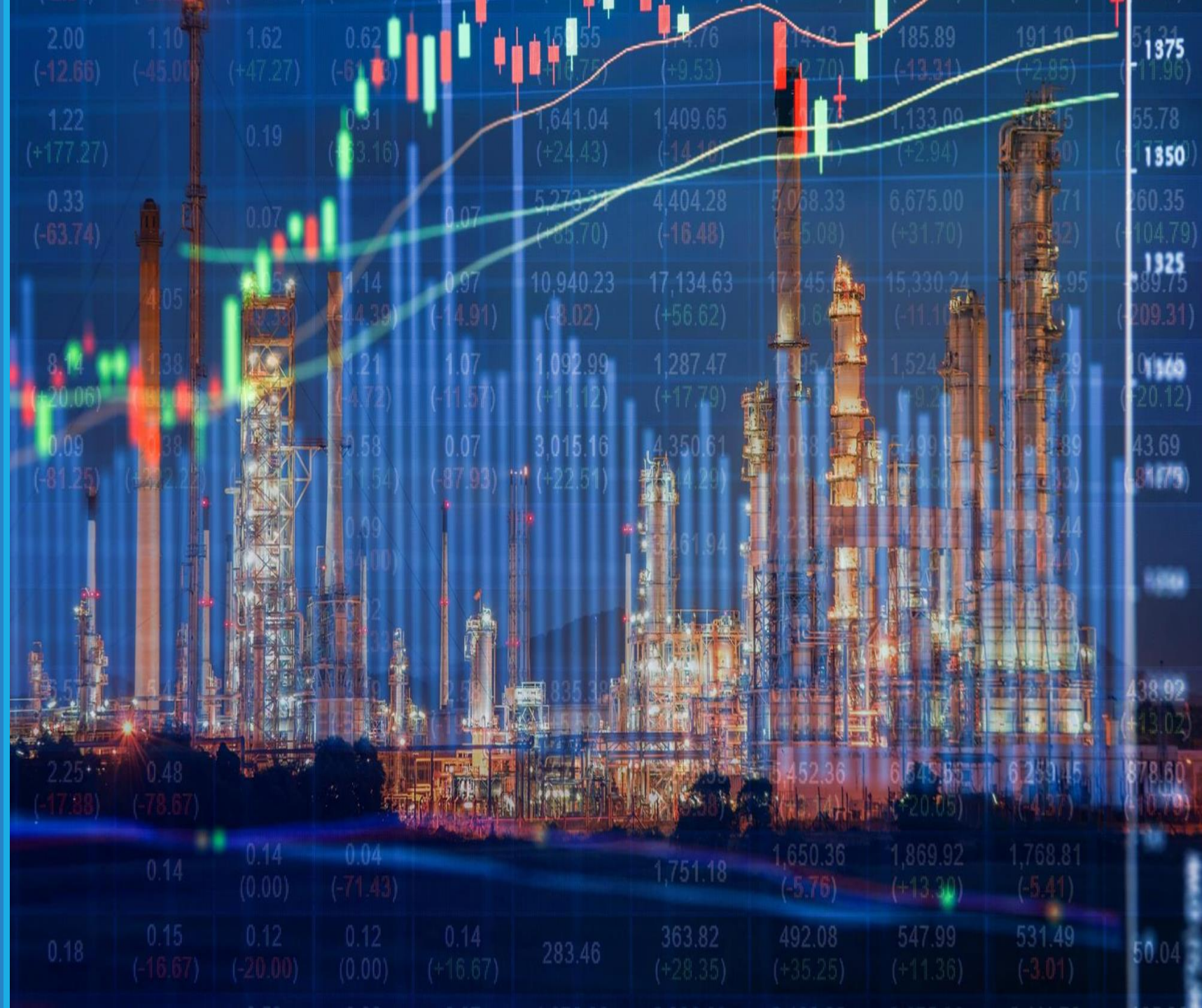


Energy Academy

Session #6: Energy Transition
with Renewable Energy

Metropolitan Mayors Caucus |
The Power Bureau

April 6, 2023



AGENDA

HOUSEKEEPING

- Course-related items

RESOURCES

- Readings
- Website of the Week

LECTURE

- Technology Review
- Past Deployments and the Outlook
- Renewable Options in Illinois

DISCUSSION

- Open



HOUSEKEEPING

HOUSEKEEPING

Announcements from MMC

Cheryl and Edith

Requests for Specific Course Items

We've had a few suggestions:

- Smart Grids
- Microgrids
- Franchise Account management/conversion
- New federal energy incentives

Recommendations

As always, please feel free to share any ideas and recommendations for improvements to the course and its content!



RESOURCES

RESOURCES

Weekly Readings

Renewable Energy Access Plan

Link: [REAP Webpage](#)

Source: Illinois Commerce Commission

Description: Process that outlines the path to an equitable, reliable, and affordable path to meeting Illinois' policy requirements for a clean electricity system.

CS² Program

Link: [Community Solar Clearinghouse Solution](#)

Source: Metropolitan Mayors Caucus

Description: Ready-made community solar program that allows municipalities to offer community solar subscriptions to their residents and small businesses

Conversion from Natural Gas to Electric

Link: [GeoMicroDistrict Feasibility Report](#)

Source: Home Energy Efficiency Team (HEET)

Description: Feasibility study by a Boston-based non-profit that identifies an approach to using shared ground source heat pumps to replace natural gas fueled appliances in residences

WEBSITE OF THE WEEK: US ENERGY ATLAS (DEPARTMENT OF ENERGY, ENERGY INFORMATION ADMINISTRATION)

The screenshot displays the EIA U.S. Energy Atlas website. The header features the EIA logo and the text "U.S. Energy Atlas" on a dark blue background. Below the header, the page is divided into a left sidebar and a main map area. The sidebar includes a "Electricity" section with the EIA logo, the text "U.S. Energy Information Administration (EIA.gov)", and "U.S. Energy Information Administration". Below this is a "Summary" section with the text "Map of the electricity infrastructure in the U.S." and a blue button labeled "View Full Details". The "Details" section lists: "Application: Web Mapping Application", "December 22, 2021: Date Updated", "October 18, 2020: Published Date", "Public: Anyone can see this content", and "Custom License: View license details". The main map area is titled "Electricity Energy Infrastructure and Resources" and shows a map of the United States with various cities labeled, including Vancouver, Seattle, San Francisco, Los Angeles, Dallas, Houston, Monterrey, Mexico City, Guadalajara, Denver, St. Louis, Chicago, Detroit, Toronto, Montreal, Boston, New York, Philadelphia, Washington, Atlanta, Miami, Havana, and Port-au-Prince. The map also shows parts of Canada and Mexico. The bottom of the page features a Windows taskbar with the date 3/29/2023 and time 8:15 AM.

WEBSITE OF THE WEEK: US ENERGY ATLAS (DEPARTMENT OF ENERGY, ENERGY INFORMATION ADMINISTRATION)

eia U.S. Energy Atlas

Electricity

eia U.S. Energy Information Administration (EIA.gov)
U.S. Energy Information Administration

Summary

Map of the electricity infrastructure in the U.S.

[View Full Details](#)

Details

- Application**
Web Mapping Application
- December 22, 2021**
Date Updated
- October 18, 2020**
Published Date
- Public**
Anyone can see this content
- Custom License**
[View license details](#)

Electricity Energy Infrastructure and Resources

Map showing electricity infrastructure and resources across the United States, including major cities and states. The map includes a search bar, home button, zoom controls, and a legend. Major cities labeled include Minneapolis, Sioux Falls, Madison, Milwaukee, Grand Rapids, Lansing, Detroit, Chicago, Cleveland, Columbus, Cincinnati, Indianapolis, Springfield, St. Louis, Jefferson City, Topeka, Kansas City, Wichita, Tulsa, Oklahoma City, Little Rock, Memphis, Nashville, Knoxville, Greenville, Charlotte, Greensboro, Raleigh, Washington, Richmond, Charleston, Frankfort, Harrisburg, Pittsburgh, Cleveland, Buffalo, Hamilton, Toronto, Rochester, Barrie, and Owen Sound. States shown include DAKOTA, WISCONSIN, MICHIGAN, IOWA, NEBRASKA, KANSAS, MISSOURI, ARKANSAS, OKLAHOMA, TENNESSEE, KENTUCKY, OHIO, INDIANA, ILLINOIS, PENNSYLVANIA, WEST VIRGINIA, and VIRGINIA. The map is titled "Electricity Energy Infrastructure and Resources" and is powered by Esri.

WEBSITE OF THE WEEK: US ENERGY ATLAS (DEPARTMENT OF ENERGY, ENERGY INFORMATION ADMINISTRATION)

The screenshot displays the EIA U.S. Energy Atlas website. The top navigation bar includes the EIA logo and the text "U.S. Energy Atlas". The main content area is titled "Electricity Energy Infrastructure and Resources" and features a map of the United States with a dense network of blue lines representing electricity infrastructure. The map includes various cities and states, such as Minneapolis, Chicago, Detroit, and New York. On the left side, there is a sidebar with the following sections: "Electricity" with the EIA logo and "U.S. Energy Information Administration (EIA.gov)"; "Summary" with the text "Map of the electricity infrastructure in the U.S." and a "View Full Details" button; and "Details" with a list of metadata: "Application: Web Mapping Application", "December 22, 2021: Date Updated", "October 18, 2020: Published Date", "Public: Anyone can see this content", and "Custom License: View license details". The bottom of the screenshot shows a Windows taskbar with the date "3/29/2023" and time "8:30 AM".

WEBSITE OF THE WEEK: US ENERGY ATLAS (DEPARTMENT OF ENERGY, ENERGY INFORMATION ADMINISTRATION)

The screenshot displays the EIA U.S. Energy Atlas website. The header includes the EIA logo and the text "U.S. Energy Atlas". The main content area is titled "Electricity Energy Infrastructure and Resources" and features a map of the United States showing a dense network of electricity transmission lines. The map is overlaid on a light gray background with state boundaries and major cities labeled. The left sidebar contains navigation and information sections: "Electricity" with the EIA logo and "U.S. Energy Information Administration (EIA.gov)", "Summary" with a "View Full Details" button, and "Details" with metadata including "Application: Web Mapping Application", "Date Updated: December 22, 2021", "Published Date: October 18, 2020", "Public" status, and "Custom License" information. The bottom of the screenshot shows a Windows taskbar with various application icons, system tray icons, and the date/time "8:36 AM 3/29/2023".

WEBSITE OF THE WEEK: US ENERGY ATLAS (DEPARTMENT OF ENERGY, ENERGY INFORMATION ADMINISTRATION)

The screenshot displays the EIA U.S. Energy Atlas interface. At the top left, the EIA logo and 'U.S. Energy Atlas' are visible. The main heading is 'Electricity Energy Infrastructure and Resources'. The central feature is a map of the United States densely populated with colored icons representing energy infrastructure. The map includes state names and major city labels. On the left side, there is a sidebar with the following sections: 'Electricity' with the EIA logo and 'U.S. Energy Information Administration (EIA.gov)'; 'Summary' with the text 'Map of the electricity infrastructure in the U.S.' and a 'View Full Details' button; and 'Details' with metadata including 'Application: Web Mapping Application', 'Date Updated: December 22, 2021', 'Published Date: October 18, 2020', 'Public' status, and 'Custom License' information. At the bottom, a Windows taskbar shows the system tray with a temperature of 38°F, search bar, and various application icons. The system clock indicates 8:38 AM on 3/29/2023.

