how.


LOAD STACKER:
Red stackers represent the energy that your loads are using and must be fulfilled by the Generation (green) stackers.

To match/fufill your loads, pair up your green Generation stackers with your red Load stackers at the end of each round, through the grid you have built.

Power plants > transmission lines > substations > distribution lines > loads

Any unpaired (unfulfilled) red Load stackers represent blackouts.

Components Continued

Bury A Line (Line Specialist)

The Line Specialist has the ability to bury a transmission line. (once per round, for an action)

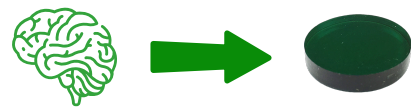
A buried line is identified by the **Bury** marker being placed over the line.

Buried lines are not damaged or destroyed by most (**but not all**) events.

Power Tokens

Each player will receive a power token corresponding to their chosen role.
- *Power tokens are color coordinated with the colors of the role cards*.

These tokens are used to keep track of when players decided to use their role's Special Power.

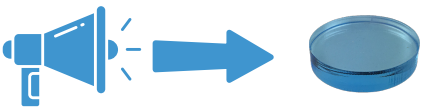


Chief Operations Officer

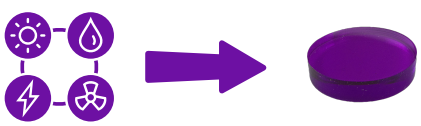
Load Legend

Volt Architect

Line Specialist



Dispatch Officer



Energy Resource Manager

Setup & Play

Choose Your Difficulty

Difficulty	Starting Loads	Blackout Cards	Meter Start
Easy	2	1	1
Medium	3	3	2
Hard	4	6	3

- Select the number of blackout cards, set by your level of difficulty. Shuffle them into the event card deck.

Set up: Starting Grid

Each grid will start with the following (decide as a team where to place components on the board):

- 1 City Tile
- 3 Nature Tiles (*Tiles can be placed in any arrangement. At least one must be placed adjacent to the city tile, and all tiles much touch at least one other tile*)
  - Waterfall Mountain
  - Forever Forest
  - Elkhorn Plains
- Loads (according to chosen difficulty)
  - Spin for a number to place your loads in your city tile.
    - *Numbers (1-9) correspond to each hole in the city tile where you place your load plugs.*
- 3 Distribution Lines (blue)
- 2 Substations
- 2 Power Plants
  - Either a wind or solar
  - Coal power plant
- 3 Transmission Lines (orange)
- 1 Squirrel
  - *Place on Forever Forest tile*

Any lines/substations you choose to not put on the board during setup can be placed in inventory for use later in the game.

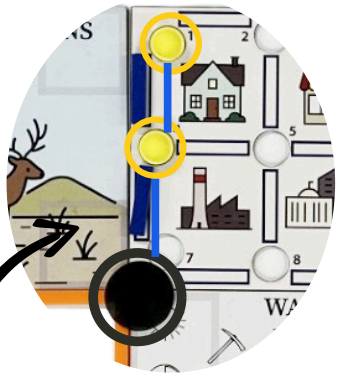
Infrastructure Placement Tips

Substations:
- go on corners of city tile

Distribution Lines:
- all loads need to be connected to a substation using distribution lines

Transmission lines:
- connect power plants to substations, or power plants to power plants

