Members and others attending: Lili Flanders, Chair of CAC; Alex Limpaecher and Mark Gebhardt, Members of CAC; and Georgia Neil (CAC volunteer).

Assign Noteaker
Alex Limpaecher

Minutes from 12/4/24

Approved by the members.

Public Records Request

- Georgia Neil will request public records at the town and county levels as part of the project to divest from fossil fuels.
- The group agreed that this could be sent as a volunteer from the climate action committee.

Climate Action Plan

The Climate Action Committee discussed the climate action plan and expressed general approval of its direction.
Alex will implement the following planned changes:

- Incorporating the 2050 timeline into the plan
- Adding a funding section
- Summarizing the action items

Future Steps:
The plan will be shared with the Energy Committee, the Climate Action Coordinator, and the Department of Public Works (DPW) in January. After input from all parties, if they are all on board, the next step is to present the plan to the select board for approval.

The CAC also discussed the Community Engagement Document, which will be included in the agenda for the next climate action plan.

Reduction of Pesticide

Laura Kelly recently delivered a presentation at the library, followed by a separate meeting with the select board. After her presentation to the select board, members recommended that she reach out to the Board of Health and the Conservation Committee to foster further collaboration.

Future Steps:
Georgia will be incorporating insights from both the library session into the upcoming Truro Talks article, ensuring the community remains well-informed and engaged.

Library Sessions Update

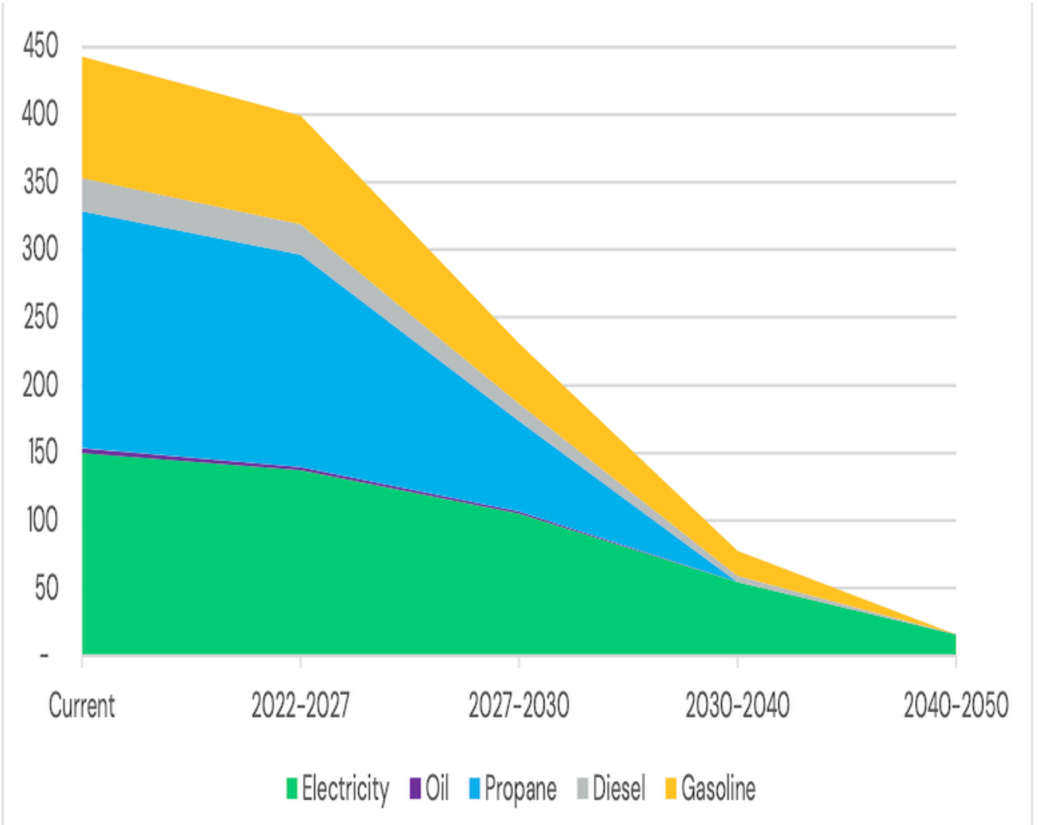
The group reviewed the schedule for upcoming library sessions. Below is the tentative schedule that has been proposed:

February: Stephanie Ellis from Wild Care to talk about rodent control.
March: Contact the Wampanoag tribe representatives for a presentation.
April: Consider hosting discussions on the Town Warrant or the Climate Action Plan.
May and June: Explore options to feature either the Cape Light Compact or the new climate action coordinator.

