
Southern Staffing Group presents
FRANK AND OLLIE'S POWER ADVENTURE
The Long Way Home
A collaborative Southern Staffing Group effort.

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Frank and Ollie's Power Adventure

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A story of curiosity, electricity,
and finding the way home.

Illustrations developed with AI tools and reviewed for this project.
A complete reading draft - October 2026.

Before we begin...

Meet Frank and Ollie

Frank likes a thoughtful pace, a comfortable bed, and dinner at a sensible hour. Ollie likes a question - especially one he can answer first. They share a house. Tonight, they are about to share a very unusual journey.

Read it your way

Follow the comic panels from left to right and top to bottom. Big boxes give big moments room. Small boxes catch little surprises. The machine sometimes explains what to look for, but Frank and Ollie have to find out why it matters.

A real story inside an imaginary adventure

The discoveries and milestones are real. The talking pets, time machine, visits, and conversations are make-believe. No scientist invented electricity all alone. Watch how one idea gives other people something to build on.

For curious families

The adventure ends at bedtime. After THE END, Exploring Together offers optional explanations, questions, career notes, and sources. You do not need those pages to enjoy the story.


FRANK LIKED TO TAKE HIS TIME.
ALMOST... COMFY.
OLLIE LIKED TO SEE WHAT HAPPENED NEXT.
WHAT'S BACK HERE?
DING!
WAS THAT DINNER?

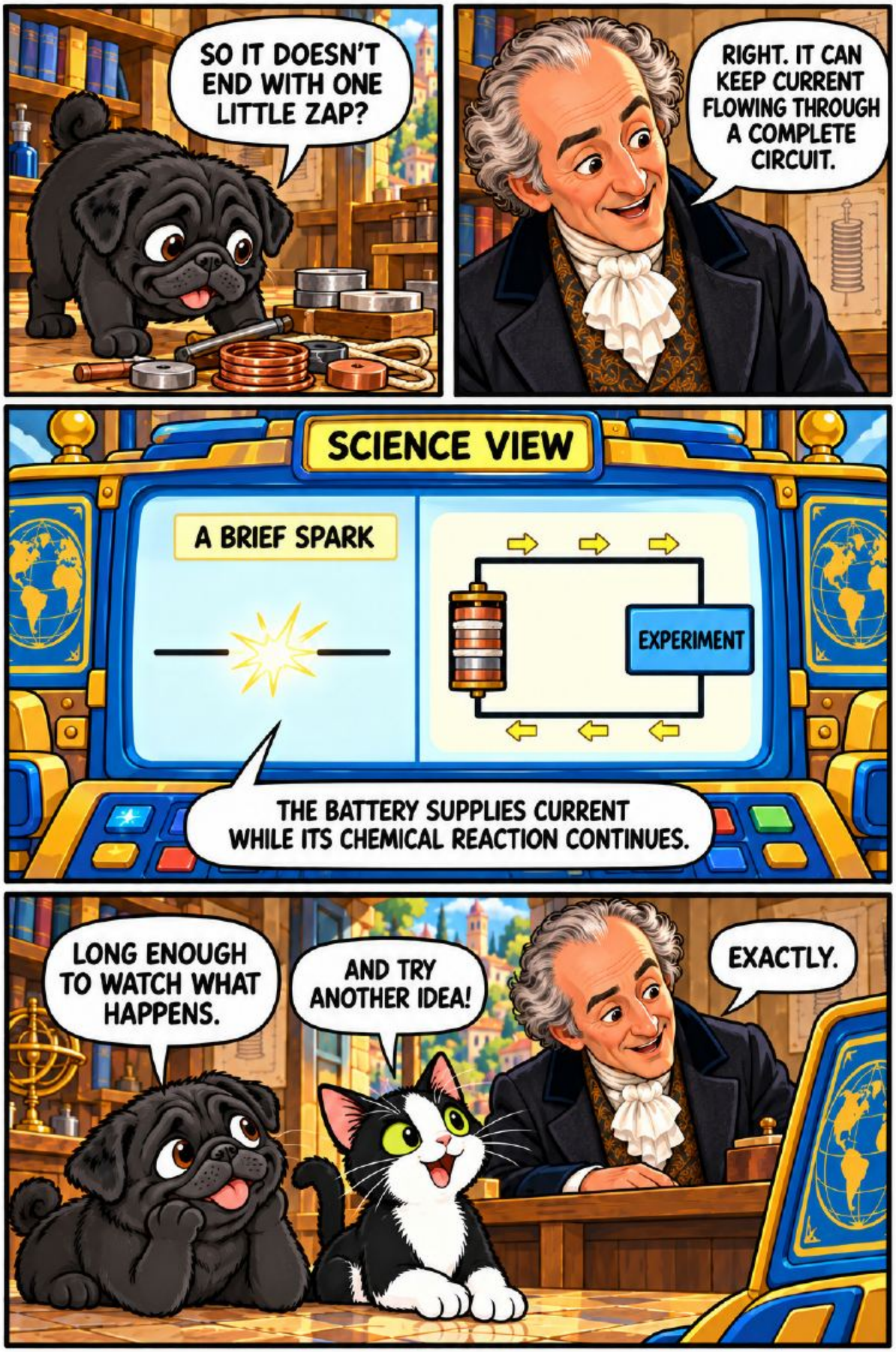

A SECRET DOOR!
DOES IT LEAD TO THE KITCHEN?
SO... A BIG KITCHEN?
IT'S BIGGER INSIDE!
WHERE DOES OUR ELECTRICITY COME FROM?


HOME BEFORE BEDTIME?
EASY.
CLICK.
BEGIN
WHOOOOSH!
THAT WASN'T BEDTIME!
BUMP.
IS THAT BEFORE OR AFTER DINNER?
UH-OH.


HOME: NOT YET BUILT.
WE'RE EARLY.
FOLLOW THE STOPS FORWARD TO GO HOME.
CAN'T WE SKIP A FEW?
NO.
ELECTRICITY WAS ALREADY HERE.
BUT NOT IN EVERY HOUSE.
NEXT STOP: A STEADY CURRENT.
HOW ABOUT A STEADY RIDE?


ITALY, 1800.
SQUARE WHEELS?
KA-THUNK!
I PREFER ROUND.
A SPARK IS BRIEF. SCIENTISTS NEEDED CURRENT THAT COULD LAST LONGER.
WHO FIGURED THAT OUT?
LET'S MEET ALESSANDRO VOLTA.
AS LONG AS WE PARK FIRST.


ALESSANDRO VOLTA'S WORKROOM.
THAT'S A TALL SANDWICH.
NO BREAD.
WHAT DOES IT DO?
IT'S A BATTERY! CHEMICAL REACTIONS INSIDE CAN PRODUCE AN ELECTRIC CURRENT.
CURRENT MEANS FLOWING ELECTRIC CHARGE.


SO IT DOESN'T END WITH ONE LITTLE ZAP?
RIGHT. IT CAN KEEP CURRENT FLOWING THROUGH A COMPLETE CIRCUIT.
SCIENCE VIEW
A BRIEF SPARK
EXPERIMENT
THE BATTERY SUPPLIES CURRENT WHILE ITS CHEMICAL REACTION CONTINUES.
LONG ENOUGH TO WATCH WHAT HAPPENS.
AND TRY ANOTHER IDEA!
EXACTLY.


COULD THIS BATTERY POWER OUR WHOLE HOUSE?
NOT THIS ONE. THERE IS MUCH MORE TO DISCOVER.
STILL. THAT'S A USEFUL SANDWICH.
A STEADY SOURCE MEANT SCIENTISTS COULD TEST MORE IDEAS.
VOLTA HADN'T INVENTED ELECTRICITY. HIS BATTERY HELPED OPEN THE WAY TO NEW DISCOVERIES.
ROUND WHEELS. EXCELLENT.
NEXT: ELECTRICITY, MAGNETS, AND MOTION.


LONDON, 1821.
CURRENT CAN DO MORE THAN MAKE A SPARK.
CAN IT MAKE SOMETHING MOVE?
PREFERABLY THE DINNER CART.
MICHAEL FARADAY, 1821
OERSTED SHOWED THIS IN 1820: CURRENT CAN TURN A COMPASS NEEDLE.
ELECTRICITY AFFECTS A MAGNET!
NOW LET'S SEE WHAT ELSE IT CAN DO.
I'M WATCHING.


A SIMPLIFIED VIEW OF FARADAY'S MOTOR EXPERIMENT.
A CURRENT AND A MAGNET CAN PRODUCE MOTION.
IT'S GOING AROUND!
I CAN DO THAT.
YOUR BATTERY IS MOSTLY BISCUITS.
THIS IS AN EARLY ELECTRIC MOTOR.


ELECTRICITY MADE MOTION.
WHAT IF MOTION MADE ELECTRICITY?
A VERY USEFUL QUESTION.
TEN YEARS LATER.
1821
1831
FLIP-FLIP!
WATCH THE NEEDLE WHEN I MOVE THIS MAGNET THROUGH THE COIL.
WHAT DO YOU PREDICT?


TWITCH!
IT MOVED!
N
S
CHANGING THE MAGNETIC FIELD THROUGH THE COIL CAN MAKE CURRENT FLOW.
MOVING MAGNET
STILL MAGNET
N
S
N
S
KEEP CHANGING IT, AND WE CAN KEEP GENERATING.
GOOD QUESTION, ME.
SO MOTION CAN MAKE ELECTRICITY!

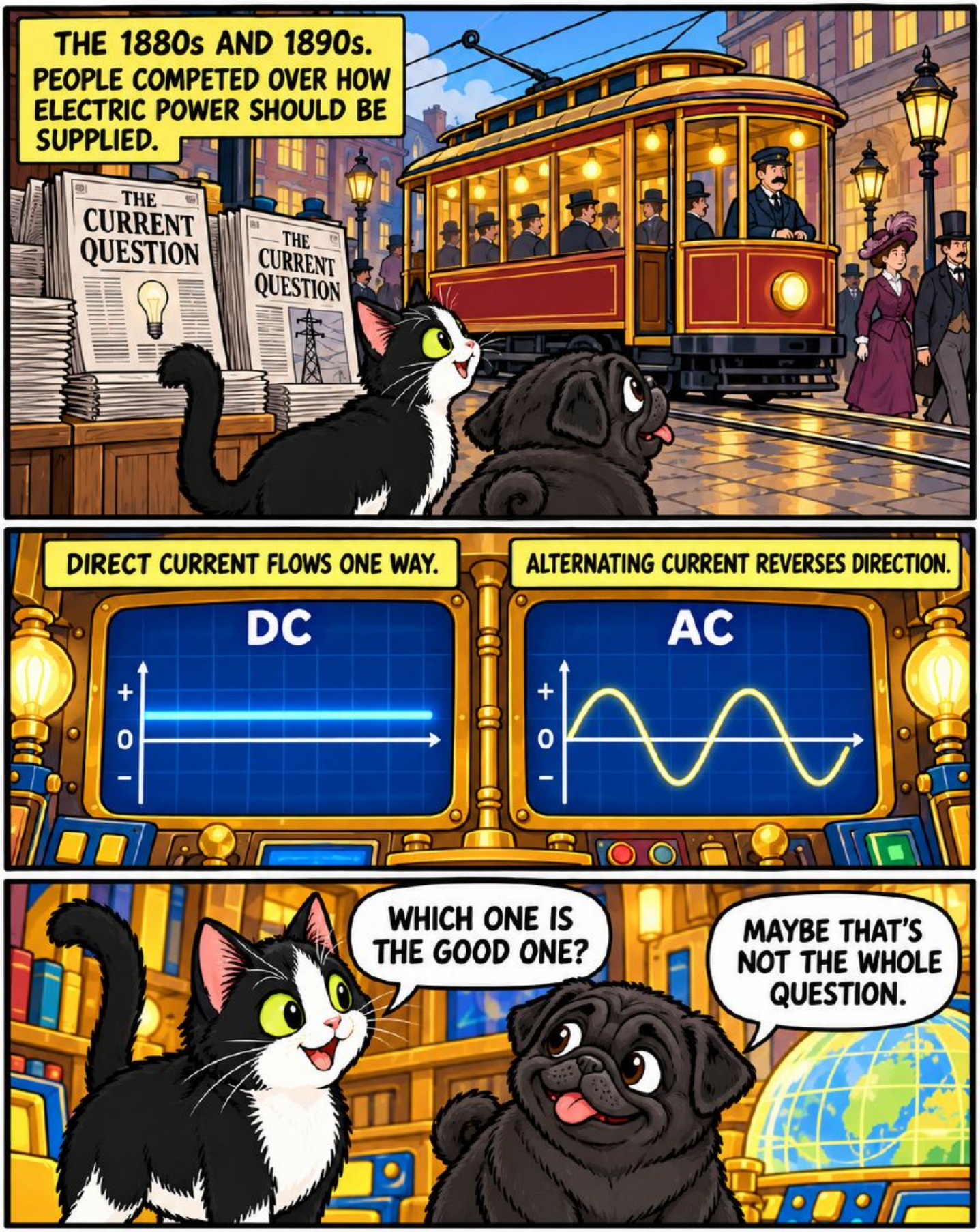

GENERATORS TURN MOTION INTO ELECTRICAL ENERGY.
AND KEEP TURNING.
BUT SOMETHING HAS TO DO THE TURNING.
LATER GENERATOR - SCIENCE VIEW
FIELD
ROTOR
OTHER PEOPLE WILL BUILD ON THIS WORK.
NOW, HOW DO YOU LIGHT A WHOLE NEIGHBORHOOD?
A VERY BIG BISCUIT?
WE MAY NEED ANOTHER IDEA.