WEBSITE OF THE WEEK: US ENERGY ATLAS (DEPARTMENT OF ENERGY, ENERGY INFORMATION ADMINISTRATION)

eia U.S. Energy Atlas

Electricity

U.S. Energy Information Administration (EIA.gov)
U.S. Energy Information Administration

Summary

Map of the electricity infrastructure in the U.S.

[View Full Details](#)

Details

- Application**
Web Mapping Application
- December 22, 2021**
Date Updated
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- Public**
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- Custom License**
[View license details](#)

Electricity Energy Infrastructure and Resources

Woodland Landfill Gas Recovery

- Plant Name:** Woodland Landfill Gas Recovery
- Plant Code:** 54662
- Utility Name:** WM Illinois Renewable Energy LLC
- Utility ID:** 54843
- City:** South Elgin
- County:** Kane
- State:**
- Sector:** IPP Non-CHP
- Technology:** Landfill Gas
- Data Period:** September 2022
- Primary Fuel:** Biomass
- Total Nameplate Capacity:** 4.8 MW

City of Chicago, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS | U.S. Energy Information Administration, Form EIA-860, Annual Electric Generator Report, Form EIA-... Powered by Esri

38°F Cloudy Search 8:49 AM 3/29/2023



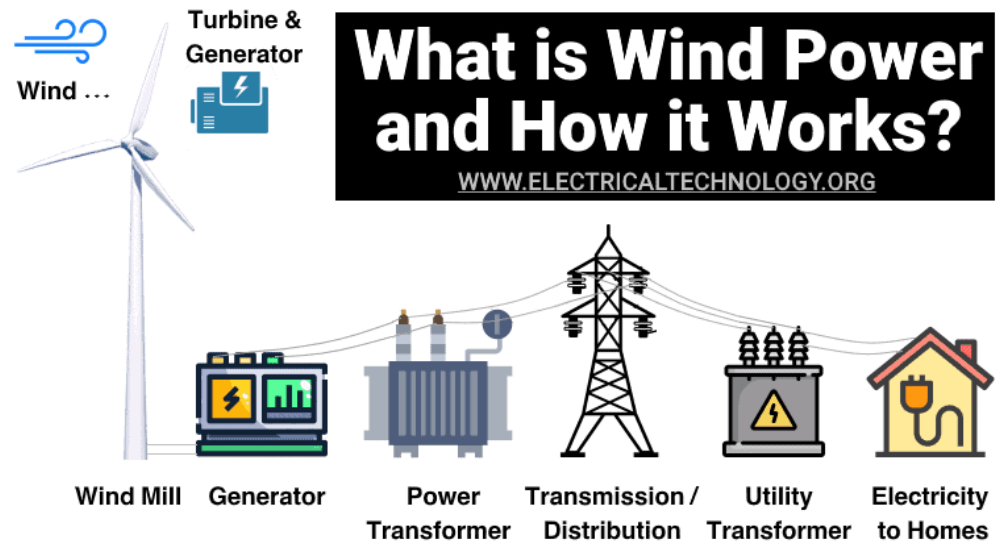
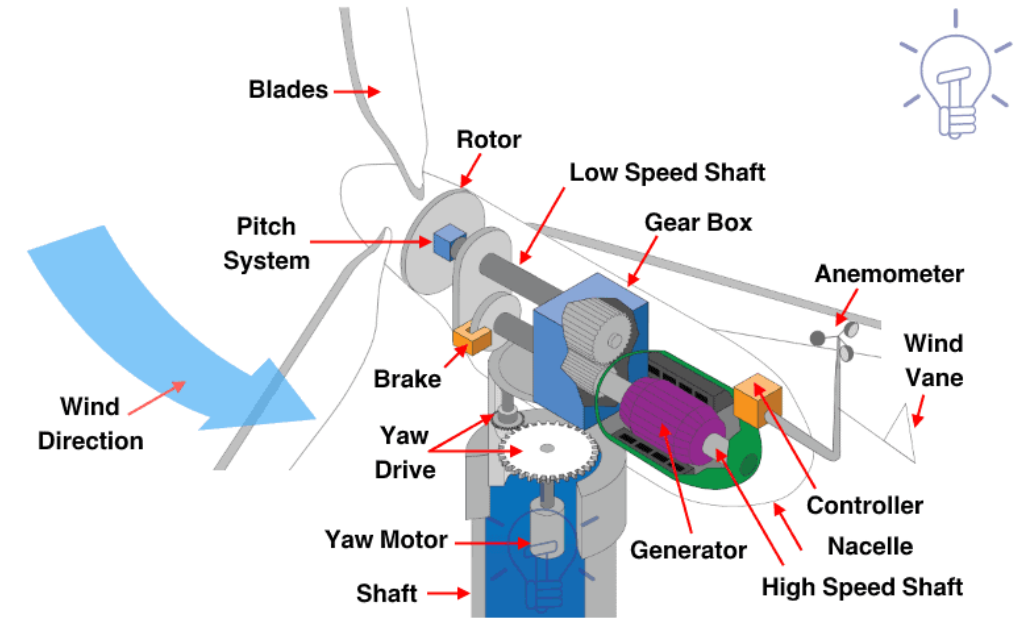
LECTURE

ENERGY TRANSITION: RENEWABLE ENERGY

Technology Overview

- Wind
- Solar
- Biomass
- Landfill Gas
- Hydroelectric
- Geothermal
- Hydrogen

Wind Energy captures air movement (blades/rotor/gearbox) to turn a generator



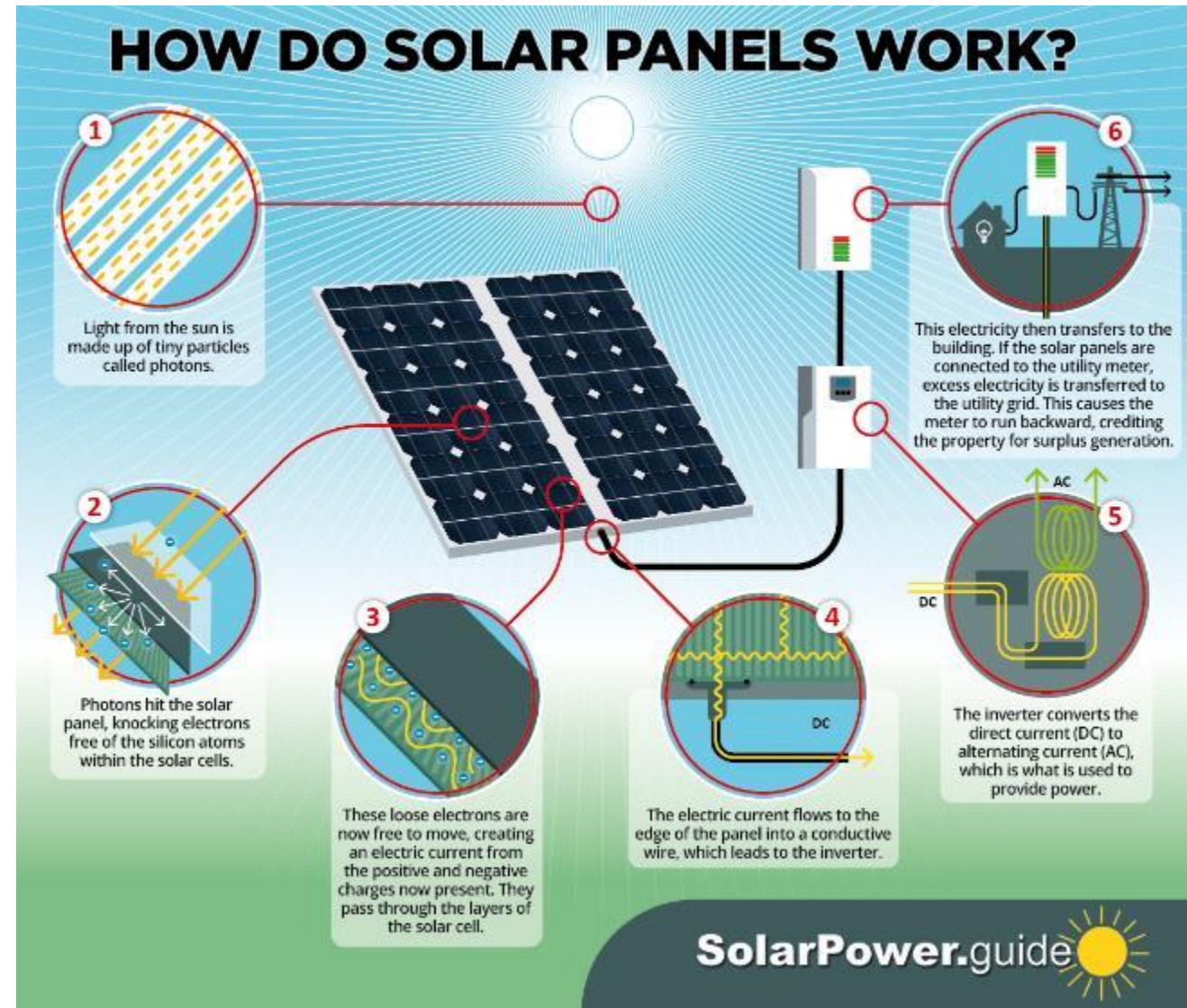
Source: [Electrical Technology](http://www.electricaltechnology.org)

ENERGY TRANSITION: RENEWABLE ENERGY

Technology Overview

- Wind
- **Solar**
- Biomass
- Landfill Gas
- Hydroelectric
- Geothermal
- Hydrogen

Solar panels allow sunlight (photons) to decouple electrons from silicon wafers to create a current (electricity)