Respectively submitted by,

Alex Limpaecher

Truro's Decarbonization Roadmap



Solar Microgrids

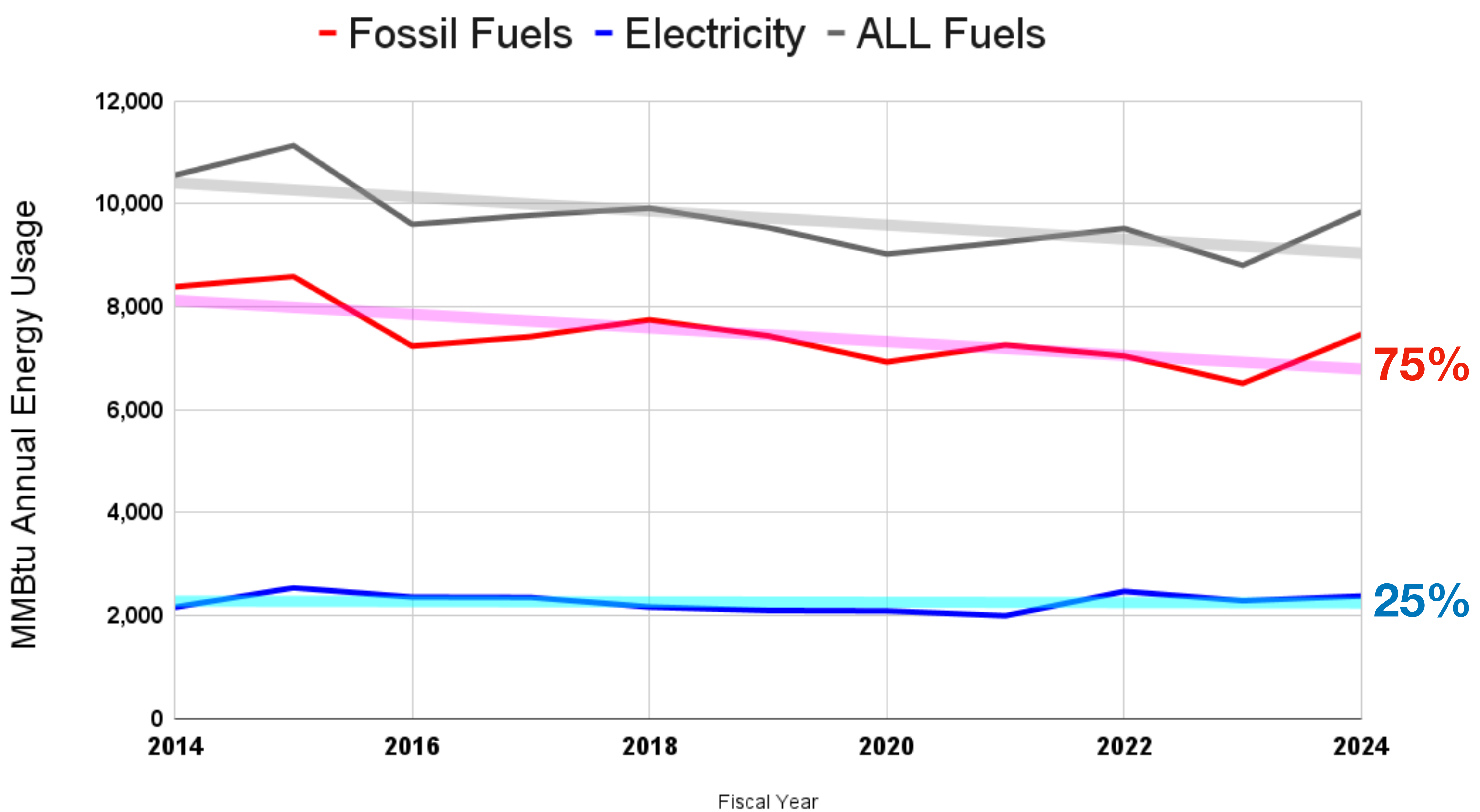
Implementation

Truro Energy Committee
Jan 6, 2025

Truro's Energy Landscape

We are *slowly* reducing our Fossil Fuels

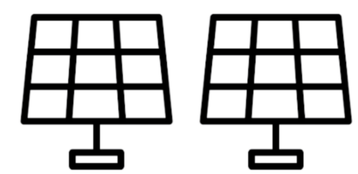
But we need to make faster progress



We Need to Electrify Faster

Replacing fossil fuels with solar electricity

- Solar panels — roof, canopy, and ground — are a proven and cost-effective approach



- Let's install them strategically to help us be more
  - Resilient
  - Energy self-sufficient
- We can do that by planning for and adopting Solar Microgrid technology