NEW YORK CITY, 1882.
BEDTIME ALREADY?
NOT OUR BEDTIME. THIS IS EDISON'S NEW YORK.
A LIGHTBULB WON'T HELP WITHOUT POWER.
EXACTLY. A USEFUL LIGHT NEEDS A WHOLE SYSTEM.
PEARL STREET STATION
FOLLOW THE WIRES?

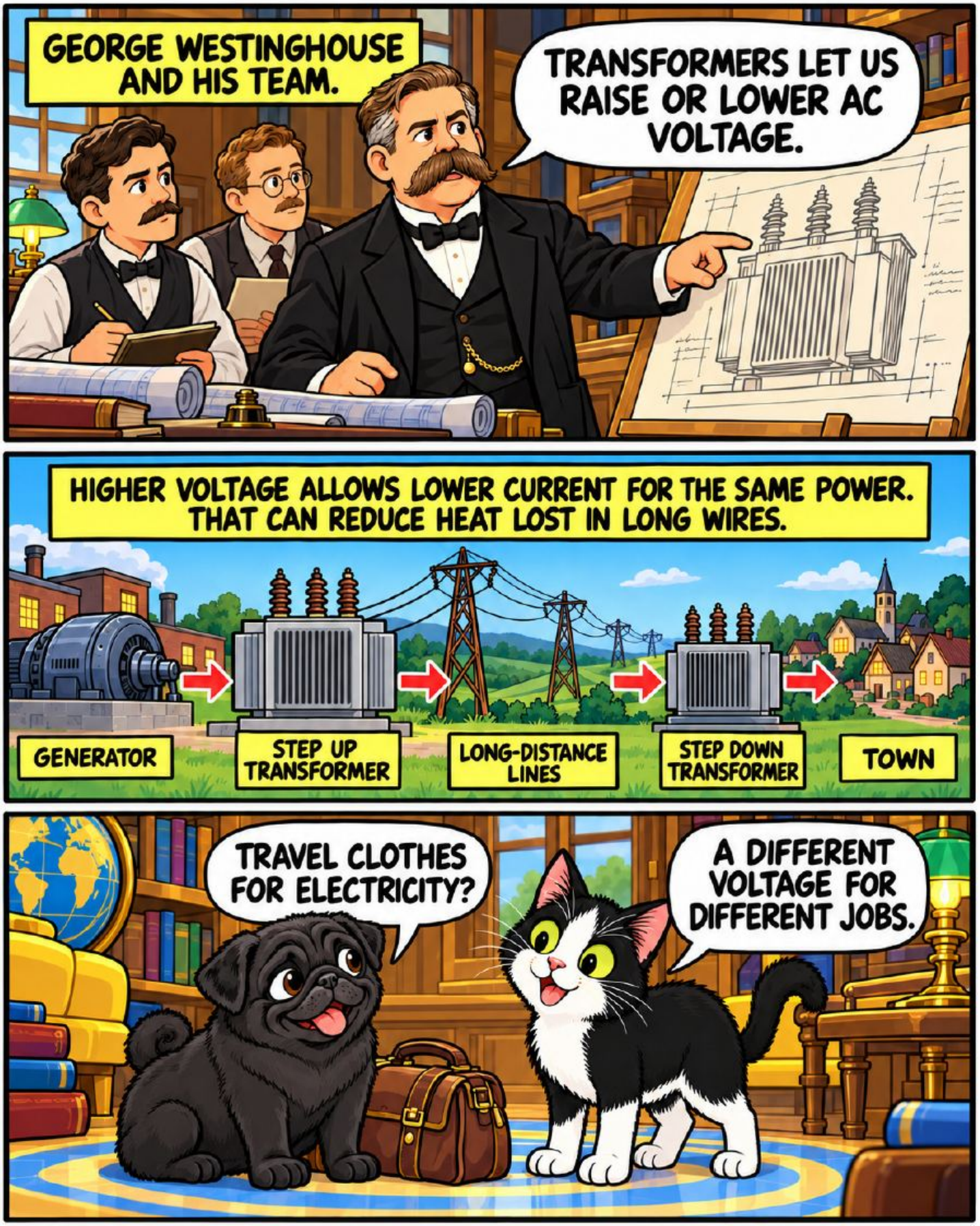

THOMAS EDISON AND HIS TEAM.
WE NEED LAMPS, GENERATORS, WIRES, METERS, AND PEOPLE TO KEEP THEM WORKING.
ALL CONNECTED!
THAT IS THE IDEA.
SO THE BULB IS THE PART WE NOTICE.
AND A LOT OF WORK HAPPENS BEHIND IT.


PEARL STREET STATION, 1882.
BOILER
STEAM ENGINE
GENERATOR
BURNING COAL HEATS WATER.
STEAM DRIVES ENGINES THAT TURN GENERATORS.
THAT LIGHT HAS A LOT OF HELP.
AND A FUEL BILL.
OUR DIRECT-CURRENT SYSTEM SERVES CUSTOMERS NEAR THE STATION.
CLICK!


WHAT ABOUT PEOPLE FARTHER AWAY?
SENDING POWER FARTHER BRINGS NEW ENGINEERING PROBLEMS.
ONE BIG QUESTION WAS HOW TO CHANGE VOLTAGE FOR THE JOURNEY.
DING-DING!
FIRST WE NEEDED MORE ELECTRICITY.
NOW WE NEED TO GET IT SOMEWHERE.


THE 1880s AND 1890s.
PEOPLE COMPETED OVER HOW ELECTRIC POWER SHOULD BE SUPPLIED.
THE CURRENT QUESTION
THE CURRENT QUESTION
DIRECT CURRENT FLOWS ONE WAY.
ALTERNATING CURRENT REVERSES DIRECTION.
DC
AC
+
0
−
+
0
−
WHICH ONE IS THE GOOD ONE?
MAYBE THAT'S NOT THE WHOLE QUESTION.


NIKOLA TESLA, 1888.
ALTERNATING CURRENTS CAN CREATE A ROTATING MAGNETIC FIELD.
FIELD
ROTOR
WHIRRR!
TESLA'S WORK HELPED MAKE PRACTICAL AC MOTORS POSSIBLE.
THAT'S FARADAY'S QUESTION GROWING UP.
MORE PEOPLE, MORE IDEAS!


GEORGE WESTINGHOUSE AND HIS TEAM.
TRANSFORMERS LET US RAISE OR LOWER AC VOLTAGE.
HIGHER VOLTAGE ALLOWS LOWER CURRENT FOR THE SAME POWER. THAT CAN REDUCE HEAT LOST IN LONG WIRES.
GENERATOR
STEP UP TRANSFORMER
LONG-DISTANCE LINES
STEP DOWN TRANSFORMER
TOWN
TRAVEL CLOTHES FOR ELECTRICITY?
A DIFFERENT VOLTAGE FOR DIFFERENT JOBS.


THIS WAS A REAL COMPETITION, WITH MANY INVENTORS, WORKERS, AND BUSINESSES.
EDISON'S EARLY DC SYSTEM HAD DIFFERENT LIMITS.
AC SYSTEMS MADE VOLTAGE CHANGES PRACTICAL.
EVERYONE WANTED THEIR IDEA TO WIN.
BUT THE JOB WAS BIGGER THAN ONE IDEA.
AND THE COMPETITION WAS NOT ALWAYS FAIR.


CHICAGO WORLD'S FAIR, 1893.
NOW THAT IS A NIGHT-LIGHT!
WESTINGHOUSE'S AC SYSTEM HELPED LIGHT THE FAIR.
SO PEOPLE COULD SEE IT WORK.
A GOOD IDEA HAS TO WORK OUT HERE.
NOT JUST ON A DRAWING.


BOTH AC AND DC STILL HAVE IMPORTANT JOBS.
BATTERIES SUPPLY DC. MANY GRIDS DELIVER AC. EQUIPMENT CAN CONVERT BETWEEN THEM.
GOOD. I LIKE MY FLASHLIGHT.
SO DC DIDN'T DISAPPEAR.
NEXT, SOMETHING THAT CAN KEEP A GENERATOR TURNING.
THAT IS NOT A TAP.
RRRROAR!

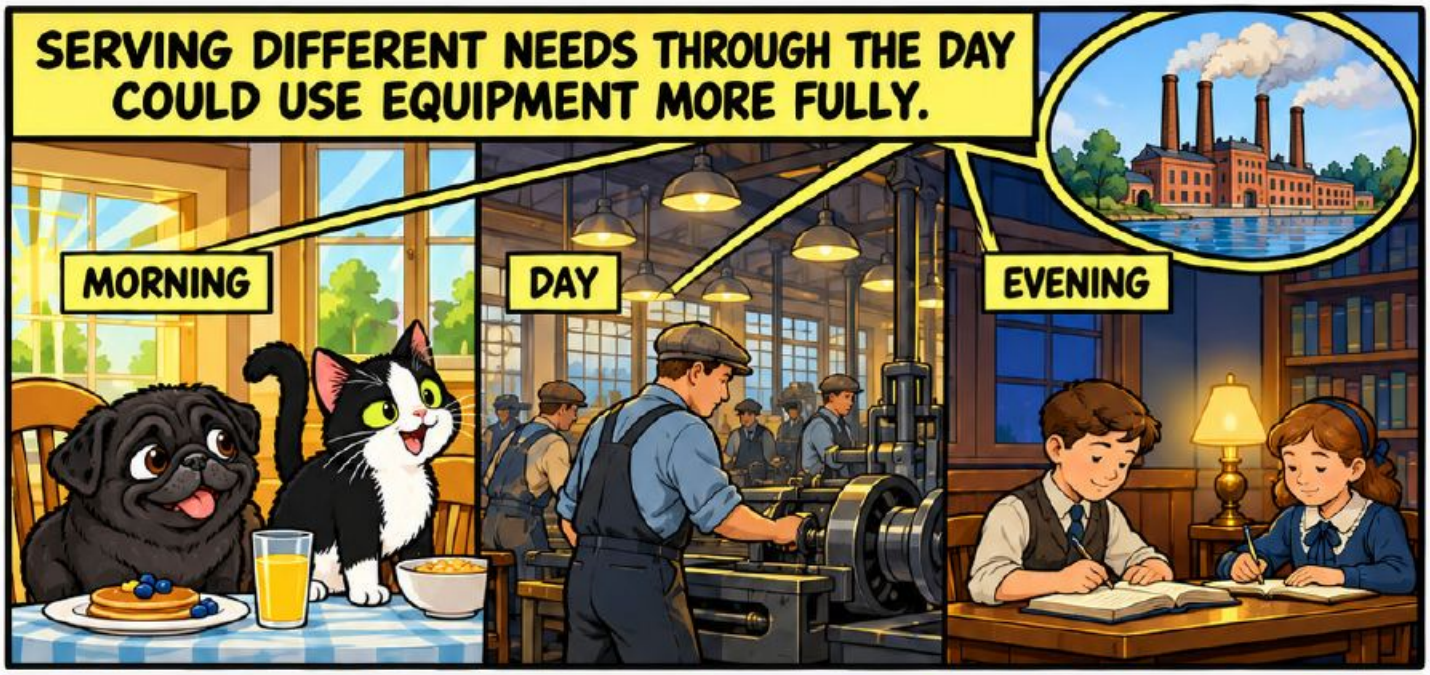

NIAGARA FALLS, THE 1890s.
FALLING WATER CAN TURN TURBINES.
NO STEAM NEEDED HERE!
WATER
GENERATOR
TURBINE
I PREFER MY WATER IN A BOWL.
THIS WATER HAS A JOB FIRST.