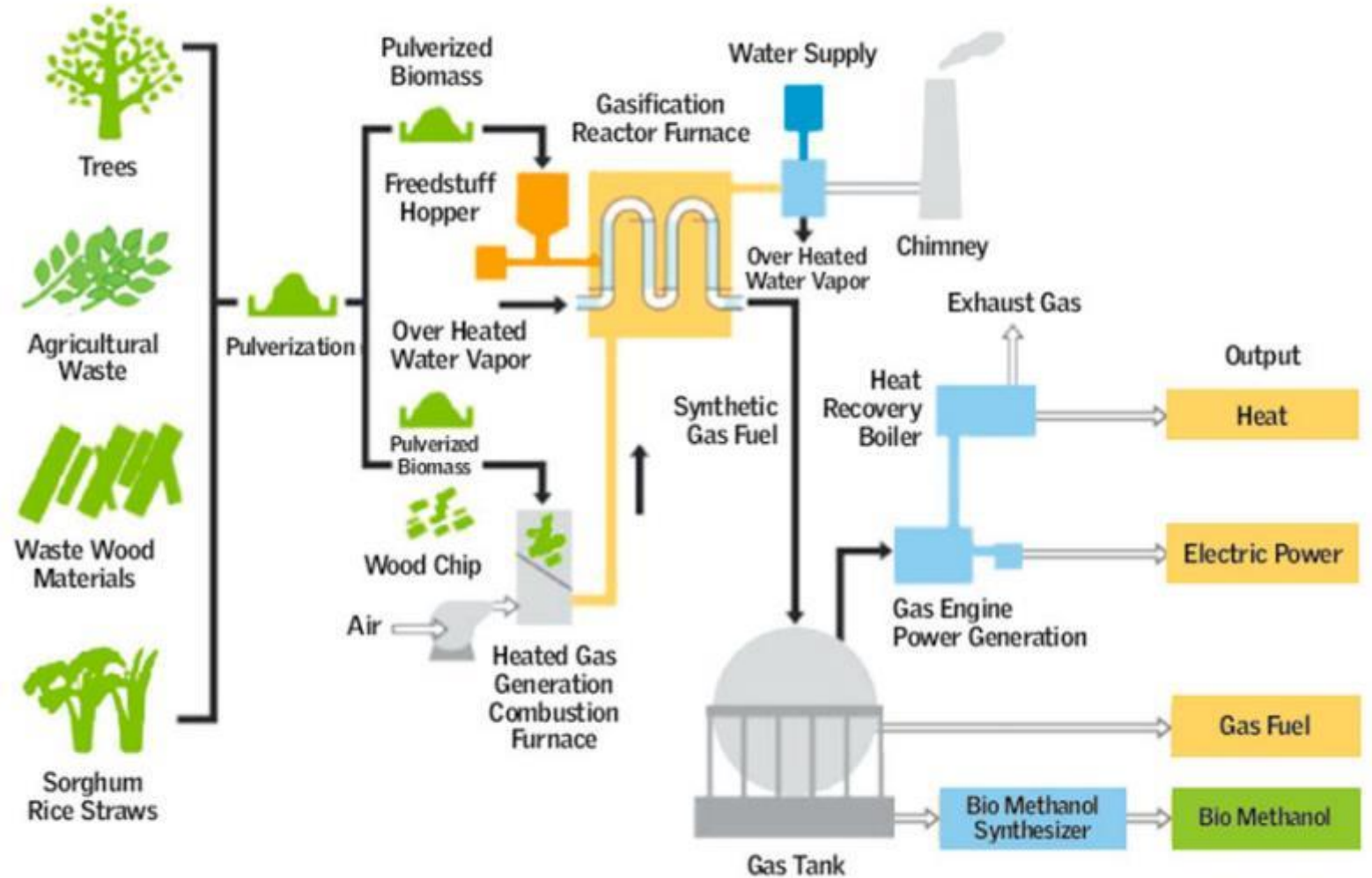
Source: [Solar Power Guide](#)

ENERGY TRANSITION: RENEWABLE ENERGY

Technology Overview

- Wind
- Solar
- **Biomass**
- Landfill Gas
- Hydroelectric
- Geothermal
- Hydrogen

Biomass replaces coal and natural gas with organic materials which are directly combusted or gasified to produce heat or fuels

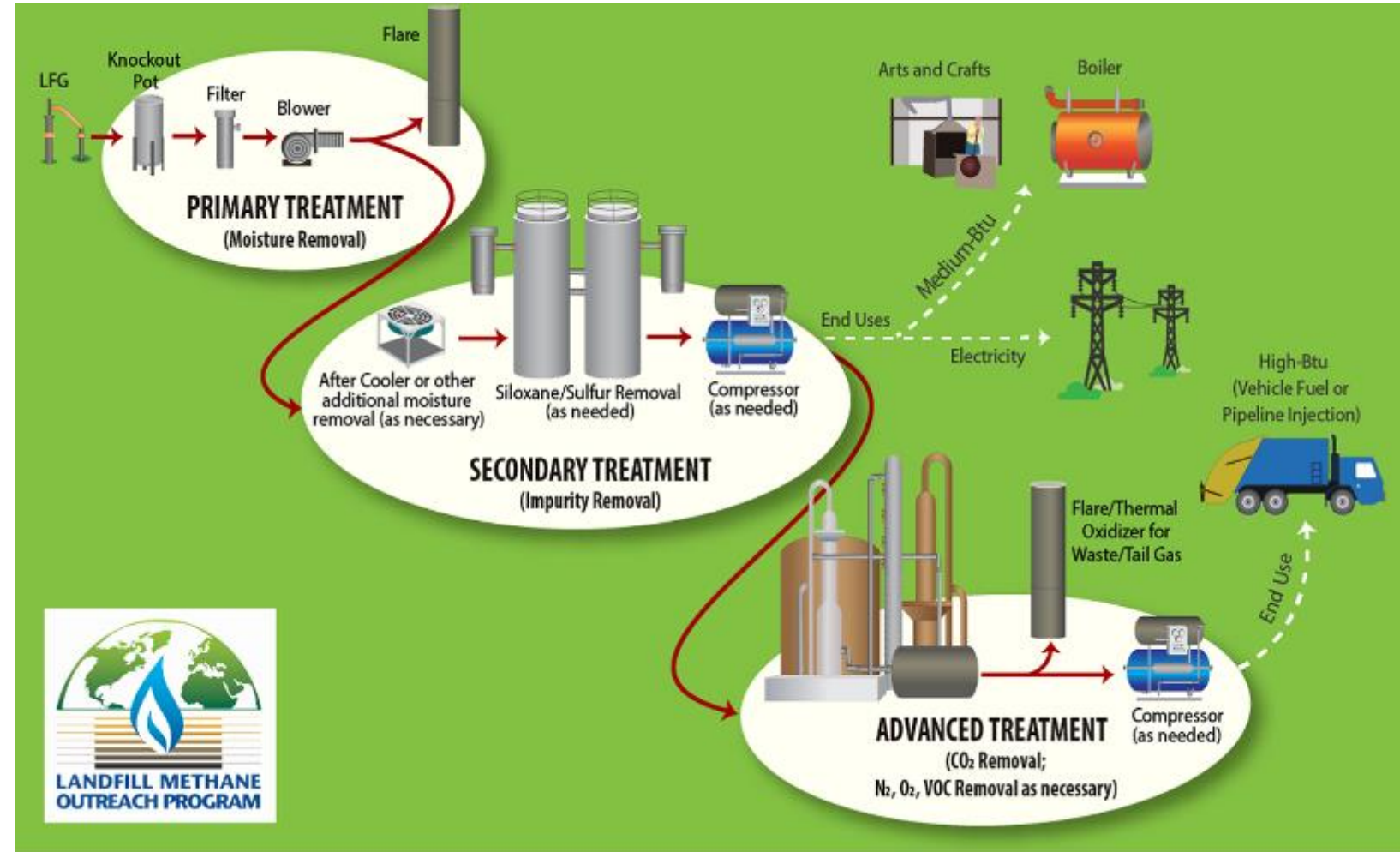


Landfill Gas is captured methane from decomposing materials in covered landfills that is collected, cleaned, dried and then pressurized for use as a fuel

ENERGY TRANSITION: RENEWABLE ENERGY

Technology Overview

- Wind
- Solar
- Biomass
- **Landfill Gas**
- Hydroelectric
- Geothermal
- Hydrogen



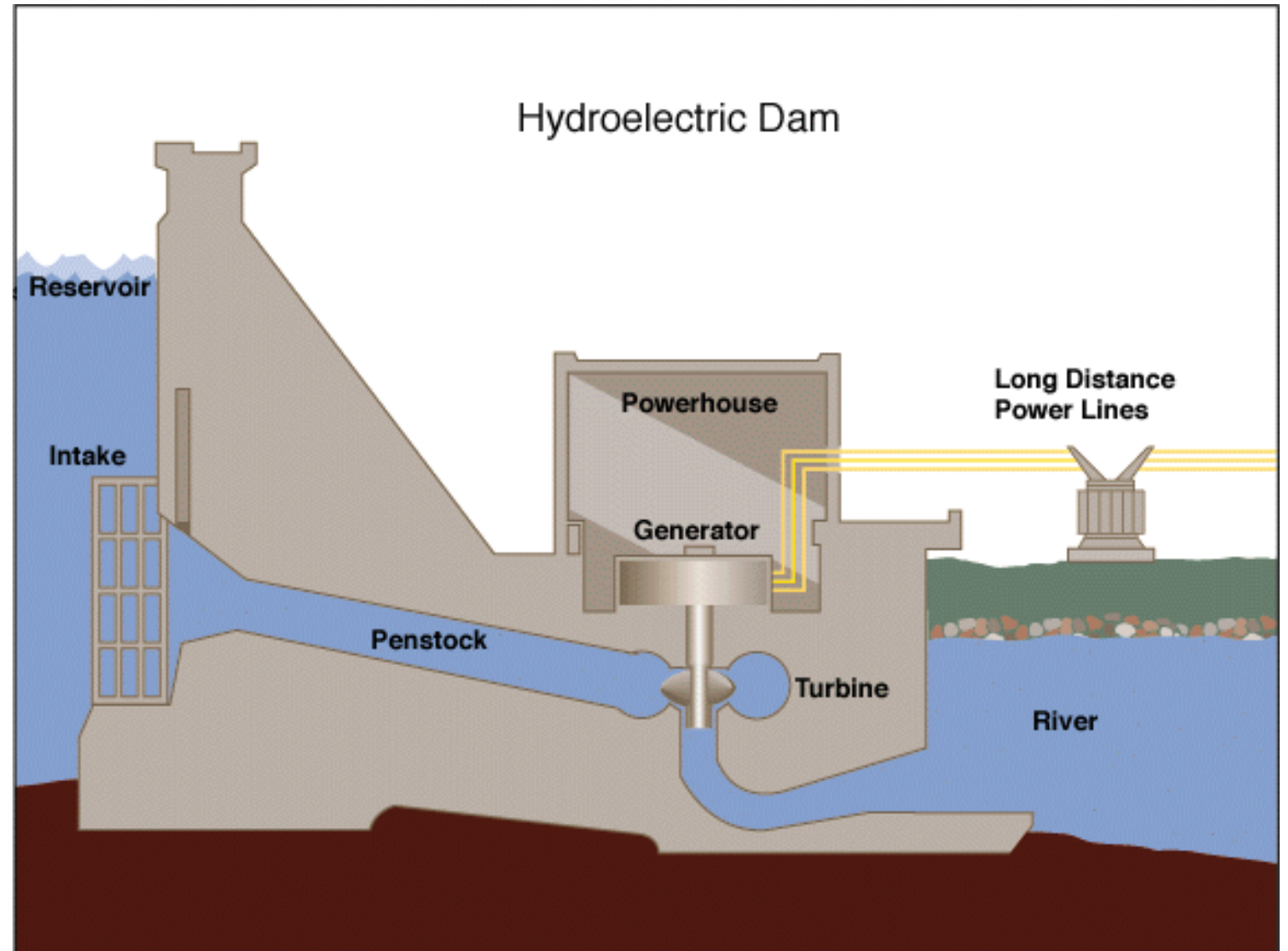
Source: [US Environmental Protection Agency](#)

Hydroelectric generation converts the pressure of falling water to move a turbine that generates electricity