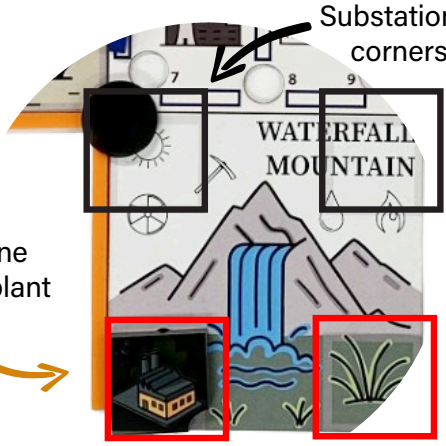
Game Play Setup Example: Easy Level



Each load is connected to the substation using a distribution line

Substations control corners touching the city

Transmission Line connects power plant to substation

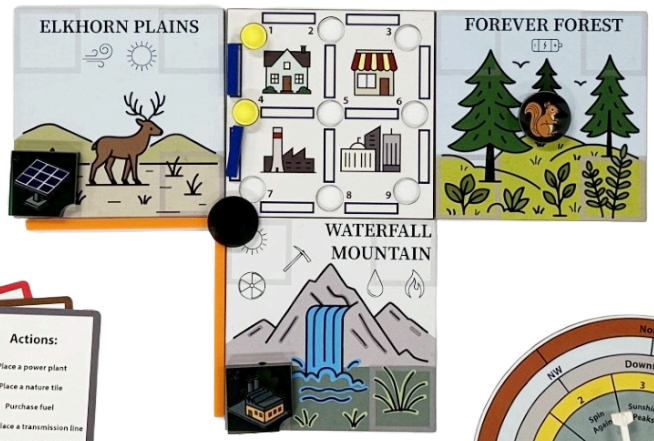


Power plant can only be placed in these spots

Don't let it get to 10!!

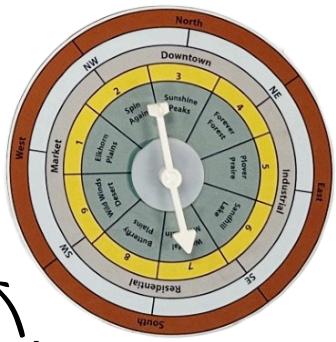
Extra Blackout Cards

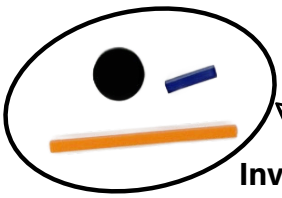
Reference Cards



Role Cards

Special Power Tokens





Inventory

Lets Play!

Player Order

Take turns performing actions during building phase. The player who can do the best squirrel impression goes first. The player to their left (clockwise) starts the next round. Continue rotating clockwise each round.

Round 1

Predicted Phase

Draw a Predicted Card.

- Place Green Generation Stackers on the corresponding power plants as listed on the card
- Place Red Load Stackers on the corresponding loads in your city according to the number in the position of your load on the card

Building Phase

Each player will take one action to equal 6 actions total.

- If playing with less than 6 players the person that started the round will continue the actions until all 6 actions are used.

This phase is when you can buy, store and place infrastructure (i.e. power plants, transmission/distribution lines, and substations)

Players can find the actions they can choose to take on the back of their role card.

Building Phase Guidelines

Power Plant	# Of Actions Required To Build
Nuclear	4 actions
Battery Storage	3 actions
Coal, Natural Gas & Hydro	2 actions
Solar & Wind	1 action
Building Limitations	**Limitations**
Nature Tiles	1 per round
Power Plants	1 per round
Power Plants Per Tile	2 per tile
Fuel	**Amount of Fuel per Action**
Coal & Natural Gas Fuel	3 per action
Nuclear Fuel	1 per action

Event Phase

Take 3 event cards from the deck
The person that started the round will pull the 3 event cards
- Read aloud for your team
- Carry out the effects of your card(s)
- The only infrastructure that can be FIXED during the event phase are distribution lines

mechanics of specific event cards are listed under "Mechanics" section

Exchange Fuel for Energy

- Consult as a team to decide how much fuel to convert into energy for your power plants.
- Keep in mind how many loads you need to fulfill and how much energy you're generating
  - *This may change after the Actual phase.*

Exchange fuel tokens for green generation stackers and place them on the corresponding power plants:
Coal and Natural Gas: 1 fuel token = 1 generation stacker
Nuclear: 1 fuel token = 5 generation stackers

Actual Phase

Draw an Actual Card
- Add or take away generation stackers (green) from the corresponding plants as listed on the card.
- Add or take away load stackers (red) from the corresponding loads as listed on the card.