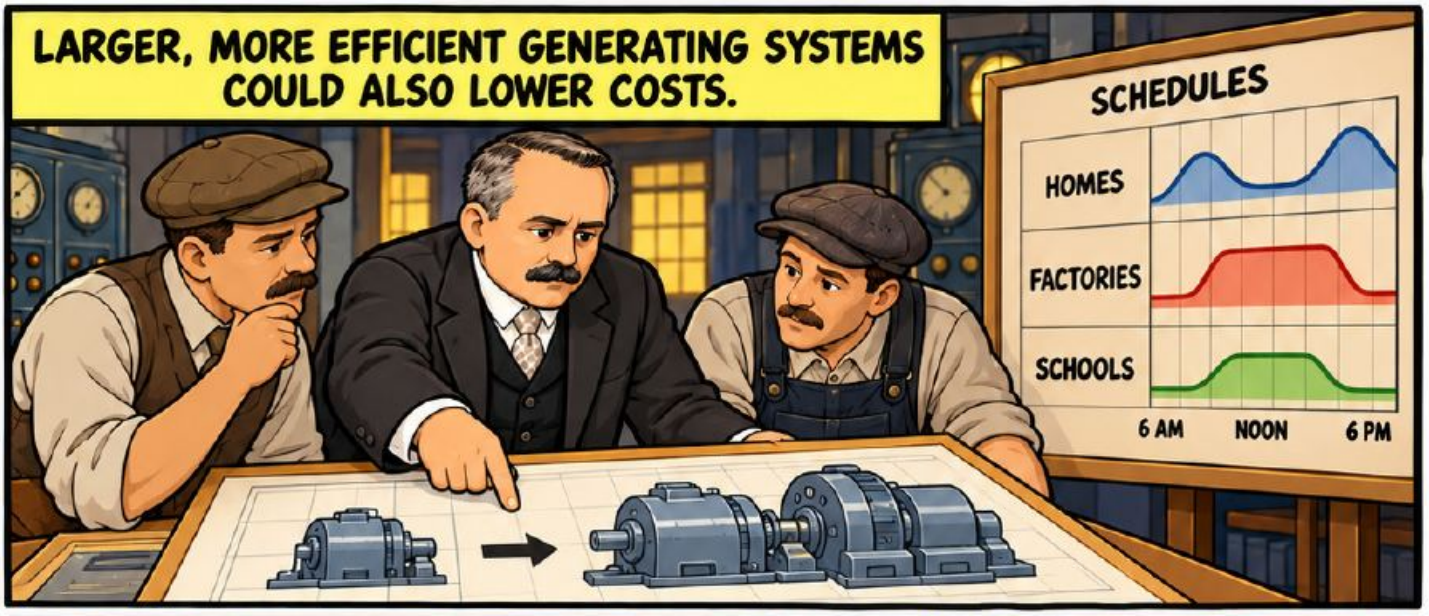

1896: NIAGARA POWER REACHES BUFFALO.
A LARGE AC SYSTEM CARRIED POWER FROM THE FALLS TO THE CITY.
MANY PEOPLE AND COMPANIES HELPED MAKE IT WORK.
GENERATE IT HERE. USE IT OVER THERE.
NOW THE DISTANCE MATTERS LESS.
AND THE WHOLE SYSTEM MATTERS MORE.


ELECTRIC POWER COULD DO WORK AS WELL AS MAKE LIGHT.
MOTORS IN WORKSHOPS!
AND SOMETHING TO CARRY TIRED PAWS.
BUT BUILDING AND RUNNING A BIG SERVICE COSTS MONEY.
WHO ORGANIZES ALL OF THAT?
AND MAKES SURE IT IS READY WHEN PEOPLE NEED IT?


CHICAGO, EARLY 1900s.
MORE EFFICIENT MACHINES HELPED. SO DID SERVING CUSTOMERS WHO NEEDED POWER AT DIFFERENT TIMES.
HOMES AT NIGHT.
FACTORIES IN THE DAY.
LET'S MEET SAMUEL INSULL. HE WORKED ON THE BUSINESS OF BRINGING ELECTRICITY TO MORE CUSTOMERS.
THIS ONE SOUNDS BUSY.
UTILITY COMPANY


SAMUEL INSULL.
A POWER STATION IS ONLY PART OF THE JOB. WE ALSO NEED CUSTOMERS, WIRES, WORKERS, AND A WAY TO PAY FOR IT ALL.
THEY DON'T ALL NEED THE SAME THING AT THE SAME TIME.
SCHOOL
WORKSHOP
STREETCAR
HOME
LIKE TAKING TURNS AT A WATER BOWL.
SHARING CAPACITY CAN HELP.

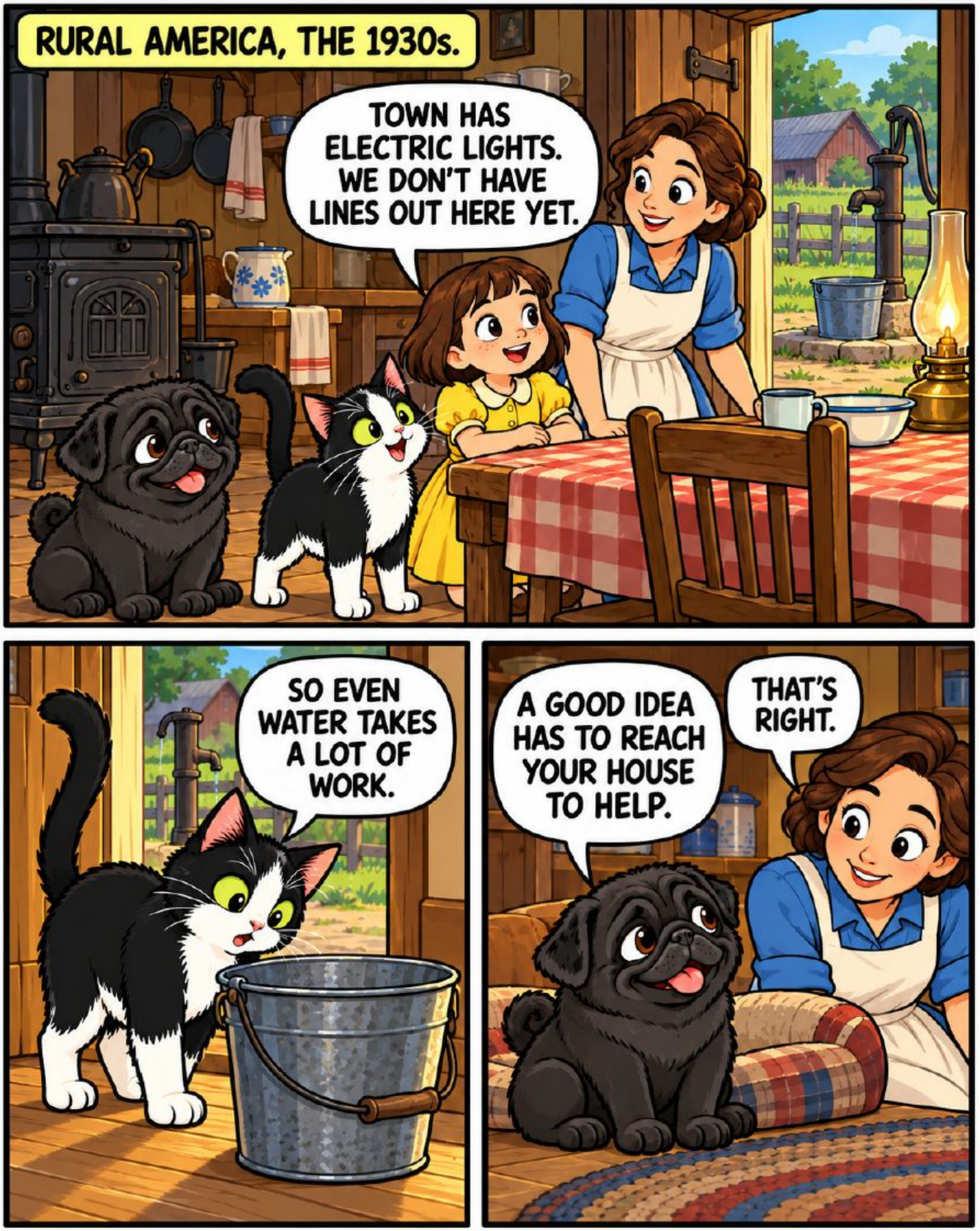

SERVING DIFFERENT NEEDS THROUGH THE DAY COULD USE EQUIPMENT MORE FULLY.
MORNING
DAY
EVENING


LARGER, MORE EFFICIENT GENERATING SYSTEMS COULD ALSO LOWER COSTS.
SCHEDULES
HOMES
FACTORIES
SCHOOLS
6 AM
NOON
6 PM


SO THE MACHINES MATTERED.
AND HOW PEOPLE USED THEM TOGETHER.
ORGANIZATION MATTERED TOO.


IF ONE COMPANY SERVES A WHOLE AREA, WHO CHECKS THE PRICES?
THAT IS ONE REASON PUBLIC OVERSIGHT MATTERS.
DIFFERENT PLACES BUILT DIFFERENT RULES FOR ELECTRIC SERVICE.
COMPANY
PUBLIC REGULATOR
CUSTOMER
DOES EVERYONE GET TO JOIN?
NOT YET. AND NOT EVERYWHERE.


WE COULD HURRY TO THE NEXT BIG MACHINE.
HOME
WAIT. WHAT ABOUT THAT HOUSE?
THEN LET'S FOLLOW THE WIRES THAT AREN'T HERE YET.
GOOD CATCH, FRANK.
SOMETIMES IT HELPS TO GO SLOW.
PUTT-PUTT!


RURAL AMERICA, THE 1930s.
TOWN HAS ELECTRIC LIGHTS. WE DON'T HAVE LINES OUT HERE YET.
SO EVEN WATER TAKES A LOT OF WORK.
A GOOD IDEA HAS TO REACH YOUR HOUSE TO HELP.
THAT'S RIGHT.