ENERGY TRANSITION: RENEWABLE ENERGY

Technology Overview

- Wind
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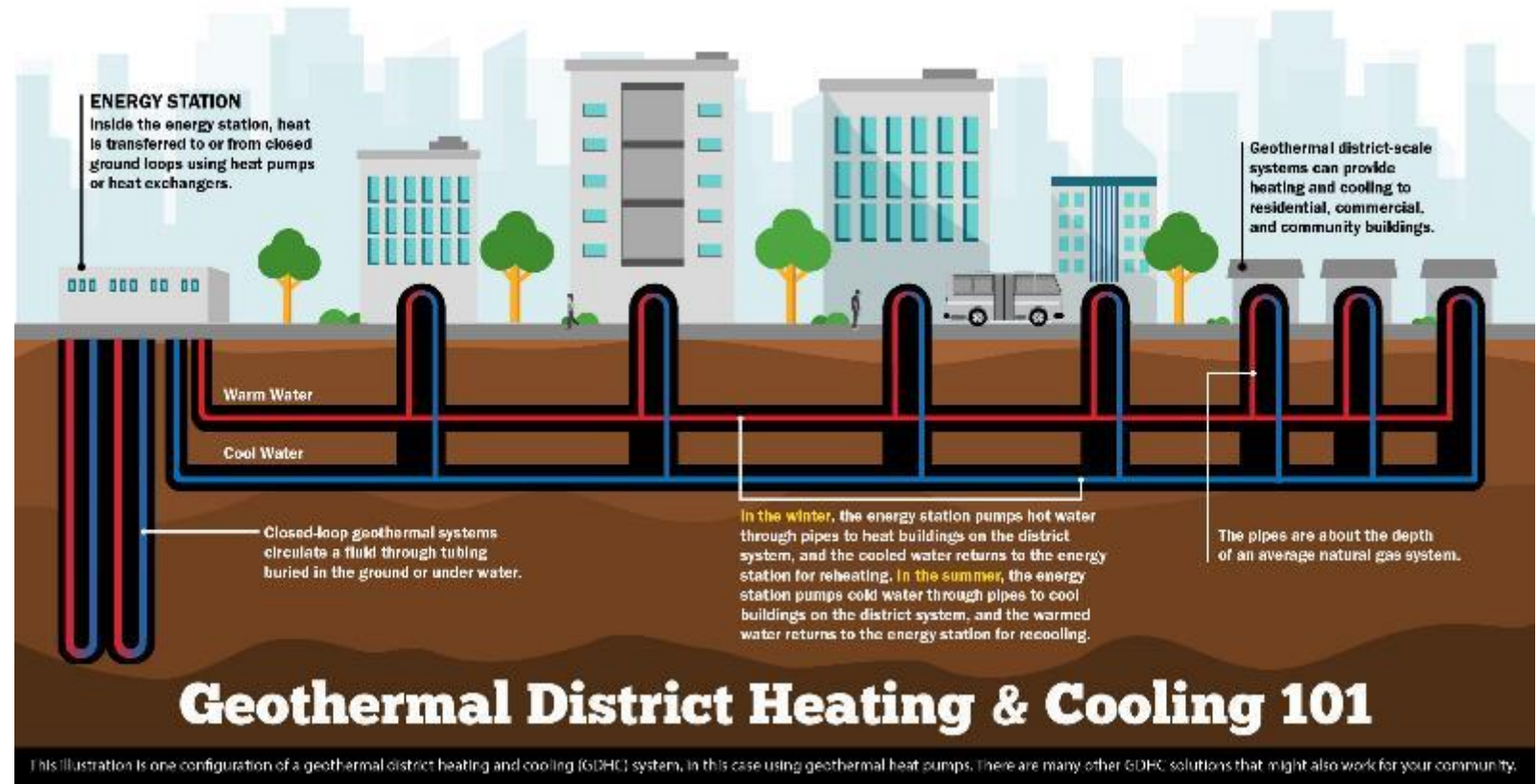
Source: [US Energy Information Administration](https://www.eia.gov)

ENERGY TRANSITION: RENEWABLE ENERGY

Technology Overview

- Wind
- Solar
- Biomass
- Landfill Gas
- Hydroelectric
- **Geothermal**
- Hydrogen

Geothermal energy captures the constant temperature of the earth and converts that energy into heating and cooling through the use of heat exchangers



Source: [US Department of Energy](#)

ENERGY TRANSITION: RENEWABLE ENERGY

Technology Overview

- Wind
- Solar
- Biomass
- Landfill Gas
- Hydroelectric
- Geothermal
- Hydrogen

Hydrogen can be produced through electrolysis using excess renewable energy, stored, and then used to produce electricity through fuel cells or combustion

How does **green** hydrogen work?

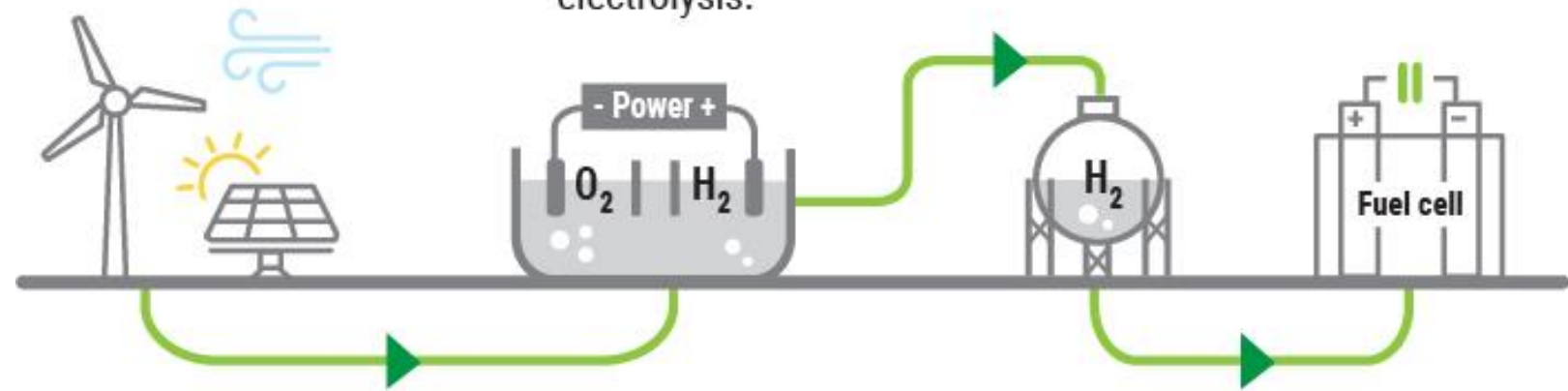


Using the excess energy produced by renewables like wind or solar...

...green electricity could produce hydrogen through electrolysis.

Hydrogen is stored safely for when needed.

Green hydrogen could be used for clean power generation.



Source: New York ISO

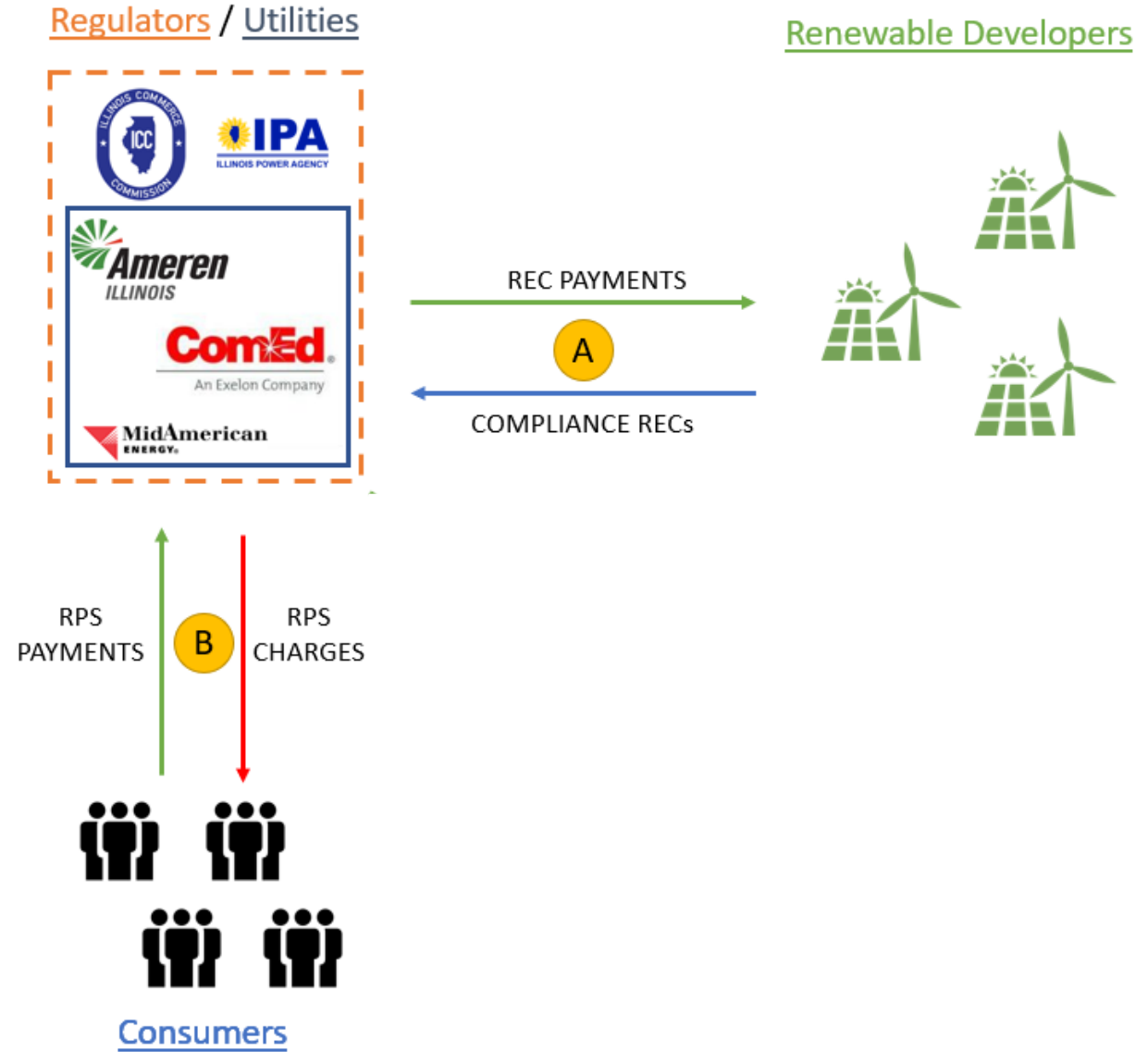
Source: [New York Independent System Operator](#)

ENERGY TRANSITION: RENEWABLE ENERGY

Illinois Renewable Portfolio Standard (RPS)

- Illinois RPS Structure
- Illinois RPS Status
- Illinois RPS Outlook

The Illinois RPS requires the ComEd, Ameren Illinois and MidAmerican Energy to purchase Renewable Energy Credits (RECs) to match a percentage of their loads



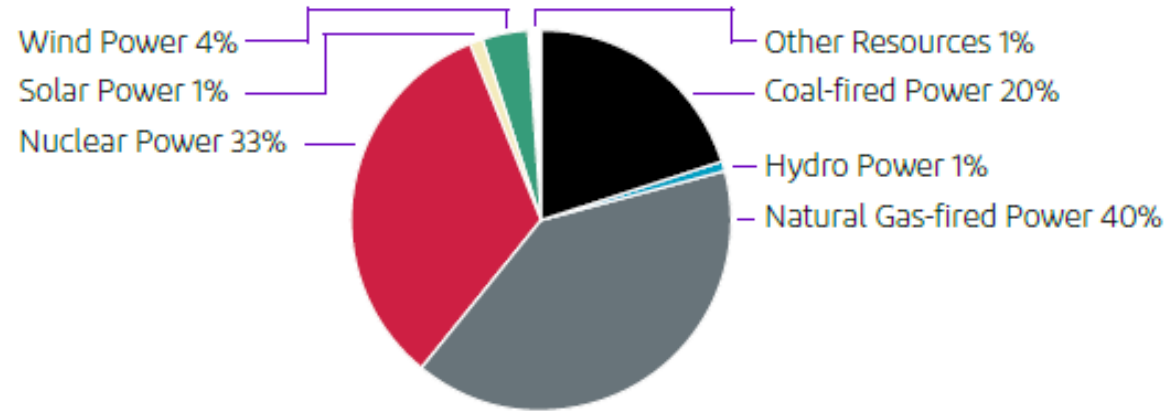
ENERGY TRANSITION: RENEWABLE ENERGY

Illinois Renewable Portfolio Standard (RPS)