Implementation Strategy

Create a municipal phased master plan

Resilient Hub Locations

Serve as future Solar Microgrids

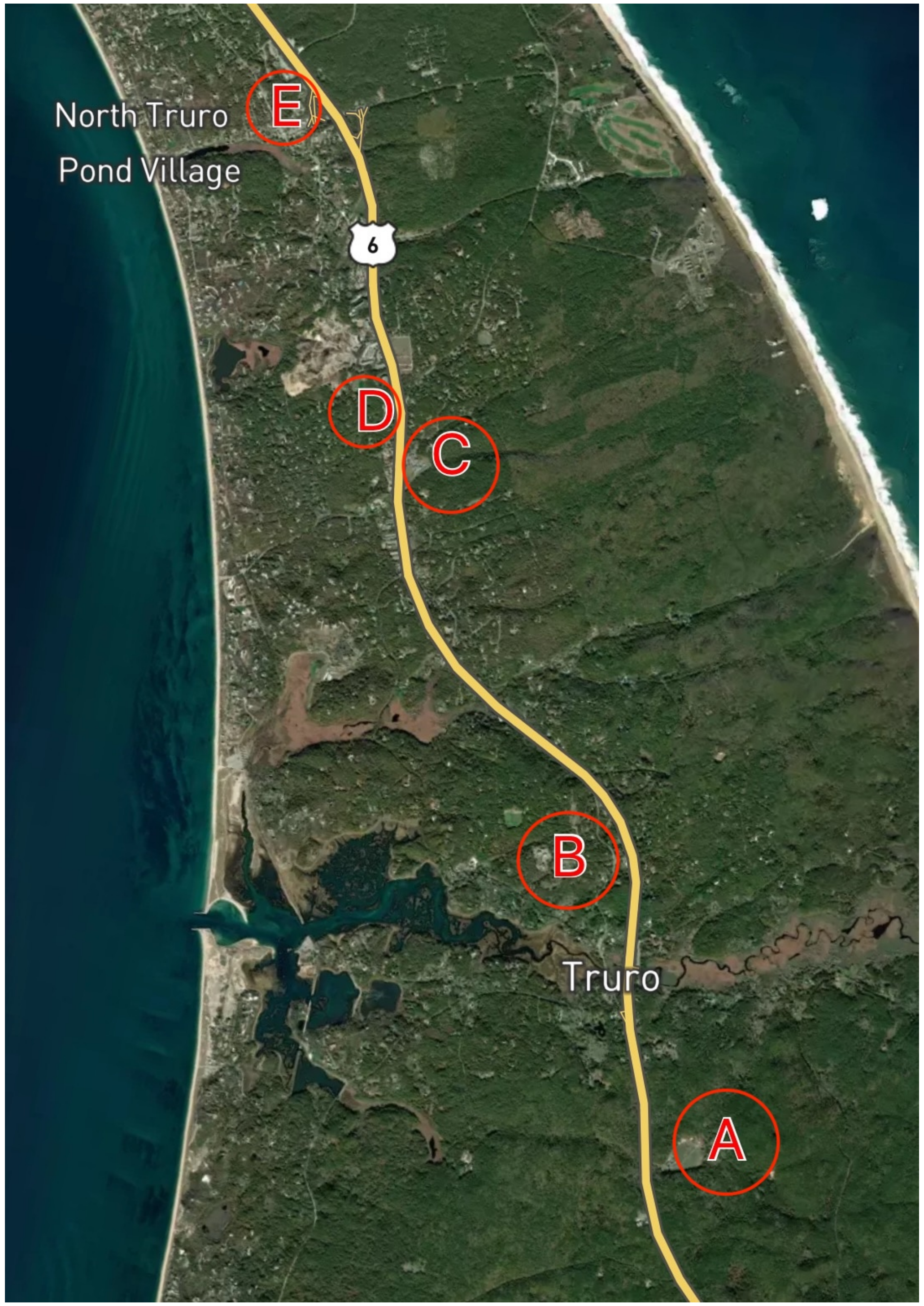
A. Transfer Station

B. Town Hall Hill

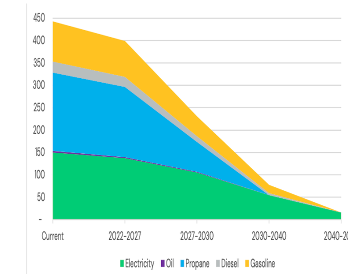
C. School/Walsh

D. Public Safety Facility

E. Community Center/Library



Truro’s Energy Timetable



✓ Decarbonization Roadmap Table 2 summarizes Target timetable

Table 2. Summary of Municipal Emissions Reductions

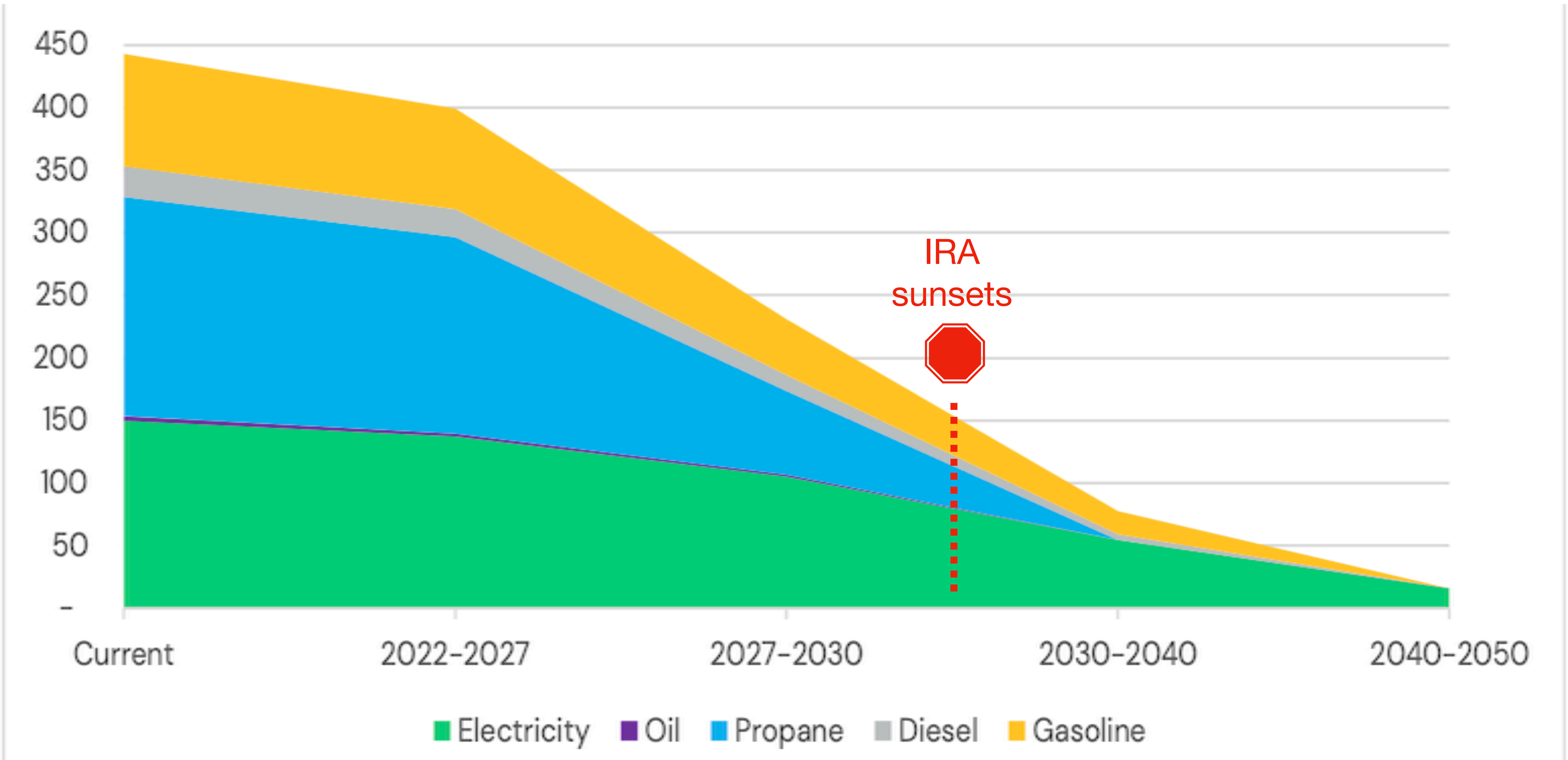
Targets	2022	2027	2030	2040	2050
Reduce emissions from onsite fossil fuels via electrification	**0%**	**-11%**	**-62%**	**-100%**	**-100%**
Zero emission vehicles (ZEVs) in light-duty fleet adoption (% of fleet)	**0%**	**10%**	**50%**	**80%**	**100%**
Zero emission vehicles (ZEVs) in medium-/heavy-duty fleet adoption (% of fleet)	**0%**	**10%**	**50%**	**80%**	**100%**
Energy Use Intensity reduction (deep energy retrofits/retro commissioning)	**EUI****	**-13%**	**-56%**	**-89%**	**-97%**
Total Emissions Reduction Goals (% of 2022 emissions)	**0%**	**13%**	**55%**	**89%**	**97%**