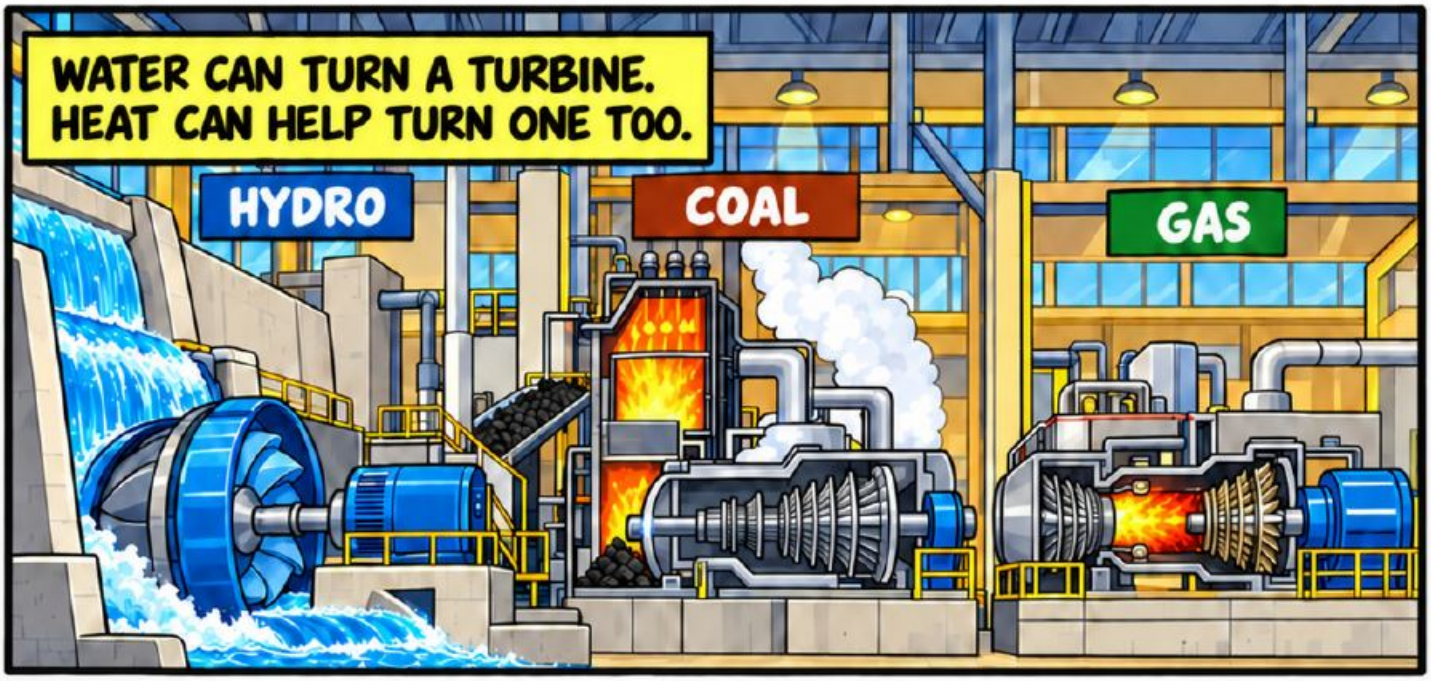

THE RURAL ELECTRIFICATION ADMINISTRATION BEGAN IN 1935.
FEDERAL LOANS AND LOCAL COOPERATIVES HELPED EXTEND RURAL SERVICE.

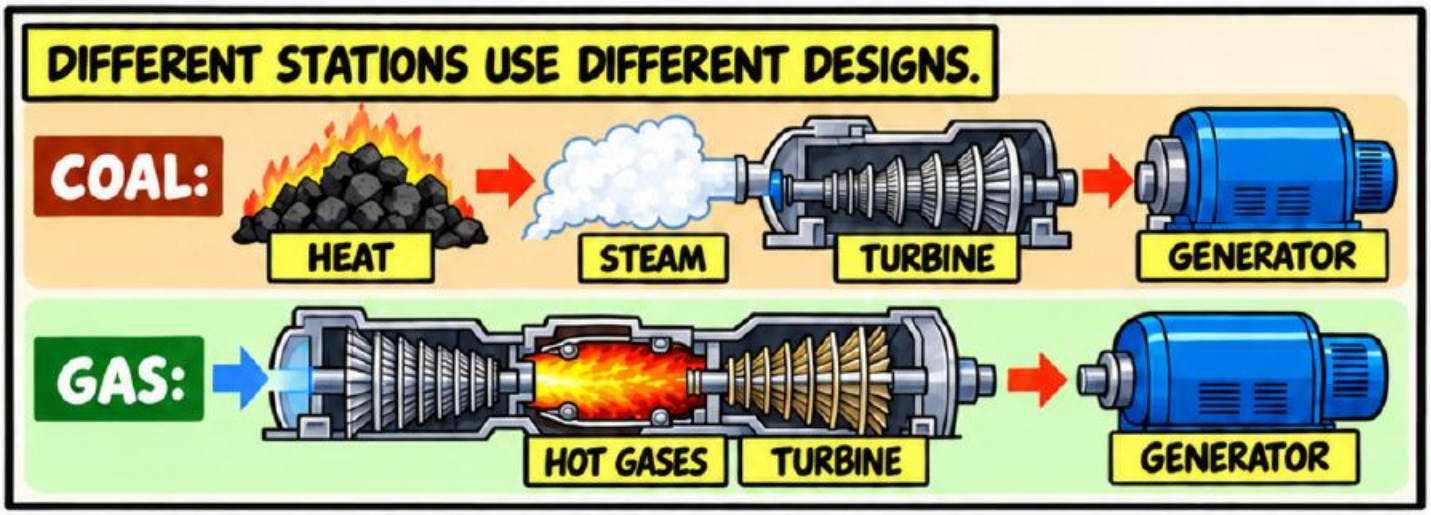

THE 1936 LAW HELPED SUPPORT MORE LOANS FOR RURAL ELECTRIFICATION.

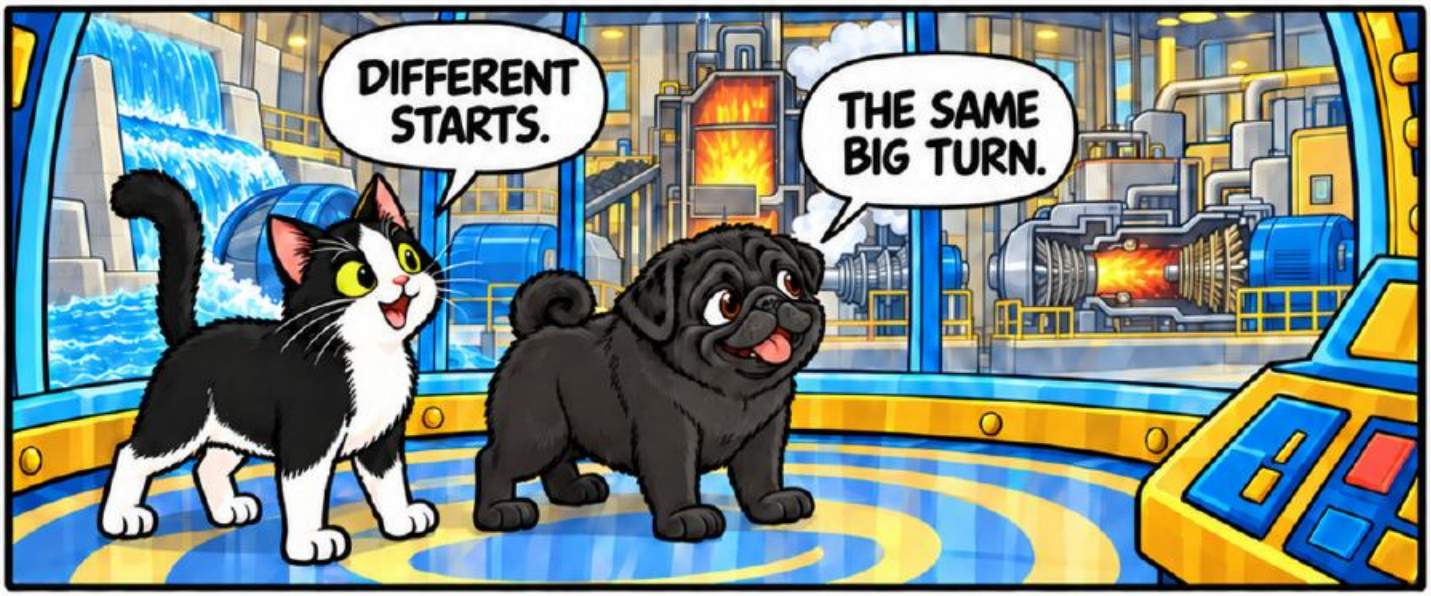

TIME PASSES.
THE FARMS WERE FAR APART.
SO THE NEIGHBORS WORKED TOGETHER.

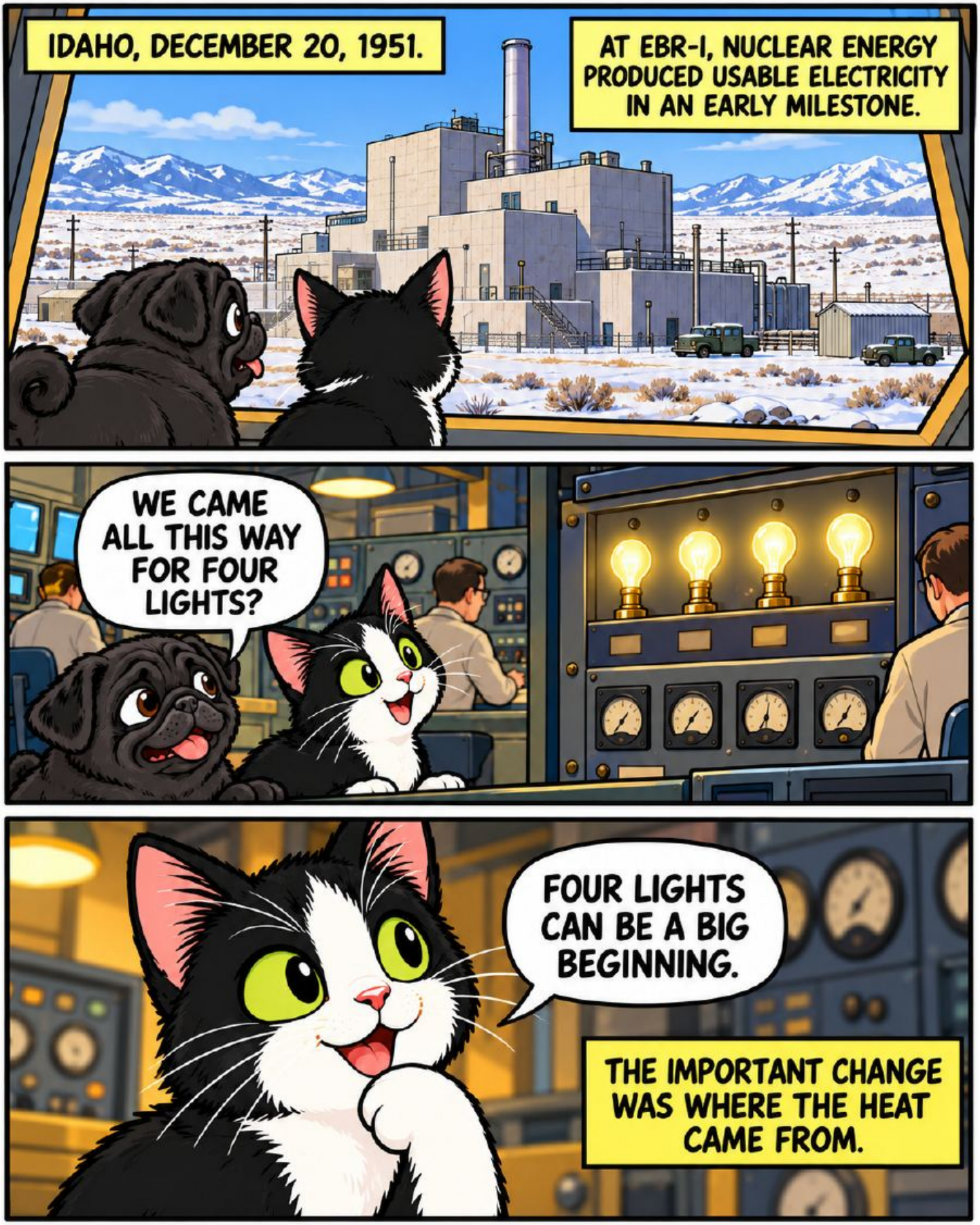

CLICK.
LATER, WHEN SERVICE REACHED THIS FARM...
WE CAN READ AFTER SUNSET!
OVER TIME, ELECTRICITY COULD HELP WITH MANY DAILY JOBS.
IT WASN'T JUST A BRIGHTER ROOM.
IT WAS A DIFFERENT DAY.