- Illinois RPS Structure
- Illinois RPS Status
- Illinois RPS Outlook

The Illinois RPS *is not* what the utilities report on their Environmental Disclosure Statements to the Illinois Commerce Commission

Sources of Electricity for the 12 months ending December 31, 2022



Sources ¹ of Electricity Supplied for the 12 Months Ending December 31, 2022	% of Total
BIOMASS POWER	0%
COAL-FIRED POWER	20%
HYDRO POWER	1%
NATURAL GAS-FIRED POWER	40%
NUCLEAR POWER	33%
OIL-FIRED POWER	0%
SOLAR POWER	1%
WIND POWER	4%
OTHER RESOURCES	1%
UNKNOWN RESOURCES PURCHASED FROM OTHER COMPANIES	0%
TOTAL	100%

ENERGY TRANSITION: RENEWABLE ENERGY

Illinois Renewable Portfolio Standard (RPS)

- Illinois RPS Structure
- Illinois RPS Status
- Illinois RPS Outlook

The Illinois RPS requires ComEd, Ameren Illinois and MidAmerican Energy to purchase Renewable Energy Credits to match increasing percentages of utility loads

Delivery Year	IRPS Goals		RPS Deliveries/Shortfall		Illinois RPS Performance	
	Goal %	Goal RECs	REC Deliveries	REC Shortfall	Effective RPS %	Shortfall %
2020-2021	18.0%	21,149,182	3,302,605	17,846,578	2.7%	-15.3%
2021-2022	19.0%	22,785,453	5,938,635	16,846,818	5.0%	-14.0%
2022-2023	21.0%	24,661,977	7,880,864	16,781,113	6.6%	-14.4%

Source: Illinois Power Agency, Long-Term Renewable Resources Procurement Plan (2022), Appendix B

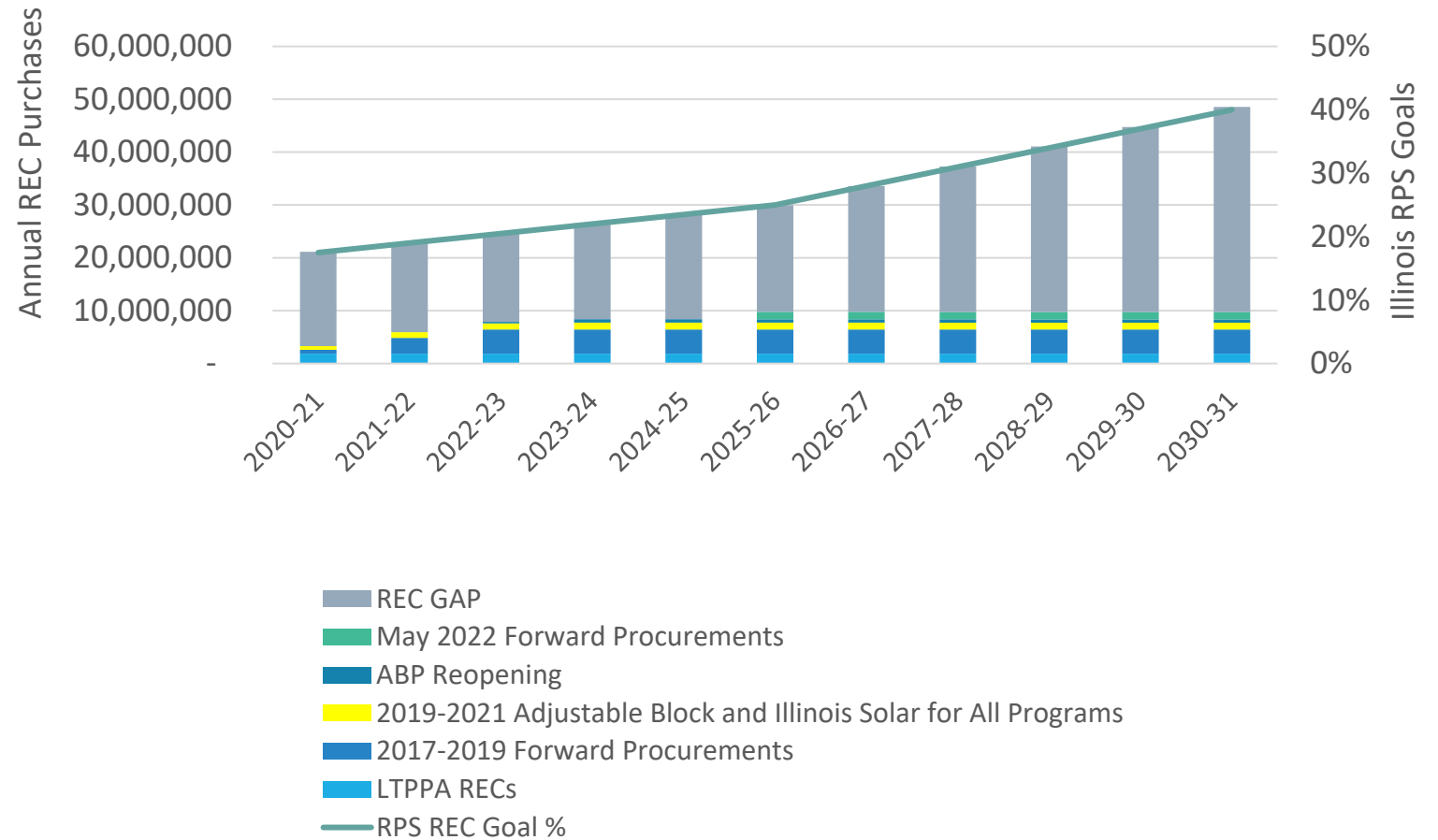
ENERGY TRANSITION: RENEWABLE ENERGY

Illinois Renewable Portfolio Standard (RPS)

- Illinois RPS Structure
- Illinois RPS Status
- Illinois RPS Outlook

The Illinois RPS sets a goal of 40% by the 2030-31 program year, and the Illinois Power Agency projects the need to fill a REC Gap of ~32%

Illinois RPS Projected Shortfalls (2020-2030 Program Years)



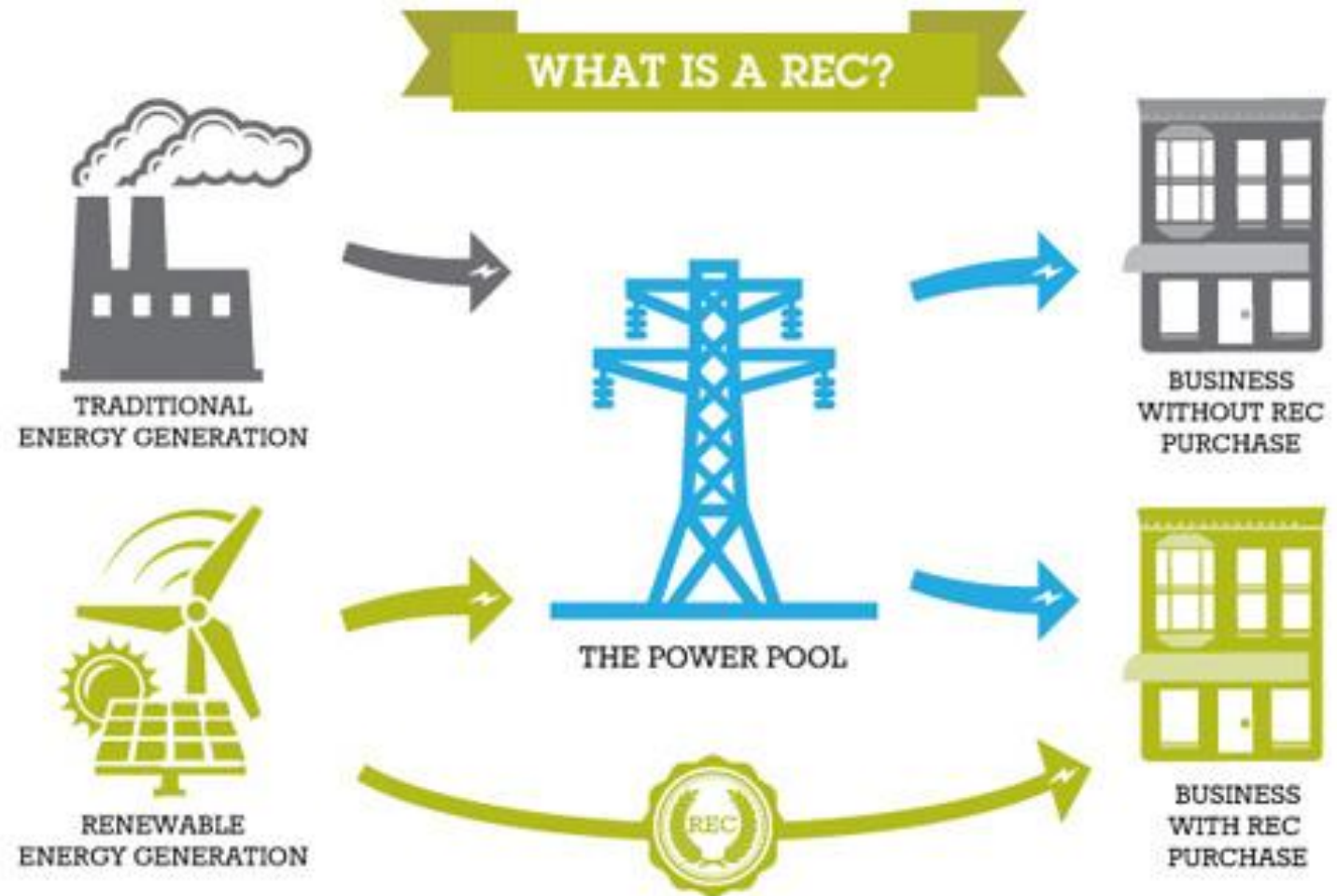
Source: Illinois Power Agency, Long-Term Renewable Resources Procurement Plan (2022), Appendix B

ENERGY TRANSITION: RENEWABLE ENERGY

Options in Illinois

- **Renewable Energy Credits (RECs)**
 - RECs can be sold separately from renewable energy
 - Combining RECs with regular grid energy is considered “renewable”
 - Most RECs sold to Illinois consumers are produced in other states
 - Only long-term REC purchases can cause new renewable energy assets to be built
- Distributed Generation (DG)
- Community Solar (DG)
- Self-Direct (SD)
- Virtual Power Purchase Agreement (VPPA)

A REC is a receipt that proves that 1,000 kWh of electricity was generated by a renewable energy resource at some time in some place and represents the “environmental attributes” of that energy (the “renewableness”)