Fulfillment Phase

- Fulfill your loads by matching green generation stackers to red load stackers through your grid: Generation stackers must be connected to load stackers through power lines, if a line is missing or broken the load is unfulfilled and counts as blackout.
  - **Power Plant → Transmission Line → Substation → Distribution Line → Load**
- Any unfulfilled load stackers = blackouts!
- Adjust the blackout meter according to the number of blackouts (*see back of meter*)
- Excess green generation stackers can be kept only if your grid has enough battery storage. If not, they are lost.

Blackout Meter

# Of Blackouts	# Of Levels
1 -3	+ 1 level
4 - 8	+ 2 levels
9 - 14	+ 3 levels
15 +	+ 4 levels

Round 2-5

Load Phase

At the beginning of each round, spin for a number (1-9).

- Each number (1-9) corresponds to the holes in the city tile to place your load plugs.
  - *If you spin a number where a load is already placed, spin again till you get an open spot.*

Predicted Phase
Building Phase
Event Phase
Exchange Phase
Actual Phase
Fulfillment Phase

same as in round 1

Round 6

This round will "TEST" your grid of its resiliency!

Load Phase

Follow phase procedure as done in rounds 2-5

Predicted Phase
Building Phase

same as in rounds 2-5

Event Phase

Each player takes 1 event card, for a total of 6 cards.
If there are fewer than 6 players, still draw a total of 6 cards.
Read your card aloud to your team and carry out its effects.
Details for specific cards can be found in the "Mechanics" section.

Exchange Phase
Actual Phase
Fulfillment Phase

same as in rounds 2-5

If at the end of Round 6 you haven't reached LEVEL 10 on the Blackout Meter, CONGRATULATIONS, you've WON the game!

Game Mechanics

Event Card Mechanics

Repairs

Repair of infrastructure (transmission, distribution, and substations)

1. Repair anytime from you inventory (event cards may restrict when repair takes place)
2. Event cards with "next round for an action" limit the repair to the next round, when you can use infrastructure in inventory (no action) or use action to get infrastructure

Squirrel Incident

Some event cards ask you to use the spinner to identify the destruction path of the squirrel;

1. Spin for a number (1-9) to determine how many tiles it moves through
2. Players will **take turns moving** the squirrel
    i. Squirrel moves tile to tile (City tile considered one tile) and can only move forward and left or right, it can't move backwards
    ii. If the squirrel hits a dead end before it uses all its moves - its path stops there
3. Reference your card to determine what component(s) are destroyed by the squirrel
4. If another squirrel card is drawn, the squirrel starts where it previously ended, unless otherwise stated on the card

Rural Load Expansions

Rural load tiles can be put into play one of 2 ways:

1. Drawn from the nature tile pile
2. An effect of an Event card

When a rural load tile is drawn:
Consult with your team where to best place the Rural Load Tile.

- This tile can be placed anywhere, except bordering the city tile, it has a built-in substation (thus does not need substation between distribution and transmission)
- These tiles MUST have a distribution line in order to fulfill its load
    - If its load isn't fulfilled = blackout

Rural Loads **MUST be fulfilled** each round following the activation of this card.

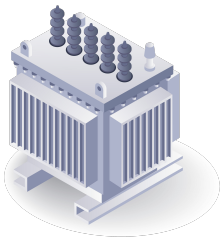
There are 4 total Rural Loads, each with a corresponding load to be fulfilled:

- Farm = 1 load stacker / round
- County Fair = 2 load stackers / round
- Suburb = 3 load stackers / round
- Crypto Mining Center = 5 load stackers / round

<u>If another Rural Load Expansion is drawn</u>,
(either as an Event or Nature tile)

- Repeat steps above for each rural load you have in your grid

How to "Spin the Spinner"



Identify Substation

To identify a substation, you only have to **spin the spinner once.**

- Spin and use the second most outer ring to determine in **which corner of the City** Tile the affected substation is located.
  - NE, SE, SW, or NW corner

Some cards ask you to keep spinning until you identify a working substation, while others only ask to identify a set number of possible locations of a substation.

- If you don't have any substation in those locations after spinning the set number of times, that card has no effect.

Identify a Transmission Line(s)

To identify a transmission line, you will have to spin a total of 2 times.