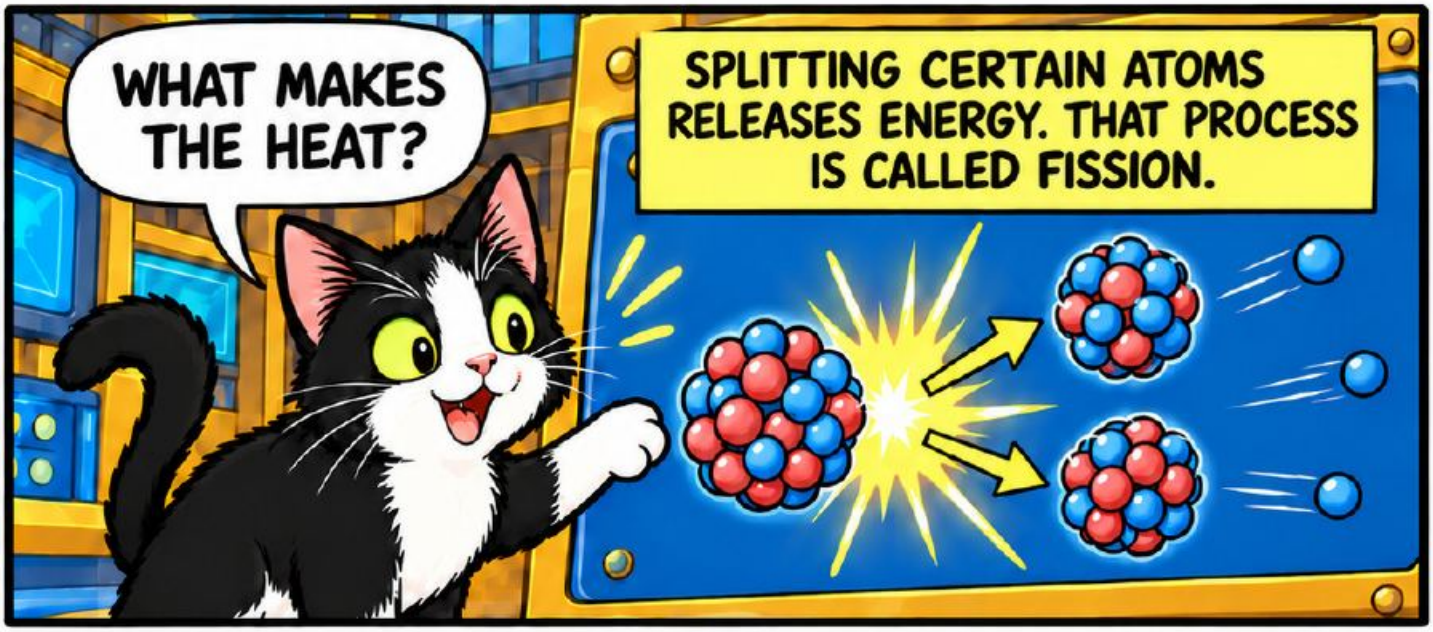

I'M GLAD WE STOPPED.
ME TOO.
ELECTRICITY REACHED DIFFERENT PLACES AT DIFFERENT TIMES. SOME COMMUNITIES STILL LACK RELIABLE SERVICE.
ILLUSTRATIVE VIEW
MEANWHILE, PEOPLE KEPT FINDING NEW WAYS TO TURN GENERATORS.
PLEASE START WITH A GENTLE WAY.
FWOOMP!

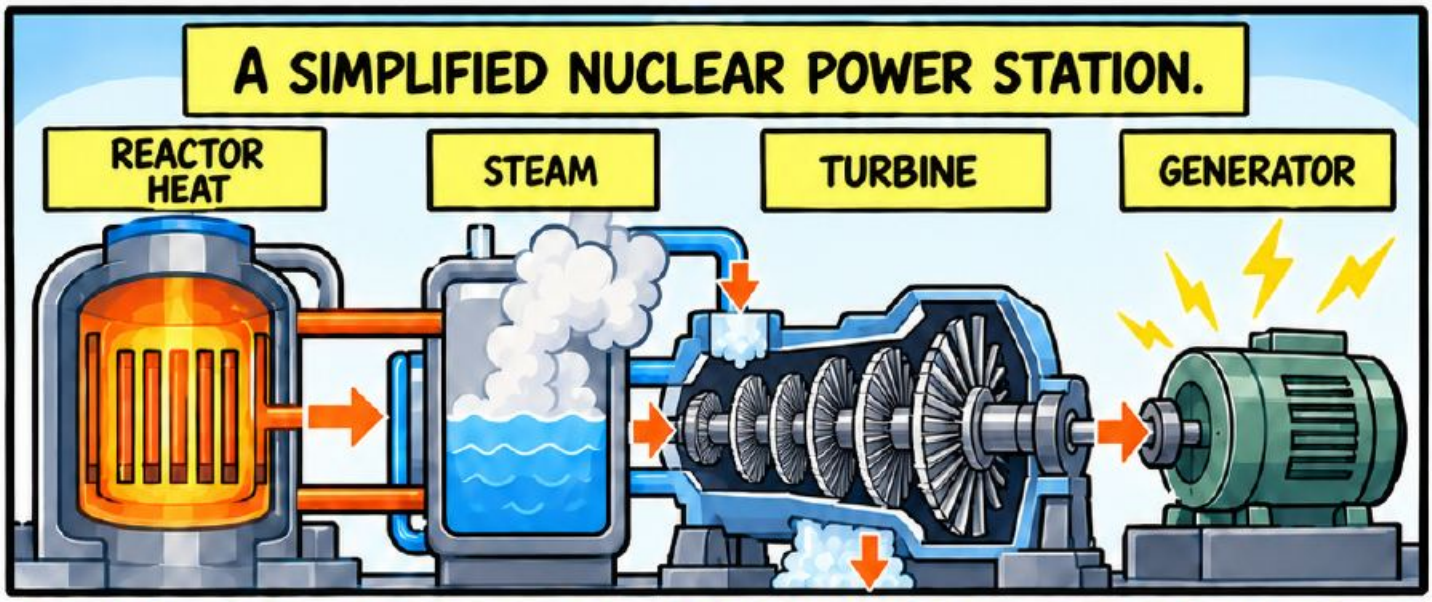

WATER CAN TURN A TURBINE.
HEAT CAN HELP TURN ONE TOO.
HYDRO
COAL
GAS

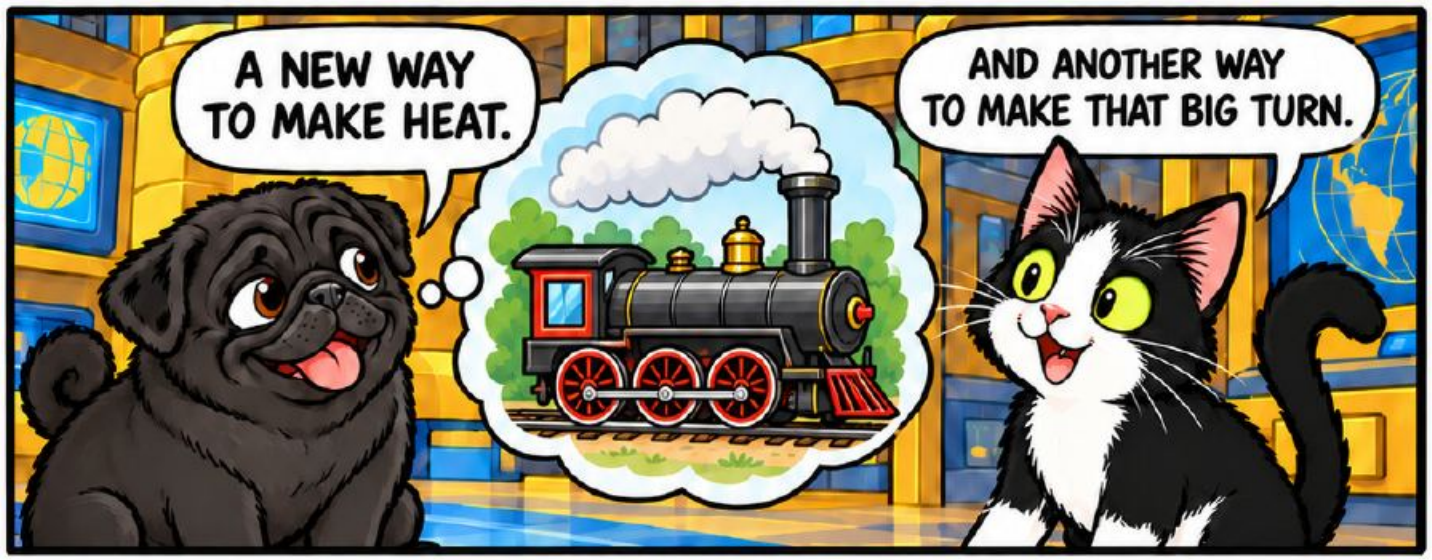

DIFFERENT STATIONS USE DIFFERENT DESIGNS.
COAL:
HEAT
STEAM
TURBINE
GENERATOR
GAS:
HOT GASES
TURBINE
GENERATOR

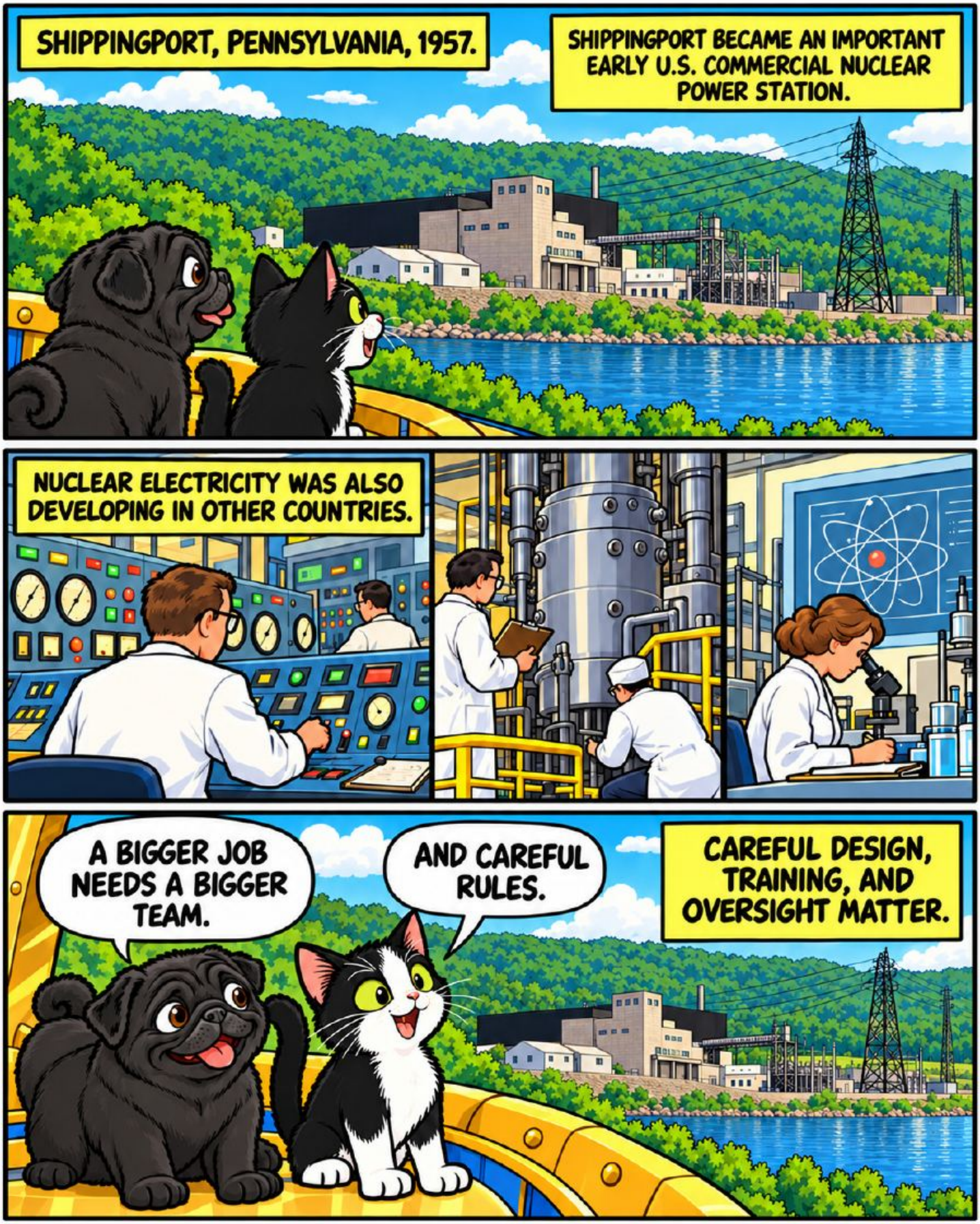

DIFFERENT STARTS.
THE SAME BIG TURN.