✓ 4 Phases:

2025-27	2028-30	2031-40	2041-50
3 years	*3 years*	*10 years*	*10 years*

Truro’s Energy Timetable

Our Decarbonization Roadmap



Microgrid Components

Building blocks of a microgrid - Today

GENERATING

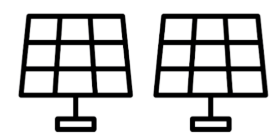
- Solar panels

Roof

$$/W

Canopy

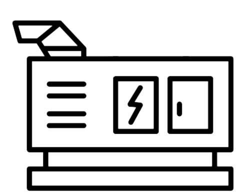
$$$$/W



Ground

$$$/W

- Propane Generator (phased out at end of life)



Used as a backup
and as a last resort

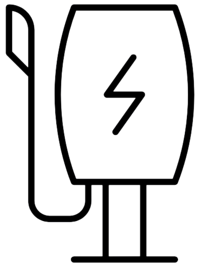
Microgrid Components

Building blocks of a microgrid - Today

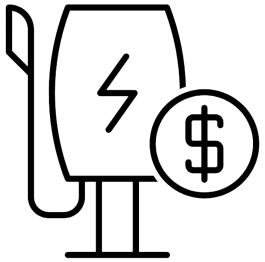
DEMANDS

- Building HVAC, Lighting, Users

- EV Batteries (charging)



- EV Charger - Retail

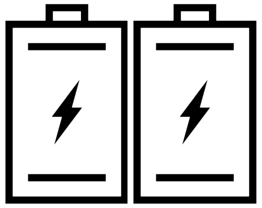


Microgrid Components

Building blocks of a microgrid - Tomorrow

STORAGE

- Battery Energy Storage System (BESS)

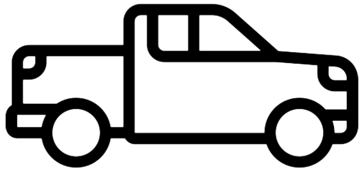


$/W

Storage can switch from being charged to generating power when needed

Tesla Powerwall 3 battery: 13.5 kWh

- Vehicle Batteries (reverse feed)



New generation EVs can feed power from <u>their</u> battery

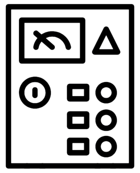
F-150 Lightning truck’s standard-range battery: 98 kWh
Mack MD Electric truck’s standard-range battery: 150 kWh
Tesla Model 3 standard-range battery: 57 kWh

Microgrid Components

Building blocks of a microgrid - Tomorrow

CONTROLS

- Microgrid Smart Controller



$

An intelligent microgrid controller determines the optimal times to consume, produce, store, or sell energy based on weather, predicted utility rates, and other factors.