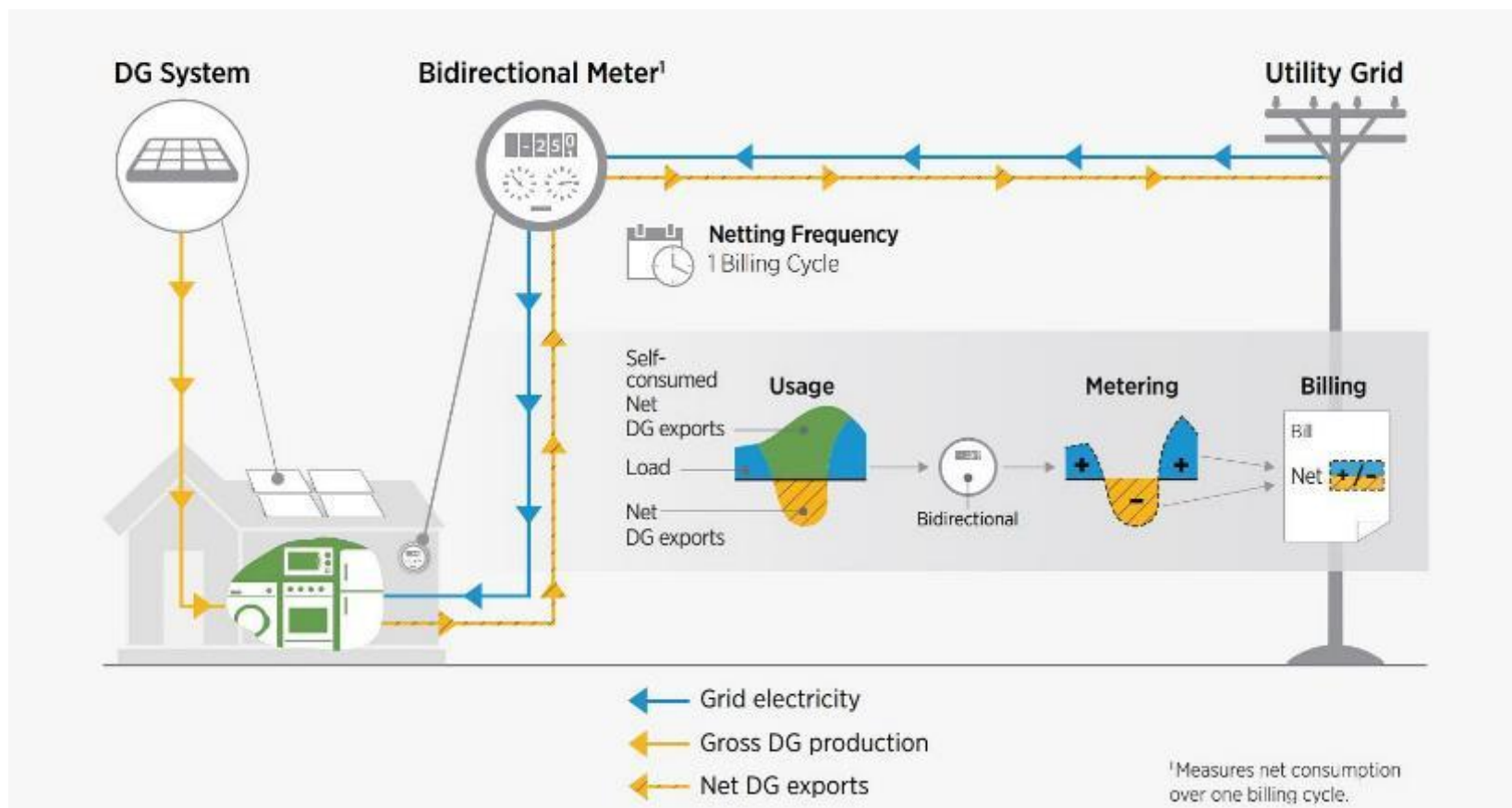
Source: [Renewable Energy World](#)

Distributed Generation produces energy where it's used.

ENERGY TRANSITION: RENEWABLE ENERGY

Options in Illinois

- Renewable Energy Credits (RECs)
- **Distributed Generation (DG)**
 - Energy from a renewable asset can be produced at buildings where the energy is used (behind-the-meter)
 - Excess DG flows back to the grid, and grid energy is delivered when DG is insufficient (net metering)
 - ComEd will purchase the RECs from DG at a fixed price for 20 years to support project financing, so the DG energy used by the consumer is not “renewable”
- Community Solar (CS)
- Self-Direct (SD)
- Virtual Power Purchase Agreement (VPPA)



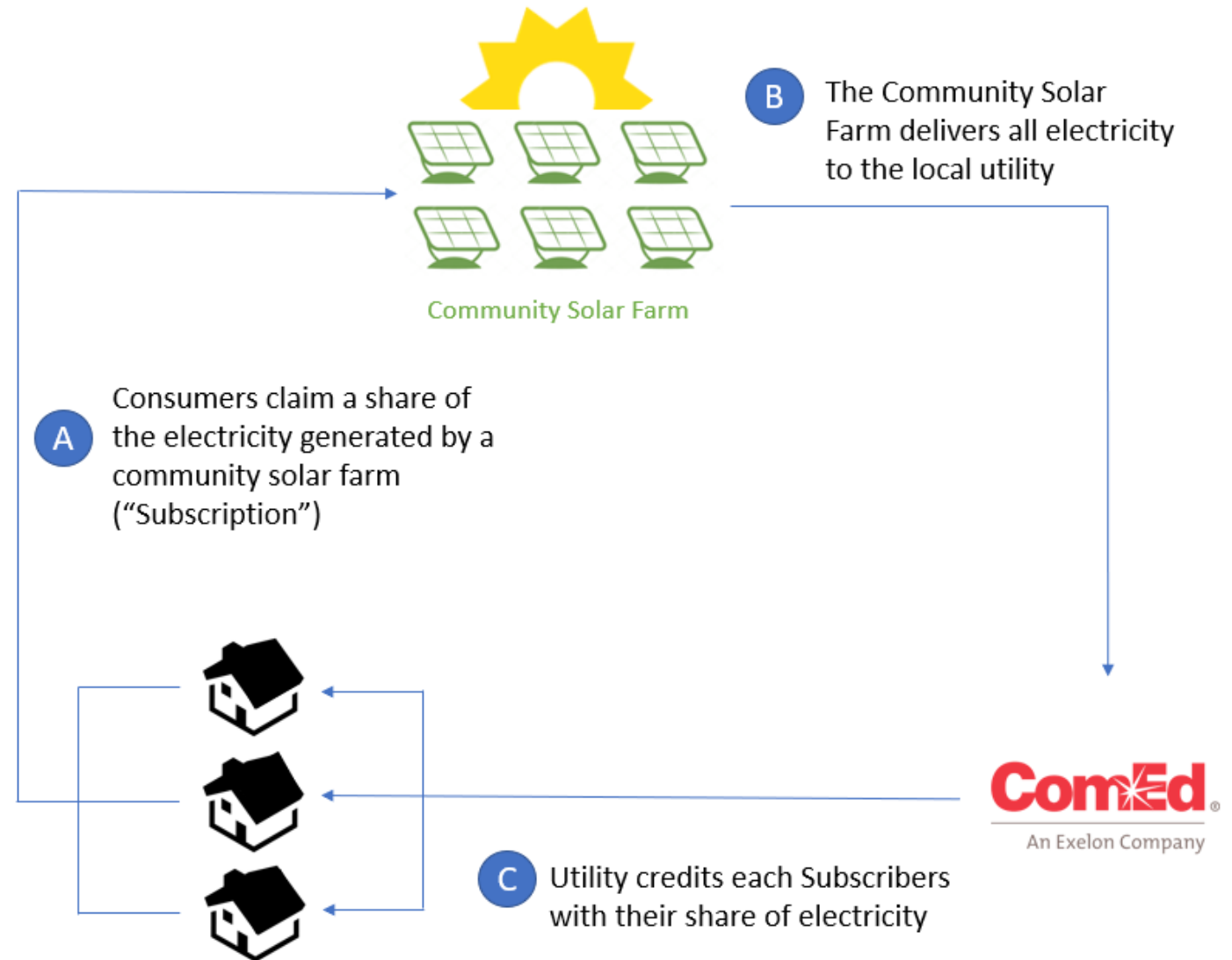
Source: [National Renewable Energy Laboratory](#)

ENERGY TRANSITION: RENEWABLE ENERGY

Options in Illinois

- Renewable Energy Credits (RECs)
- Distributed Generation (DG)
- **Community Solar (CS)**
 - Also called “Shared Solar” or “Virtual Net Metering”
 - Credits consumers (“Subscribers”) with a portion of the electricity generated by a large solar farm
 - In Illinois there is no upfront cost, so always a savings for the consumer
 - In Illinois, the utility purchases the RECs, so it’s not “renewable energy”, but it does support the financing of new solar assets in Illinois
- Self-Direct (SD)
- Virtual Power Purchase Agreement (VPPA)

Community Solar allows multiple consumers to receive a share of the energy generated from a single large solar farm

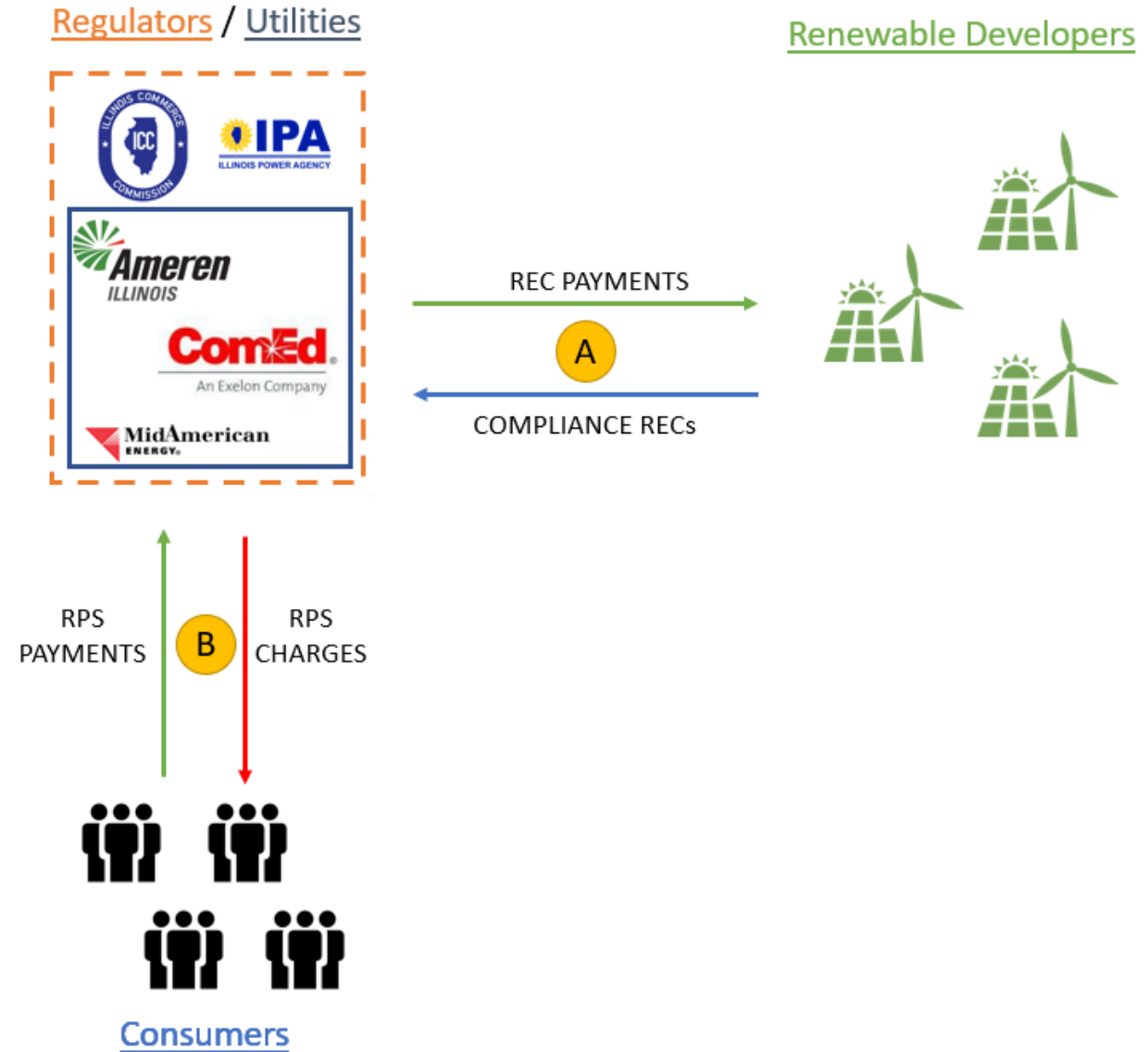


ENERGY TRANSITION: RENEWABLE ENERGY

Options in Illinois

- Renewable Energy Credits (RECs)
- Distributed Generation (DG)
- Community Solar (CS)
- **Self-Direct (SD)**
 - The Illinois RPS directs the utilities to purchase RECs from qualified renewable energy assets under long term contracts with funds collected from consumers (A + B)
 - The Self-Direct option allows large consumer (>10MW) to purchase and keep their own RECs under long term contracts and receive a rebate for a portion of their RPS charges (C + D)
- Virtual Power Purchase Agreement (VPPA)