IDAHO, DECEMBER 20, 1951.
AT EBR-I, NUCLEAR ENERGY PRODUCED USABLE ELECTRICITY IN AN EARLY MILESTONE.
WE CAME ALL THIS WAY FOR FOUR LIGHTS?
FOUR LIGHTS CAN BE A BIG BEGINNING.
THE IMPORTANT CHANGE WAS WHERE THE HEAT CAME FROM.


WHAT MAKES THE HEAT?
SPLITTING CERTAIN ATOMS RELEASES ENERGY. THAT PROCESS IS CALLED FISSION.

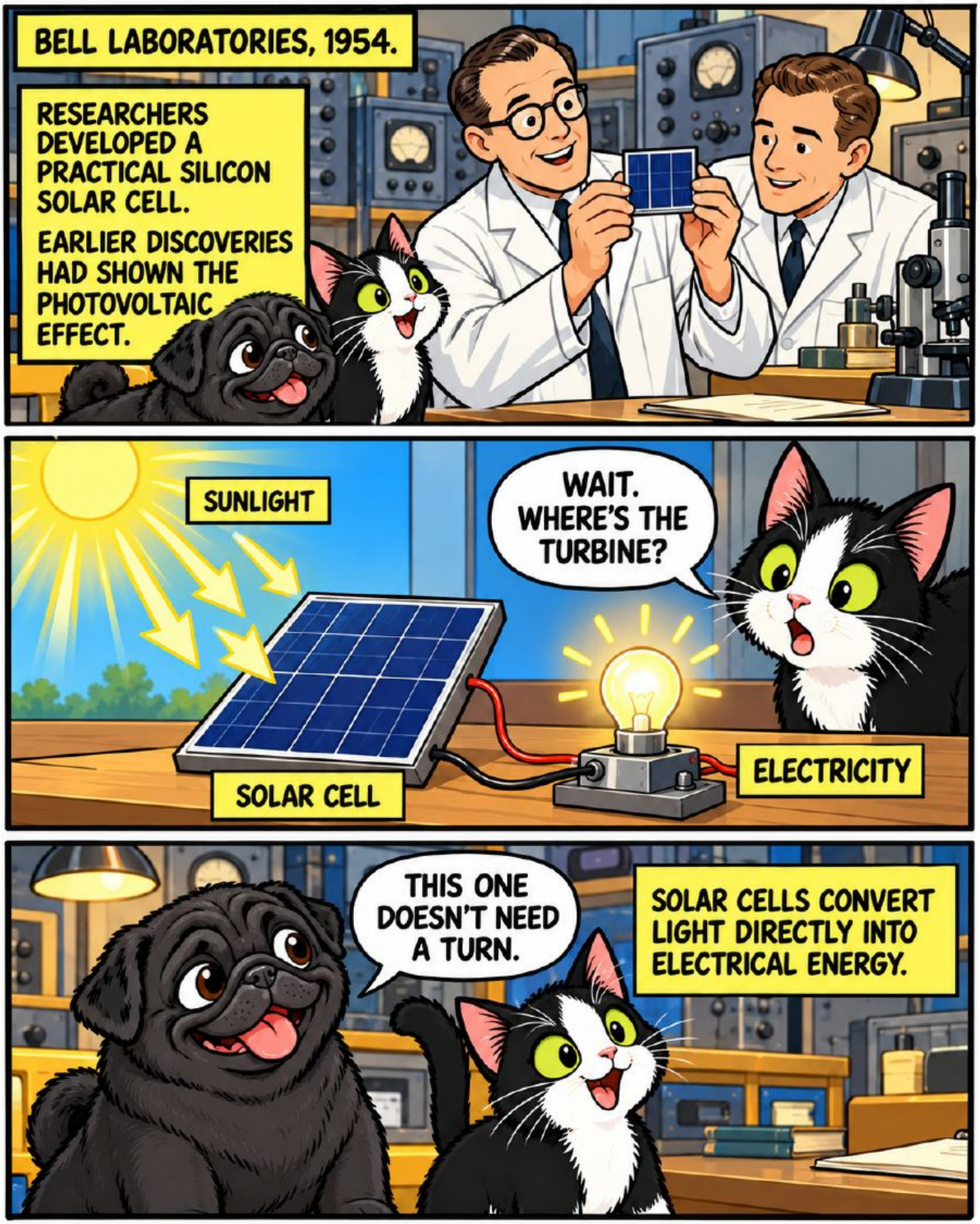

A SIMPLIFIED NUCLEAR POWER STATION.
REACTOR HEAT
STEAM
TURBINE
GENERATOR


A NEW WAY TO MAKE HEAT.
AND ANOTHER WAY TO MAKE THAT BIG TURN.

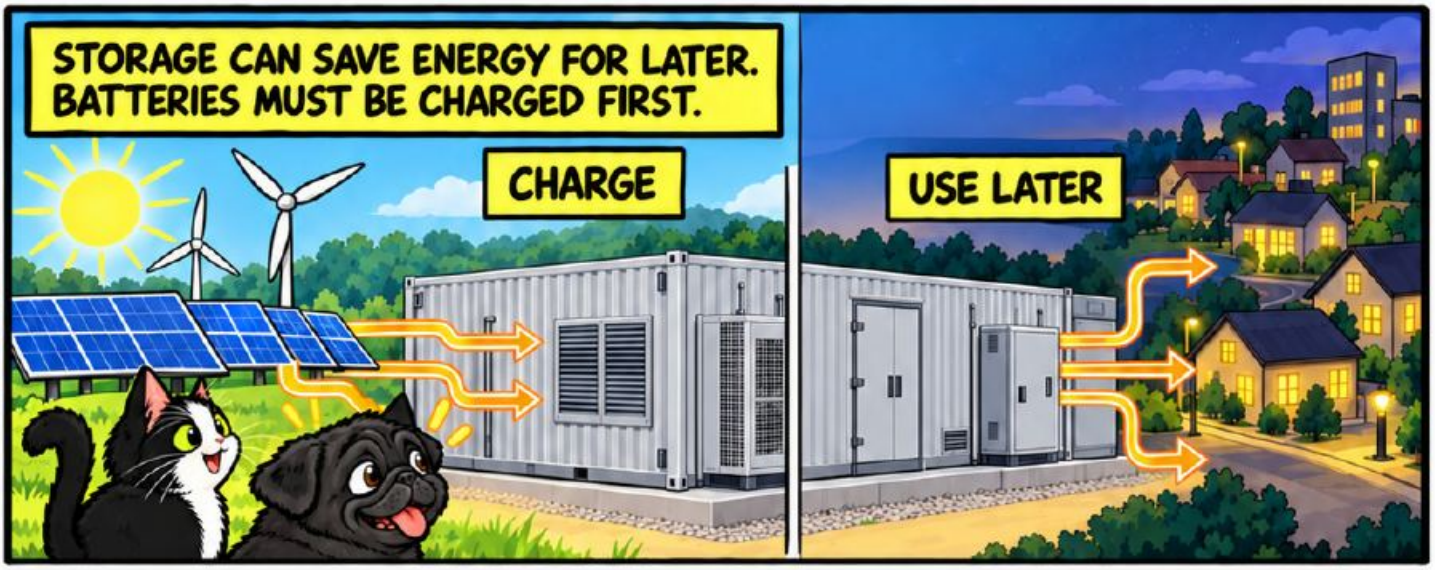

SHIPPINGPORT, PENNSYLVANIA, 1957.
SHIPPINGPORT BECAME AN IMPORTANT EARLY U.S. COMMERCIAL NUCLEAR POWER STATION.
NUCLEAR ELECTRICITY WAS ALSO DEVELOPING IN OTHER COUNTRIES.
A BIGGER JOB NEEDS A BIGGER TEAM.
AND CAREFUL RULES.
CAREFUL DESIGN, TRAINING, AND OVERSIGHT MATTER.

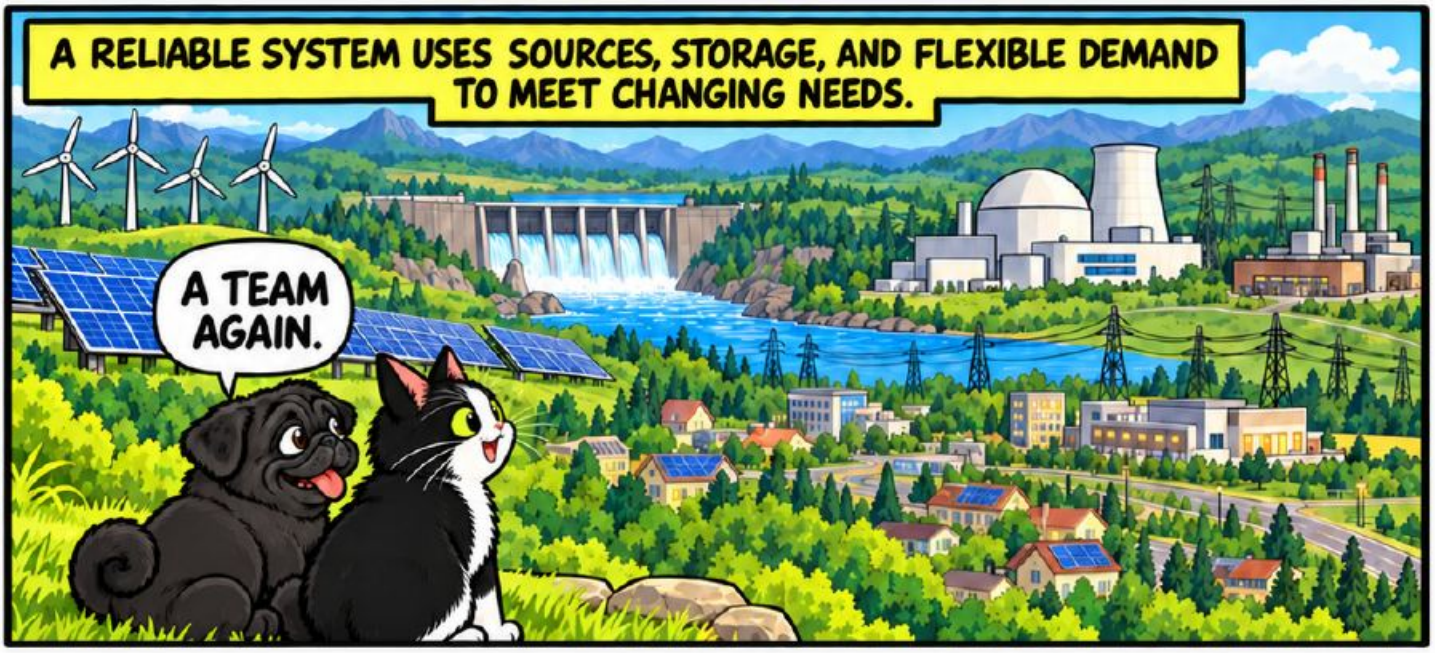

EVERY SOURCE HAS BENEFITS AND TRADEOFFS.
HOW MUCH CAN IT MAKE?
WHEN DO WE NEED IT?
COST, LAND, AIR, WATER, WASTE, AND SAFETY ALL MATTER TOO.
WHOOP!
BACKWARD AGAIN?
THE LONG WAY HOME.
SOME IDEAS STARTED LONG BEFORE THEY GREW LARGE.