- First spin - **identify a nature tile** (inner most ring)
- Second spin - **identify the side** of the previously identified nature tile, where a transmission line can be located
  - N, E, S, or W side (outer most ring)

Some cards ask you to keep spinning until you identify a transmission line, while others only ask to identify a set number of possible locations of transmission lines.

- If you are asked to identify 2 transmission lines, you will **spin a total of 4 times**.
- If you don't have transmission lines in the identified locations after the set number of spins, that card has no effect.

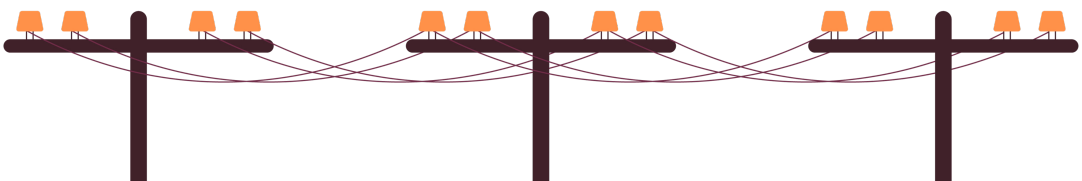
Identify a Distribution Line(s)

To identify a distribution line, you will have to spin a total of 2 times.

- First spin - identify a **region of the city** (third ring; *residential, market, industrial, downtown*)
- Second spin - **identify the side** of the previously identified city region, where a distribution line could be located
  - N, E, S, or W side (outer most ring)

Some cards ask you to keep spinning until you identify distribution line, while others only ask to identify a set number of possible locations of distribution lines.

- If you are asked to identify 2 distribution lines, you will **spin a total of 4 times.**
- If you don't have distribution lines in the identified locations after the set number of spins, that card has no effect.



How to "Spin the Spinner" Cont.

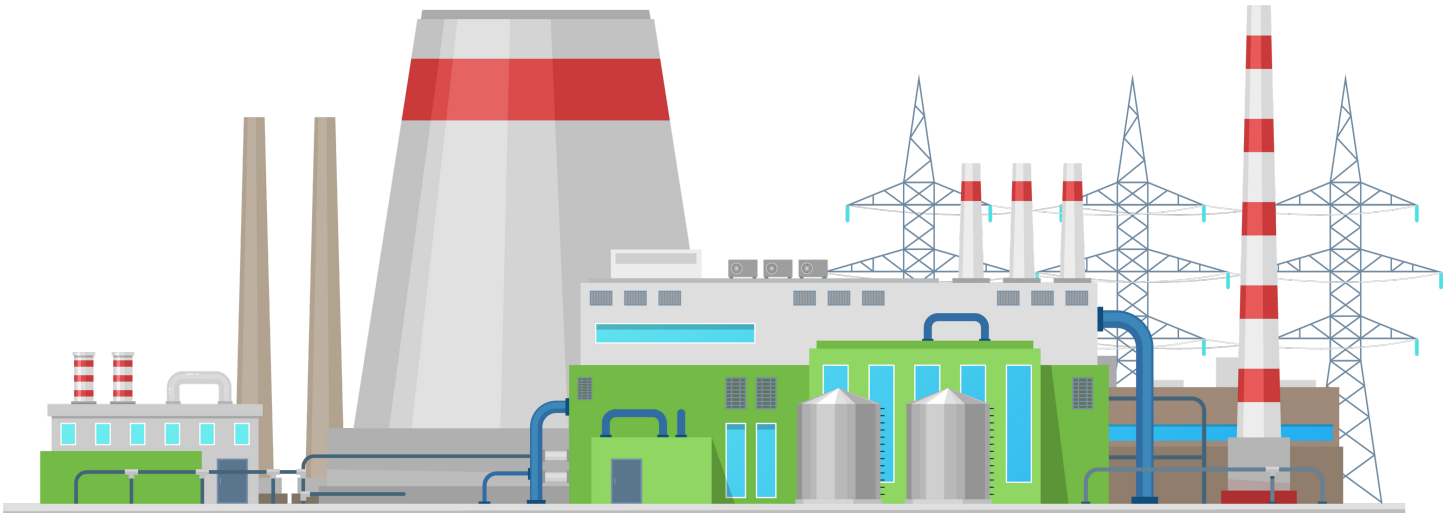
Identify a Power Plant(s)

To identify a power plant, you will have to spin a total of 2 times.