The Self-Direct RPS allows qualified energy users to purchase RECs from new renewable energy assets and receive a rebate for a portion of their RPS charges

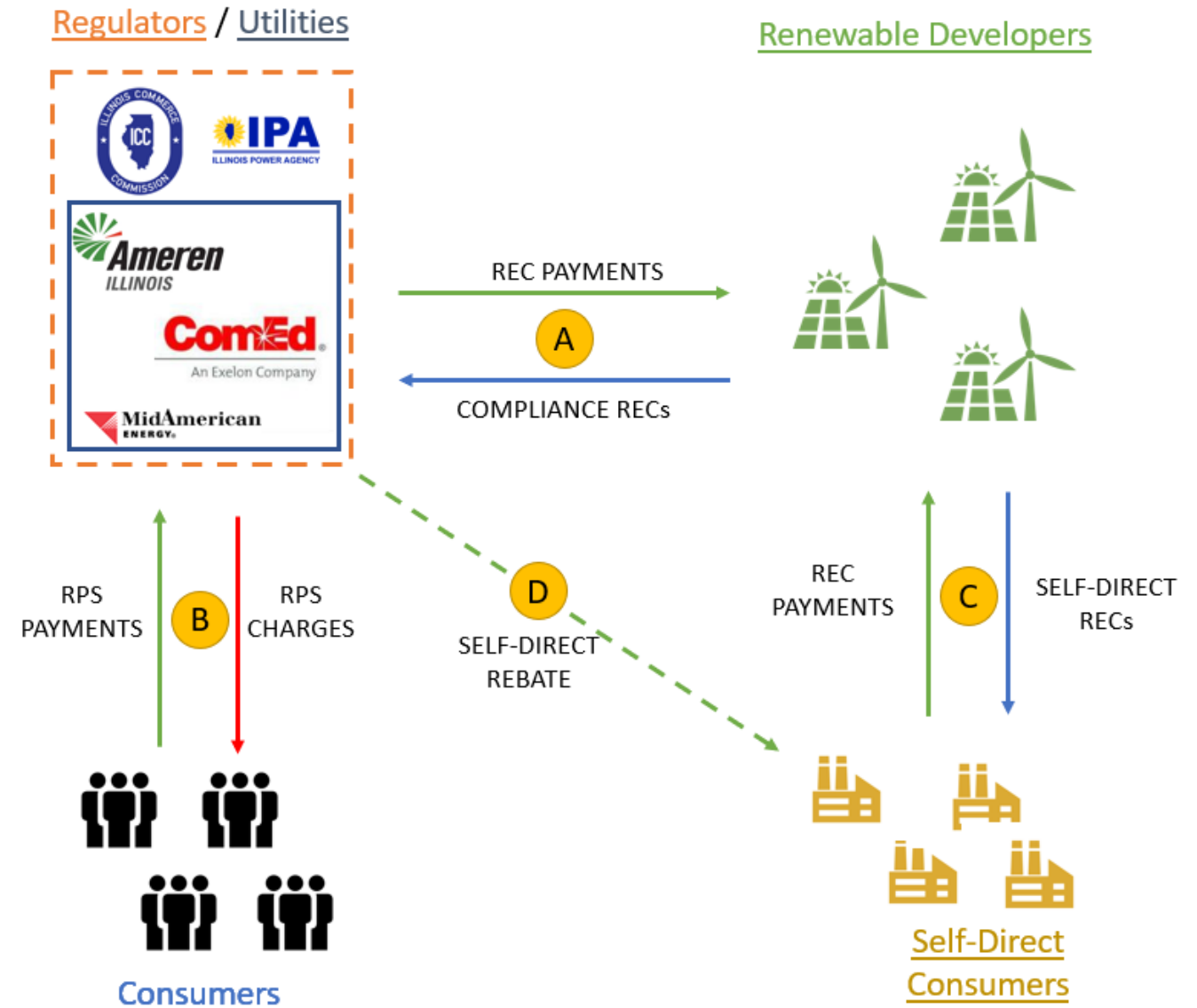


ENERGY TRANSITION: RENEWABLE ENERGY

Options in Illinois

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The Self-Direct RPS allows qualified energy users to purchase RECs from new renewable energy assets and receive a rebate for a portion of their RPS charges

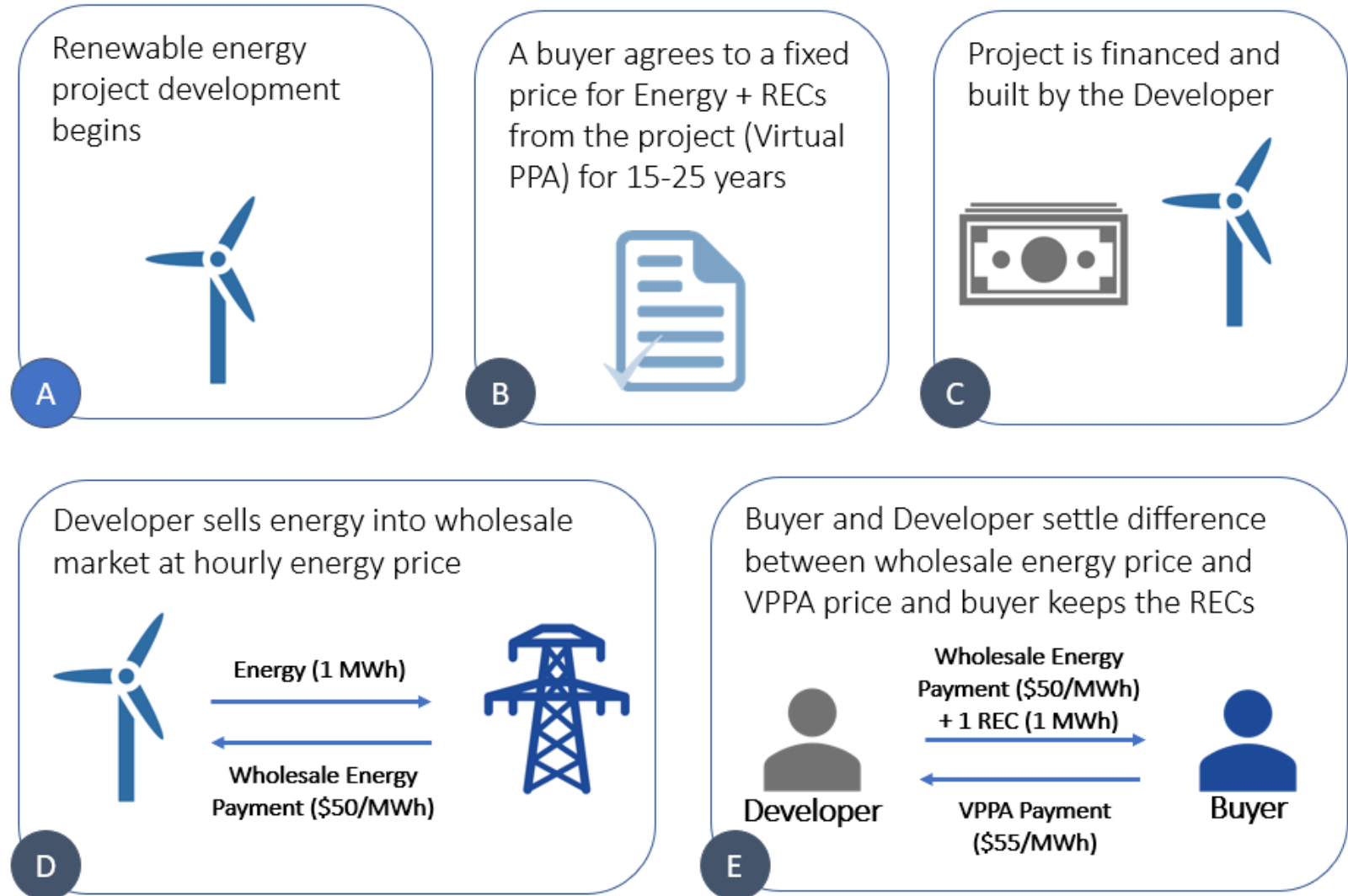


A Virtual Power Purchase Agreement (VPPA) is a long-term agreement to support financing the development of new utility-scale renewable assets

ENERGY TRANSITION: RENEWABLE ENERGY

Options in Illinois

- Renewable Energy Credits (RECs)
- Distributed Generation (DG)
- Community Solar (CS)
- Self-Direct (SD)
- **Virtual Power Purchase Agreement (VPPA)**
 - Long term power purchase agreement with a new renewable energy asset
 - Instead of delivering energy to the buyer, the energy from the renewable energy asset is sold into the wholesale market by the developer
 - The developer then trades the wholesale market revenue plus the RECs to the buyer for the VPPA price
 - Example: $\$55 - \$50 = \$5/\text{REC}$