It allows us to use our own loads without paying peak rates from the utility and the option to sell excess power when available.

https://www.se.com/ww/en/work/solutions/microgrids/

https://blog.se.com/energy-management-energy-efficiency/2022/09/13/microgrids-10-key-questions-answered/

https://youtu.be/72RhPRZY01E?si=wjRdIeVE0t5gYBAN

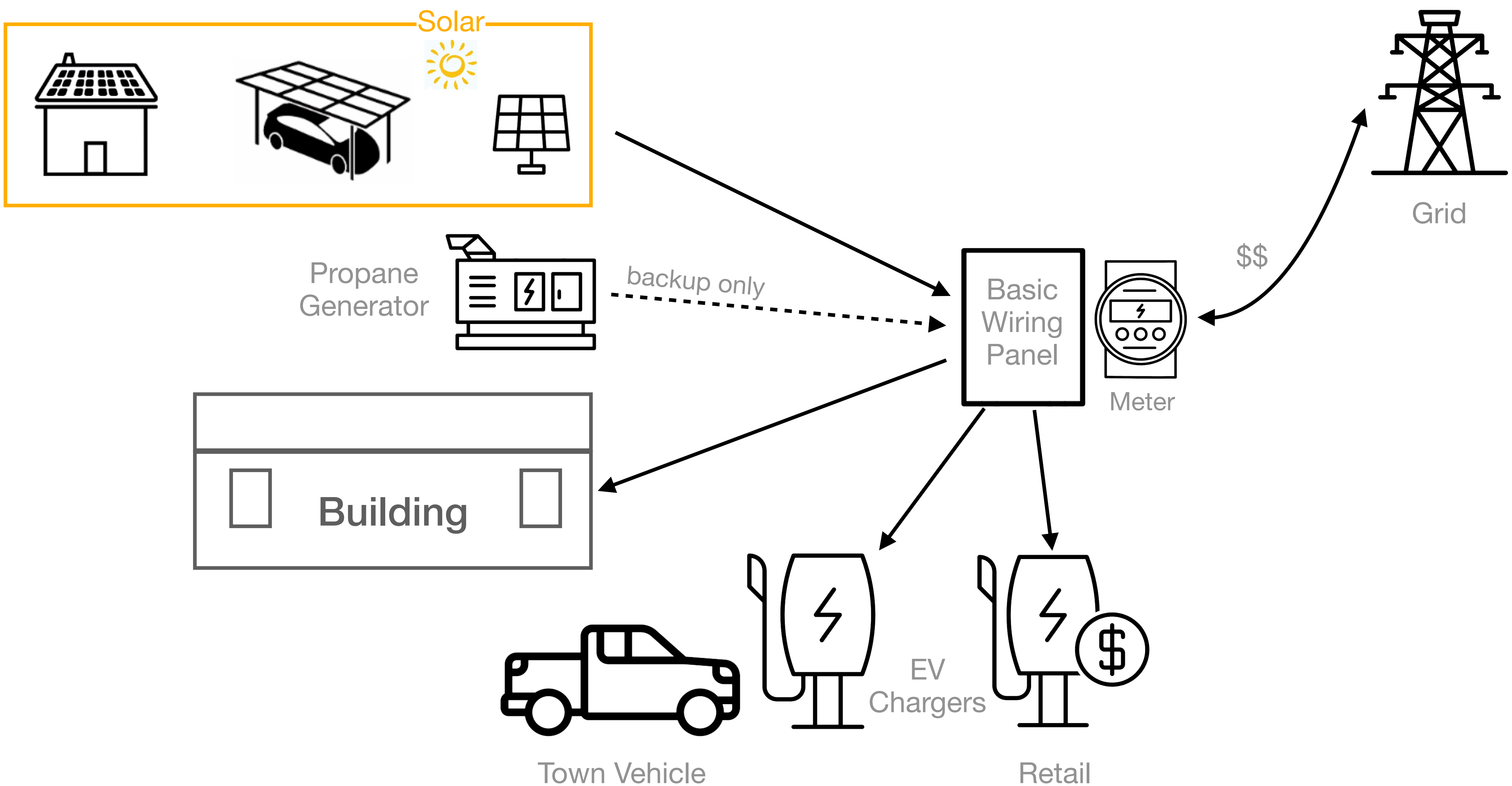
https://youtu.be/RYaaQ84htRk?si=tobkeBrUfZ13GBuD