CLEVELAND, 1888.
CHARLES BRUSH USED A LARGE WIND MACHINE TO GENERATE ELECTRICITY. THIS WAS ONE EARLY EXAMPLE.
THE WIND DOES THE TURNING!
MUCH LATER.
THEY CHANGED THE SHAPE.
PEOPLE KEPT IMPROVING THE TECHNOLOGY.


BELL LABORATORIES, 1954.
RESEARCHERS DEVELOPED A PRACTICAL SILICON SOLAR CELL.
EARLIER DISCOVERIES HAD SHOWN THE PHOTOVOLTAIC EFFECT.
SUNLIGHT
WAIT. WHERE'S THE TURBINE?
SOLAR CELL
ELECTRICITY
THIS ONE DOESN'T NEED A TURN.
SOLAR CELLS CONVERT LIGHT DIRECTLY INTO ELECTRICAL ENERGY.


WHAT IF THE SUN SETS?
OR THE WIND TAKES A BREAK?


STORAGE CAN SAVE ENERGY FOR LATER. BATTERIES MUST BE CHARGED FIRST.
CHARGE
USE LATER


A RELIABLE SYSTEM USES SOURCES, STORAGE, AND FLEXIBLE DEMAND TO MEET CHANGING NEEDS.
A TEAM AGAIN.


ELECTRICITY SUPPLY AND USE HAVE TO STAY IN BALANCE.
SUPPLY
DEMAND
EVEN WHEN MILLIONS OF PEOPLE CHANGE WHAT THEY'RE DOING?
EVEN AT BEDTIME?
THAT IS PART OF OUR JOB.
EVEN AT BEDTIME.


LET'S SEE THE CONNECTIONS.
A SLOW LOOK, PLEASE.
SIMPLIFIED GRID MAP
GENERATION
STEP UP
TRANSMISSION
SUBSTATION
DISTRIBUTION
HOMES AND BUSINESSES
ANOTHER SOURCE
POWER HAS A JOURNEY TOO.
AND IT NEEDS A WAY ALL THE WAY HOME.


A SUBSTATION VISITOR LOOKOUT.
TRANSFORMERS CHANGE VOLTAGE. OTHER EQUIPMENT CONNECTS, SWITCHES, AND PROTECTS CIRCUITS.
SOUTHERN STAFFING GROUP
FRANK
OLLIE
TRANSMISSION MOVES POWER OVER LONG DISTANCES. DISTRIBUTION BRINGS IT INTO LOCAL AREAS.
HIGH-VOLTAGE SUPPLY
TRANSFORMER
LOWER-VOLTAGE LOCAL LINES
WE LOOK FROM HERE.
THE TRAINED CREW WORKS OVER THERE.


WHAT IF SOMETHING GOES WRONG?
A PROTECTIVE RELAY CAN NOTICE A FAULT AND SIGNAL A BREAKER TO INTERRUPT CURRENT.
RELAY DETECTS
BREAKER OPENS
FAULTED SECTION ISOLATED
THE RELAY NOTICES.
THE BREAKER STOPS THE FLOW.
SWITCHGEAR BRINGS SWITCHING AND PROTECTION EQUIPMENT TOGETHER.


ISOLATING A FAULT CAN LIMIT THE PROBLEM. IT DOES NOT FIX THE DAMAGE.
EXAMPLE
WHO KNOWS WHAT TO DO HERE?
CAN WE HELP?
TRAINED PEOPLE. LET'S WATCH THEM WORK.
FIRST, WE LISTEN.
GRID OPERATOR
FIELD SUPERVISOR
LINEWORKER
SUBSTATION TECHNICIAN


CREW, WE HAVE A LINE FAULT TO CHECK.
LOCAL OUTAGE AREA
WE'LL ASSESS THE DAMAGE AND FOLLOW OUR SAFETY PROCEDURES.
THE CREW SECURES THE AREA AND CONFIRMS SAFE WORKING CONDITIONS.
NO GUESSING.
NO RANDOM BUTTONS.


REPAIRS TAKE SKILL, EQUIPMENT, AND TIME.
CREWS AND OPERATORS CHECK THE WORK AND COORDINATE SAFE RESTORATION.
CHECKS
PLAN
LATER...
THERE IT IS.
A WHOLE TEAM BEHIND ONE LITTLE CLICK.
CLICK.


WE MET THE DISCOVERIES.
BUT WHO KEEPS IT ALL GOING NOW?
LET'S PUT SOME PEOPLE IN THE PICTURE.
THIS LOOKS LIKE A GOOD LAST STOP.
BEFORE DINNER.
SOUTHERN

THE PEOPLE BEHIND POWER



OLLIE WE FOLLOWED POWER THROUGH HISTORY.

FRANK NOW WE WANT TO MEET ITS TEAM.


LINEWORKERS CARE FOR POWER LINES.
SUBSTATION TECHNICIANS CARE FOR EQUIPMENT THAT CONNECTS CIRCUITS AND CHANGES VOLTAGE.
ELECTRICIANS.
ELECTRICIANS HELP POWER WORK SAFELY IN BUILDINGS.
TEST TECHNICIANS.
TEST TECHNICIANS CHECK THAT EQUIPMENT WORKS AS IT SHOULD.
THE PEOPLE BEHIND THE CLICK.
AND BEHIND THE SAFE CLICK.


GENERATOR TECHNICIANS
GENERATOR TECHNICIANS KEEP MACHINES READY.
RENEWABLE-ENERGY TECHNICIANS
RENEWABLE-ENERGY TECHNICIANS CARE FOR WIND AND SOLAR EQUIPMENT.
NUCLEAR REACTOR OPERATORS
REACTOR OPERATORS MANAGE THE REACTOR AT A NUCLEAR PLANT.
GRID OPERATORS
GRID OPERATORS HELP BALANCE AND COORDINATE THE ELECTRIC SYSTEM.
DIFFERENT CONTROL ROOMS.
IMPORTANT WORK IN BOTH.


ENGINEERS DESIGN AND SOLVE PROBLEMS.
SUPERVISORS AND MANAGERS COORDINATE PEOPLE, PLANS, AND RESOURCES.
SO THE GRID NEEDS DIFFERENT KINDS OF CLEVER.
AND PEOPLE WHO NOTICE WHAT OTHERS MISS.
EXACTLY. THERE ARE MANY WAYS TO HELP.
VISITOR CENTER
THANK YOU, MICAH AND TUCKER!
NOW... ABOUT DINNER.
DESTINATION: HOME.


YOU HAVE FOLLOWED DISCOVERIES, MACHINES, WIRES, AND PEOPLE.
THE ANSWER WASN'T JUST ONE POWER STATION.
IT WAS EVERYTHING WORKING TOGETHER.
HOME. BEFORE BEDTIME.
AND AFTER A VERY LONG APPETIZER.


WE MADE IT.
EVERY LITTLE LIGHT HAS A BIG STORY.
AND EVERY LONG DAY NEEDS DINNER.
THIS WAY.


AT LAST.
CRUNCH.
MUNCH.
FRANK
OLLIE
I THOUGHT WE WERE LOOKING FOR ONE BIG ANSWER.
FRANK
WE FOUND A LOT OF PEOPLE ADDING THEIR PIECES.
AND A LOT OF TURNING.
OLLIE
FRANK


YOU LEARNED TO WAIT FOR THE ANSWER.
I WANTED TO KNOW EVERYTHING FAST.
FRANK
OLLIE
I THOUGHT GOING SLOW MEANT FALLING BEHIND.
YOU NOTICED THE FARMHOUSE.
I'M GLAD YOU DID.
ME TOO.


ONE...
TWO...
THREE.
IS THREE THE RULE?
IT IS TONIGHT.
DINNER. HOME. BEDTIME.
THE END.

Exploring Together

The story is finished. The questions can keep going.

A note for curious readers

You can enjoy the adventure on its own. These optional pages give families, teachers, and older readers a little more to talk about. Choose a question that interests you; there is no quiz to finish.

Real history, imaginary visitors

Frank and Ollie are inspired by real household pets. Their conversations, the machine, its transformations, the secret door, and the historical meetings are invented. Unnamed families and staff are fictional composites. None of the dialogue is a documented quotation. The machine is fantasy, not a design for a working time machine or a source of free energy.

A selected journey

This is a selected, mostly European and U.S. route through a much wider global history. Many contributors are outside its pages. Electricity was observed in nature long before batteries or generators. No person invented electricity, and no single inventor built the modern grid.

Dates and pictures

The story sometimes revisits an earlier date, especially when comparing technologies that developed alongside one another. Historical scenes are simplified cartoons, not exact reconstructions. Science-view diagrams leave out equipment and detail so the central relationship is visible.

Looking safely

The animals watch historical experiments as imaginary visitors. Those scenes are not activities to copy. In real life, leave electrical panels, utility sites, batteries being dismantled, and power lines to trained people. Stay well away from fallen wires and report them to emergency services or the utility. A helmet or vest does not make electrical equipment safe to approach.

A short timeline

Different discoveries joined a much larger story.

Before 1800

People investigated static electricity, magnetism, and electrical effects long before this adventure begins. Lightning is a natural electrical discharge. Water wheels and windmills also did mechanical work long before electric generators.

1800 - a steady source

Alessandro Volta announced his voltaic pile. Chemical reactions could supply sustained current in a complete circuit, giving researchers a valuable experimental source.

1820, 1821, 1831 - connections

Hans Christian Oersted showed the magnetic effect of a current in 1820. Faraday demonstrated electromagnetic rotation in 1821 and discovered electromagnetic induction in 1831. These were different experiments, ten years apart.

1882 to 1896 - systems grow

Pearl Street service began in 1882. Tesla developed important AC motor and system ideas in the 1880s. Westinghouse and many collaborators developed AC systems. The Chicago fair in 1893 and Niagara-to-Buffalo service in 1896 were prominent milestones.

1888 and the early 1900s - overlapping paths

Charles Brush operated an early wind-electric machine in Cleveland in 1888. In the early twentieth century, Insull helped develop larger utility businesses and more efficient service. Wind did not suddenly begin after nuclear energy.

1935 and 1936 - reaching farther

The Rural Electrification Administration was established in 1935. The Rural Electrification Act followed in 1936, supporting loans that helped cooperatives and other organizations extend rural service.

1951, 1954, 1957 - new milestones

EBR-I lit four bulbs with usable nuclear electricity in 1951. Bell Labs demonstrated a practical silicon solar cell in 1954. Shippingport began operation in 1957, an important early U.S. commercial nuclear milestone. These are selected milestones, not claims that all the technologies began on these dates.

What makes the big turn?

Energy changes form; it is not created from nothing.

Current, voltage, and energy

Current is the flow of electric charge. Voltage describes an electrical potential difference that can drive current through a circuit. Electrical energy can be transferred to lights, heaters, motors, and other devices. Power is the rate of energy transfer. A watt is a unit of power; a kilowatt-hour is a unit of energy.