- First spin - **identify a nature tile** (inner most ring)
  - *If the nature tile is already identified on the event card, ignore this first spin.*
- Second spin - **identify a corner** of the previously identified nature tile, where a power plant can be located
  - NE, SE, SW, or NW side (second outer most ring)

Some cards ask you to keep spinning until you identify an operating power plant, while others only ask to identify a set number of possible locations of power plants.

- If you are asked to identify 2 power plants, you will **spin a total of 4 times**.
- If you don't have power plants in the identified locations after the set number of spins, that card has no effect.



Optional Game Goals

Green Powerhouse

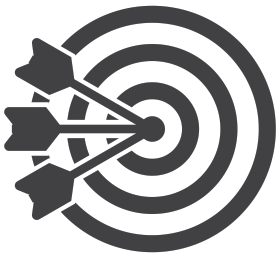
End the game with **only renewable power plants (solar, wind, hydro) generating power** in round 6.

A Balanced Grid

Build and Fuel at least **one plant of each fuel type (coal, natural gas, and nuclear)** by the end of the game.

Battery Bonus

Fill your battery to capacity at any point during the game.



The Architects Dream

Place **6 or more power plants** by the end of the game.

Variants

Time Crunch

When you don't have as much time...

- Only play **4 rounds**
- Set the **blackout meter max to 8**

Solo Mode

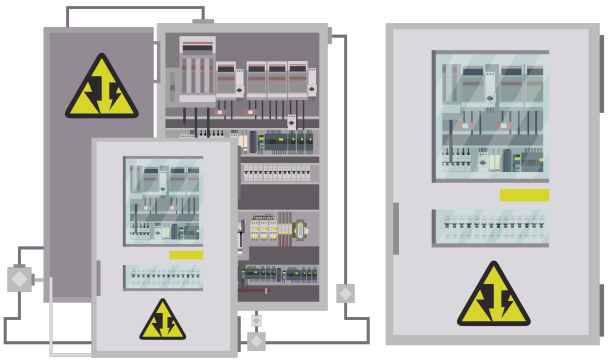
When playing solo...

- Manage **3 roles**
- **Set up with**:
  - 2 Blackout Cards
  - Start blackout meter at level 2
  - 2 starting loads

Shift Change

When you want to switch it up...

- At the beginning of **Round 4**:
  - 1-3 players: **swap** out current roles for new roles
  - 4-6 players: all players **rotate** roles clockwise



The Story Behind Microgrid Mastermind

We're a team of four passionate students from the University of Nebraska-Lincoln who believe learning should be exciting, hands-on, and rooted in the real world.

Our journey started when we were hired by F. John Hay and Dr. Jenny Keshwani to help build a board game to teach people about the electrical grid along with the support of a grant from the Nebraska Center for Energy Sciences Research (NCESR) which is funded by the Nebraska Public Power District (NPPD). That idea turned into a board game called Microgrid Mastermind.

Combining our strengths in engineering, education, sustainability, and design, we set out to create a board game that makes the invisible world of electricity visible and understandable. Players don't just learn, they strategize, cooperate, and face realistic challenges as they try to keep the lights on, and the grid running strong.

From balancing supply and demand to investing in renewable energy, Microgrid Mastermind helps young learners explore the complexity of our power systems in a way that's fun, memorable, and empowering.

We're proud of what we've built, and we're thankful to NCESR and NPPD for believing in our vision. As students, this project has been a powerful learning experience. As creators, our hope is to inspire energy awareness in classrooms and homes across Nebraska and far beyond.

Katie Morland, Sakshi Jani, Jada Vogel, Luke Freyhof

GROWABLE
Game-Based Learning Page

Microgrid Mastermind BOT
(ChatGPT)