https://youtu.be/RYaaQ84htRk?si=tobkeBrUfZ13GBuD

https://www.youtube.com/watch?v=q6IFC7W1bNg

Microgrid Configuration

Today's Start of a Microgrid

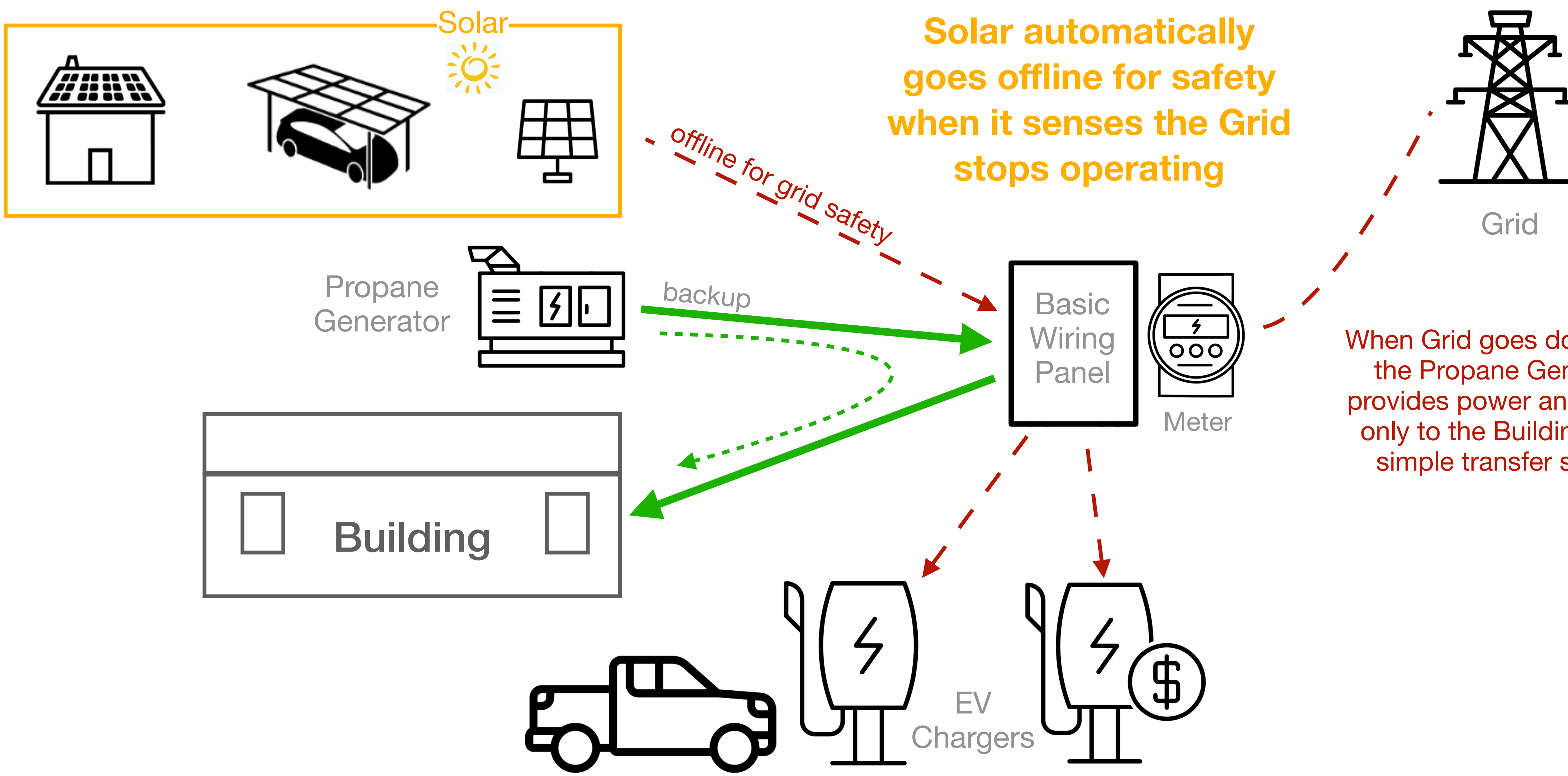


A key is to wire the basic components of a microgrid so that future components can be more easily added