A battery is a source with limits

Chemical reactions in a battery can maintain a potential difference. A connected, complete circuit allows current to flow. The battery does not contain an endless supply, and its voltage, capacity, and permitted current limit the jobs it can do. Volta did not make a modern household battery or invent electricity.

Motor and generator

A motor converts electrical energy into mechanical motion. A generator converts mechanical energy into electrical energy through electromagnetic induction. Real machines have losses. A motor driving a generator cannot produce an endless supply of extra energy.

Why motion mattered

Faraday showed that a changing magnetic field through a circuit can induce an electrical effect. A magnet simply resting beside a coil is not a steady source of current. Practical generators use continuing relative motion or another changing magnetic field.

An important exception

Solar photovoltaic cells convert light directly into electrical energy without a rotating generator. That is why Frank notices the missing turbine. Other technologies also exist; the story uses a few clear examples, not a complete catalog.

AC, DC, and a real rivalry

Different tools can have different useful jobs.

What the letters mean

DC means direct current: current has one direction. Its size can vary. AC means alternating current: direction reverses periodically. In many power systems its waveform is approximately sinusoidal. The story draws a simple steady DC line and AC wave as introductory examples.

Why transformers mattered

A transformer uses changing magnetic fields to transfer energy between circuits. Conventional transformers work with AC and can raise or lower voltage. For the same transmitted power, raising voltage allows lower current, reducing resistive heating losses in wires. Transmission voltage is later reduced for local distribution and use.

A competition, not a fairy tale

The late-nineteenth-century contest involved Edison, Tesla, Westinghouse, other inventors, engineering teams, investors, and customers. Business rivalry, patents, public demonstrations, and harmful publicity campaigns were part of it. The child-facing adventure omits distressing demonstrations involving animals. That omission does not mean the real rivalry was always friendly.

Both are here today

Batteries and solar cells produce DC. Many local public grids distribute AC. Electronic converters link different forms; high-voltage DC also has important transmission uses. AC is not simply the good kind and DC the bad kind. Both require appropriate safety measures.

Talk about it

What did each person or team add? Why might a useful invention need other inventions before it can help a city? Try identifying a battery device and a plug-in device at home without opening either one.

Bringing power to people

An invention and an available service are different achievements.

The system behind the lamp

Edison and his teams worked on a connected lighting and supply system, including generation, distribution, meters, lamps, and business arrangements. Pearl Street used coal-fired boilers and reciprocating steam engines to drive dynamos, not the later steam-turbine layout.

Why Insull belongs in the story

Samuel Insull helped develop large utility businesses, more efficient generation, and service to customers with different patterns of use. Equipment used more fully across the day could spread fixed costs across more sales. Economies of scale and load diversity helped shape utility economics; they did not automatically make service affordable or fair for everyone.

Public oversight and complicated history

Electric networks often developed as regulated utility monopolies, although ownership and rules vary. Oversight concerns include prices, access, reliability, and public responsibilities. Insull also built a complicated holding-company structure that collapsed during the Great Depression. His contributions and that failure both belong in a fuller account.

The farmhouse matters

Scattered rural customers could be expensive to connect. Federal loans, cooperatives, local organizing, and skilled construction helped extend lines. The farm family is fictional, and its changing kitchen combines experiences over time. Service did not reach every farm at once.

Access is still a question

People around the world have unequal access to reliable electricity today. Frank notices a house outside the main route because usefulness depends on reaching people, not only on making impressive machines.

Choosing an energy mix

Ask what starts the process, and what tradeoffs follow.

Water, fuels, and nuclear heat

Hydropower uses moving water to turn turbines. Coal plants usually use combustion heat to make steam that drives turbines. Gas turbines can use hot combustion gases directly; combined-cycle plants also capture exhaust heat for a steam cycle. Nuclear fission supplies heat; many nuclear designs use steam turbines and generators. The story shows simplified chains, not detailed piping.

Nuclear milestones in context

EBR-I produced usable nuclear electricity on December 20, 1951. International development included Obninsk in the Soviet Union in 1954 and Calder Hall in Britain in 1956 before Shippingport in 1957. Different descriptions of "first" depend on the purpose and scale being compared. Shippingport is not called the world's first in this book.

Renewables have long histories

Hydro, wind, and solar technologies developed over many decades. Brush's 1888 wind machine is one early example, not a world-first claim. The photovoltaic effect was observed in the nineteenth century; Bell Labs' 1954 silicon cell was a major practical milestone. Modern designs and manufacturing later expanded their use.

Storage is not a new fuel

A battery stores energy supplied during charging and releases some of it later, with losses. Pumped-storage hydropower stores energy by lifting water for later use. Storage, flexible demand, transmission, and a mix of sources can help match supply and demand.

Useful comparisons

Discuss availability, cost, land, materials, emissions, water, waste, and safety. No single cartoon icon captures all of a technology's effects. A cooling tower's visible plume is generally condensed water vapor, not a special sign of radioactivity.

Following the grid

A network with people watching it.

Transmission and distribution

A useful introductory route is generation, step-up transformation, transmission, substation, distribution, and customer. The real grid has branches, multiple sources, loops, interconnections, and some generation connected locally. Power flows according to electrical conditions across the network; it is not a package following a single reserved road.

Substations and switchgear

Substations may change voltage, connect circuits, switch equipment, measure conditions, and provide protection. Switchgear is an assembly of switching and protection equipment. Not every substation performs every function, and not every box is a transformer.

Relay versus breaker

A protective relay monitors selected electrical quantities and logic. When specified conditions are met, it can send a trip signal. A circuit breaker interrupts current. Their jobs are related but different: sensing a problem and breaking the circuit are not the same action.

An outage is not automatically fixed

Protection can isolate a faulted section and reduce damage or the scope of an interruption. It does not remove a fallen branch, replace damaged equipment, or guarantee that every other customer stays supplied. Crews and operators assess, secure, repair, check, and coordinate restoration. The book's fault is an illustrative example, not an operating procedure.

Keeping things balanced

Operators coordinate the system as supply and use change. Generators, storage, interconnections, forecasts, and controllable demand can all play parts. Nuclear reactor operators manage reactor operations at a plant; grid operators coordinate a different system-level responsibility.

Meet the team: in the field

Different skills help electricity reach everyday life.

Lineworkers

Build, inspect, maintain, and repair overhead and underground electric lines. The work can involve storms, heights, specialized equipment, and carefully controlled hazards. Training and teamwork matter.

Substation technicians

Maintain and troubleshoot equipment in substations. Work may involve transformers, breakers, controls, batteries, and related systems; responsibilities vary by employer and specialization.

Electricians

Install and maintain electrical wiring and equipment in buildings and other facilities. The trade includes different specialties and licensing requirements. Household wiring is not a child's experiment.

Test technicians

Measure and verify how equipment and protection systems perform. Depending on the role, they may test relays, breakers, cables, transformers, or other equipment, document results, and help find problems.

Generator technicians

Inspect, service, and troubleshoot generating equipment. Some specialize in standby engine-generator sets; others work with larger rotating machinery or plant systems. The title does not mean every technician works on every kind of generator.

Renewable-energy technicians

Wind technicians inspect, maintain, and repair wind-turbine equipment. Solar technicians and installers work with photovoltaic systems in different installation, testing, and maintenance roles. Safe access, electrical skills, and mechanical skills can all matter.

Meet the team: planning and operating

Some important work is quiet, and some happens overnight.

Engineers

Design equipment and systems, analyze performance, solve problems, and plan improvements. Electrical, mechanical, civil, nuclear, controls, and other specialties contribute. Engineering is a broad set of roles, not a single desk or task.

Nuclear reactor operators

Operate and monitor reactor systems under formal procedures and regulatory requirements. Their plant responsibility is distinct from balancing the entire public grid. Training, qualification, and licensing requirements depend on the position and jurisdiction.

Grid and control-room operators

Monitor conditions, coordinate resources and switching, and respond to changing system needs. Control-room roles differ among utilities, balancing authorities, generators, and other organizations. Communication and careful decisions are central.

Supervisors, managers, and coordinators

Arrange people, schedules, materials, budgets, work plans, and communication. They help teams perform the right work at the right time. Good coordination supports the people doing the hands-on and operating work.

Many ways to begin

Pathways can include apprenticeships, technical education, employer training, military experience, college, and specialized qualifications. Requirements vary. For a child, useful beginnings include curiosity, reading, math, asking clear questions, working with others, and following safety directions.

About the guide

Micah is an invited, fictionalized guide based on Micah from Southern Staffing Group. The cameo introduces representative careers; it is not a promise of a job, a training credential, or a complete list of everyone who supports power.

Keep exploring together

Conversation and observation, with no equipment to open.

One room, many helpers

Look around an ordinary room. What uses electricity? Choose one item and imagine the people needed to design it, supply it, wire the room, and keep the service operating. Do this by looking only; leave sockets and equipment closed.

A story in three pictures

Draw a beginning, a discovery, and a result for your favorite historical stop. Can someone else explain why that discovery mattered by looking at your pictures?

The missing piece

What would a lightbulb need besides the bulb itself? What would change if a farm had a lamp but no line reaching it? These questions separate an invention from an available service.

A fair comparison

Pick two generating sources. Ask what starts the process, whether a turbine is involved, when energy is available, and what resources or tradeoffs matter. "Which is best?" may have different answers in different places.

Noticing and listening

When did Frank's slower pace help? When did Ollie's curiosity help? When did listening help more than pressing a button? Which skill would you bring to a team?

A bedtime thought

The next time you turn off a light, think of one discovery and one worker behind it. Then let the adventure rest. Tomorrow's questions do not need to interrupt tonight's sleep.

Sources: discoveries and access

Tap a source link in the PDF, or search its organization and title from your printed copy.

Smithsonian: precursors to electric lighting

Volta and earlier electrical sources. Read source online

Royal Institution: Faraday's motor

Electromagnetic rotation in 1821; surviving apparatus from 1822. Read source online

Royal Institution: Michael Faraday

Faraday's work, including induction in 1831. Read source online

National Park Service: Edison biography

Pearl Street and the connected lighting system. Read source online

Rutgers Edison Papers: Pearl Street

Period engines, dynamos, and system development. Read source online

U.S. Department of Energy: AC and DC

Rivalry, the 1893 fair, and Niagara-to-Buffalo service. Read source online

Smithsonian: Generating Change

Insull, scale, efficiency, and utility business. Read source online

USDA: Electric Programs

Rural electrification and federal support. Read source online

Idaho National Laboratory: EBR-I

The December 20, 1951 nuclear-electricity milestone. Read source online

U.S. DOE: early nuclear history

Shippingport and U.S. nuclear development. Read source online

Sources: systems and people

Tap a source link in the PDF, or search its organization and title from your printed copy.

IAEA: History of the Agency, chapter 6

International milestones, including Obninsk and Calder Hall. Read source online

EIA: wind timeline

Early wind-electric development, including Brush. Read source online

EIA: photovoltaic timeline

Photovoltaic discoveries and the 1954 silicon cell. Read source online

EIA: delivering electricity

Transmission, voltage changes, and distribution. Read source online

DOE: transformers and protection framework

Grid equipment, protection, and resilience. Read source online

BLS: electrical power-line workers

Linework and training pathways. Read source online

BLS: electricians

Building electrical work and apprenticeships. Read source online

BLS: power operators and dispatchers

Plant, reactor, and grid-operation distinctions. Read source online

BLS: wind turbine technicians

Wind maintenance work. Read source online

BLS: solar photovoltaic installers

Solar installation roles. Read source online

A simple question. A very long way home.

When Ollie asks where electricity comes from, a mysterious machine sends him and Frank tumbling through history. Follow the sparks, the big turns, and the people behind the lights – then come home for dinner and bedtime.

A complete comic adventure, with Exploring Together notes for curious families.