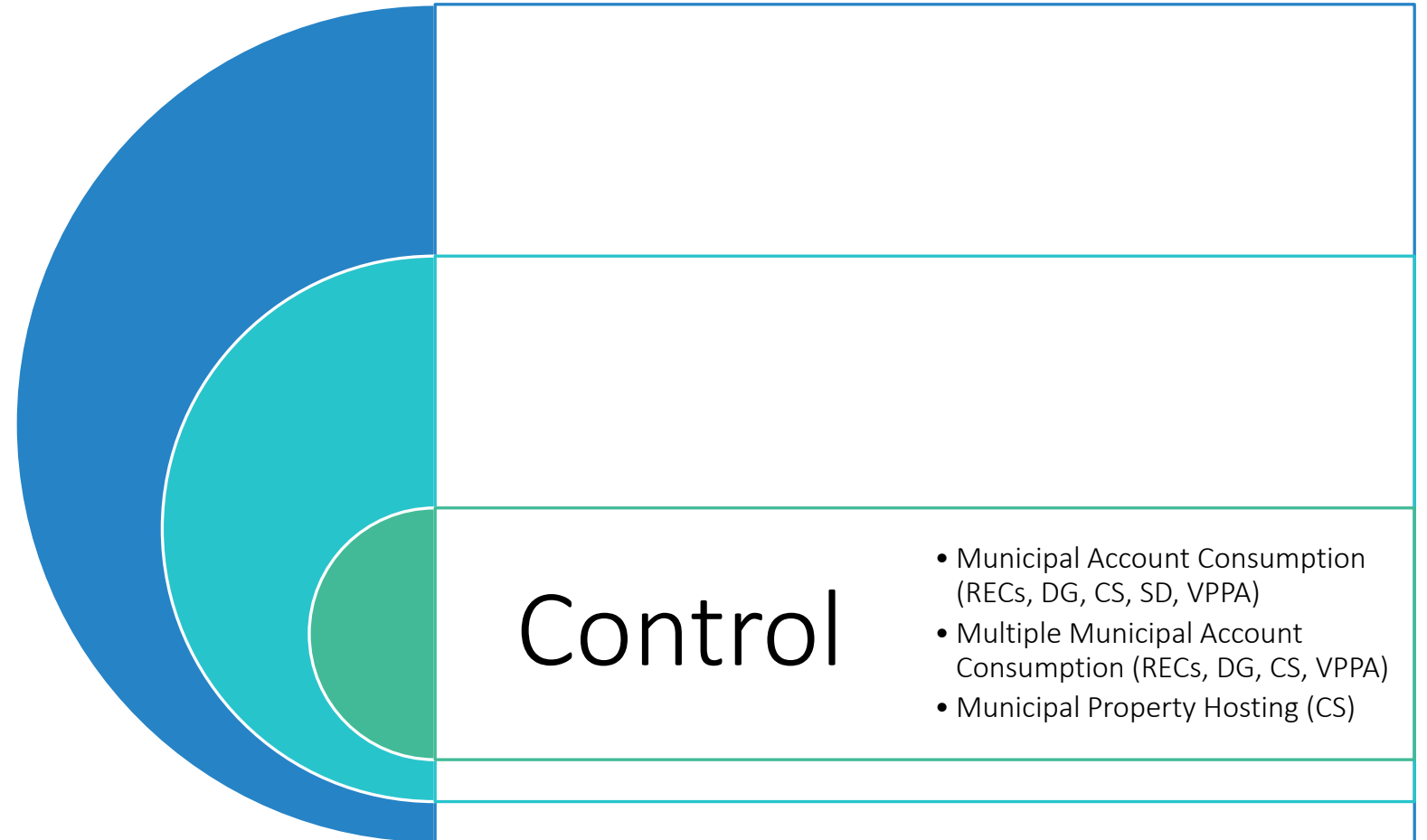


ENERGY TRANSITION

ROLE FOR MUNICIPAL GOVERNMENT

- Control
- Sponsor
- Influence

Municipalities have the authority to regulate certain aspects of development, operations and reporting from private sector entities that can support sustainability policies and programs

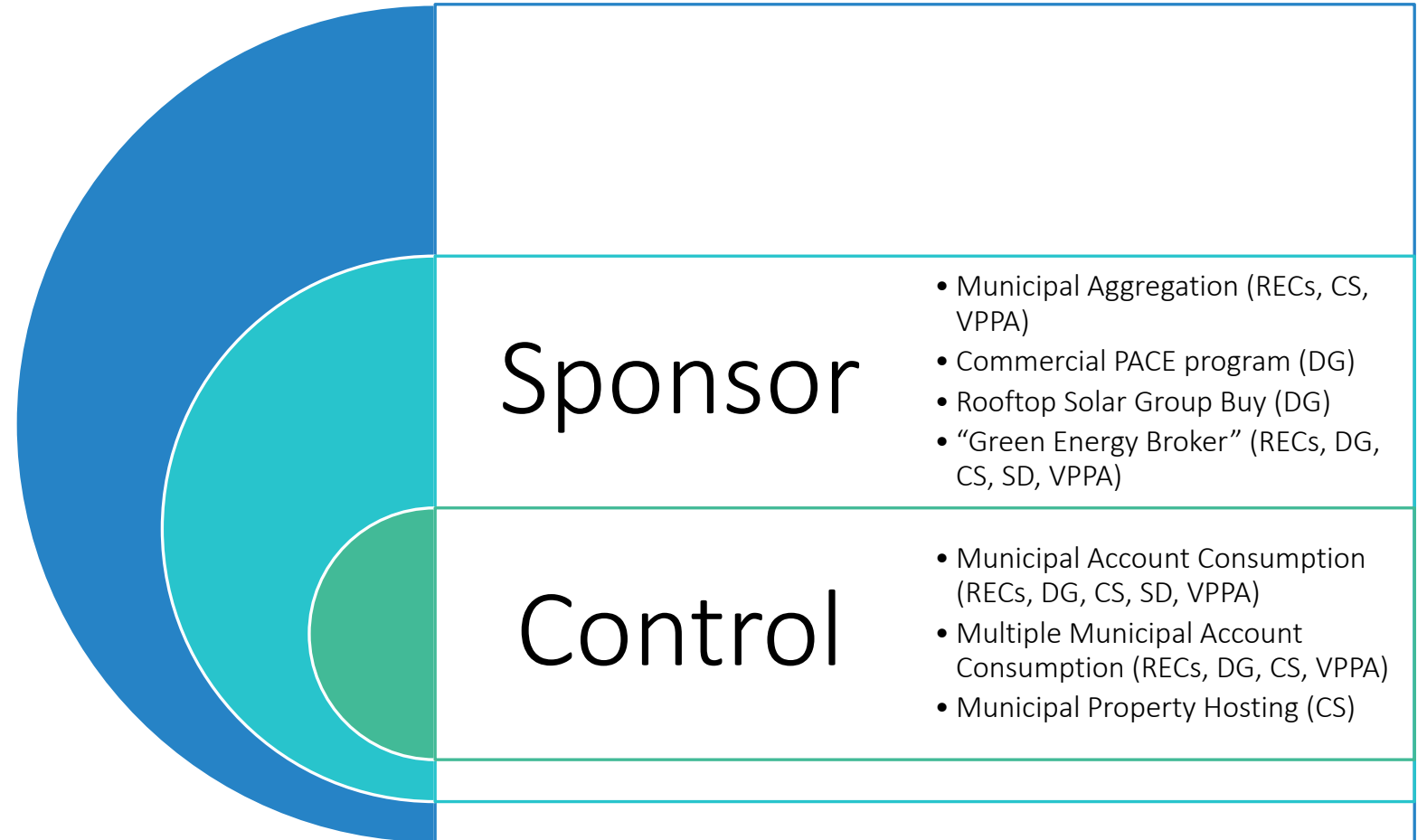


ENERGY TRANSITION

ROLE FOR MUNICIPAL GOVERNMENT

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Municipalities have the authority to regulate certain aspects of development, operations and reporting from private sector entities that can support sustainability policies and programs

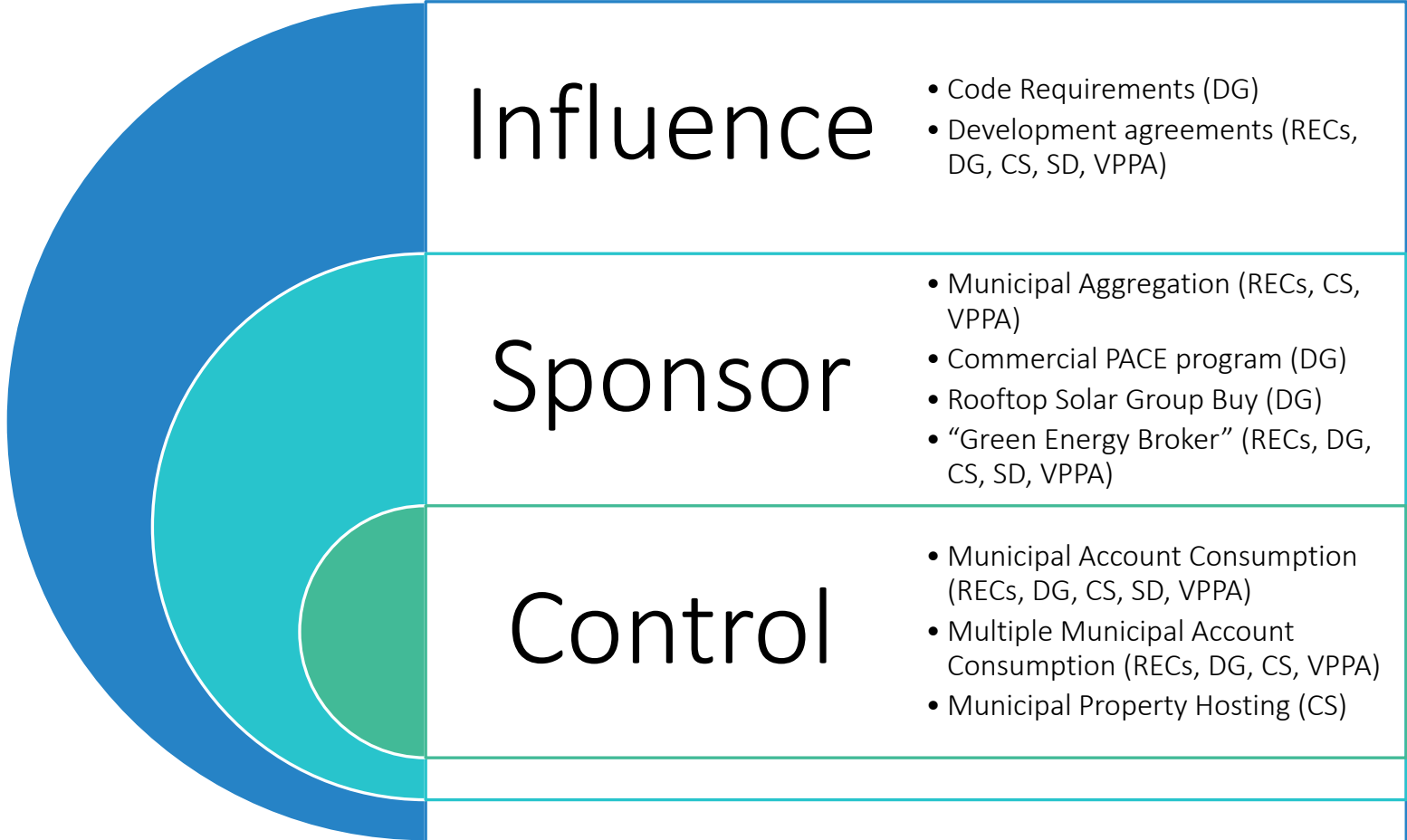


Municipalities have the authority to regulate certain aspects of development, operations and reporting from private sector entities that can support sustainability policies and programs

ENERGY TRANSITION

ROLE FOR MUNICIPAL GOVERNMENT

- Control
- Sponsor
- Influence





DISCUSSION

DISCUSSION AND QUESTIONS

Key Points

- Municipalities could rely on the Illinois Renewable Portfolio Standard (RPS) to meet renewable energy goals
 - Current goal of 40% renewables by 2040; but,
 - Past RPS goals have not been met
- Municipalities have options for pursuing their own renewable energy goals:
 - “Renewable” means different things to different people
 - Are RECs from an existing wind farm in Texas really “renewable”?
 - Municipalities should think strategically about how they define “Renewable” before adopting any goals
 - RECs
 - “Additionality”
 - “Clean Sources”

THANK YOU

Mark Pruitt

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