Microgrid Configuration

Today's Start of a Microgrid

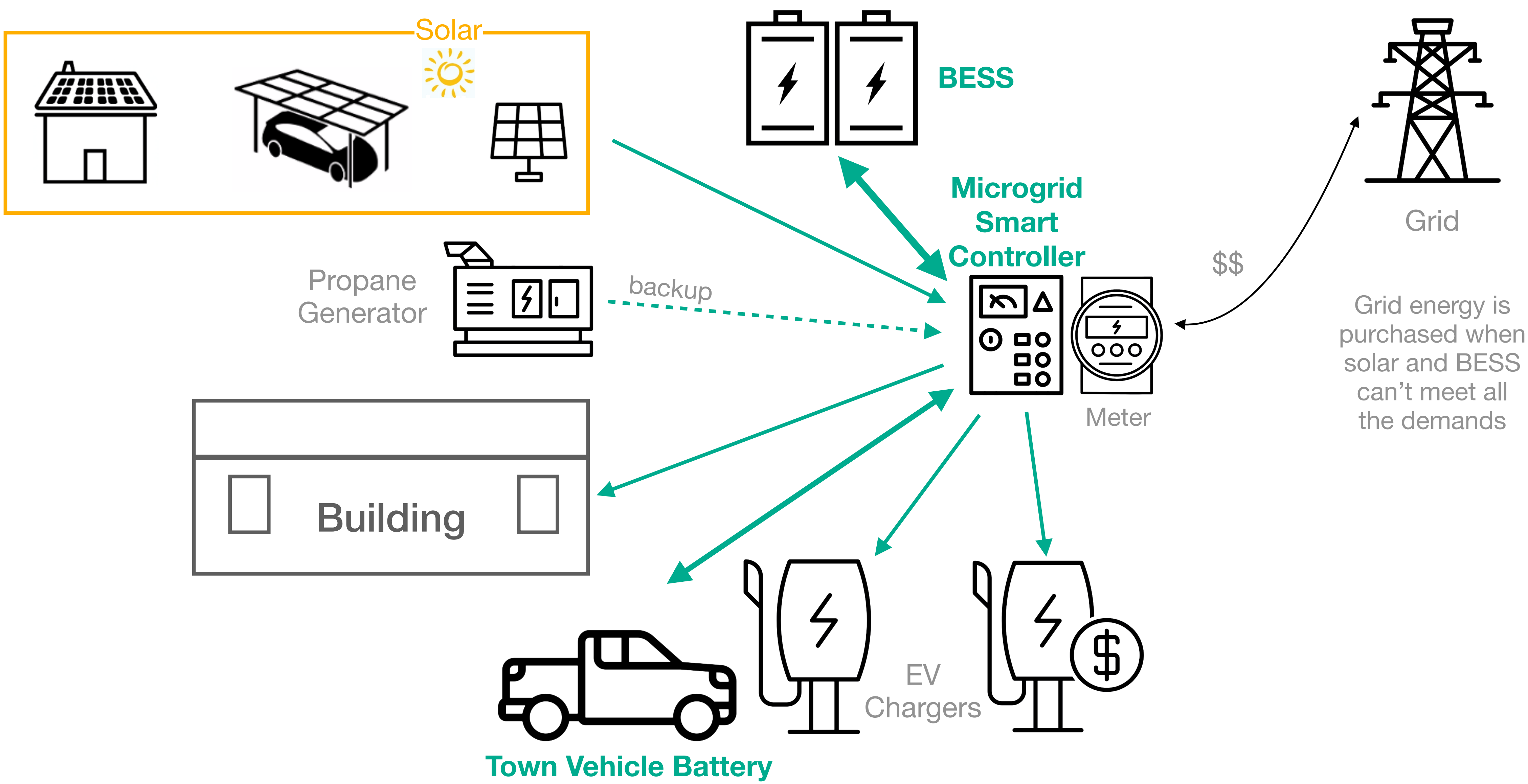
Grid Outage



When Grid goes down, only the Propane Generator provides power and usually only to the Building, via a simple transfer switch.

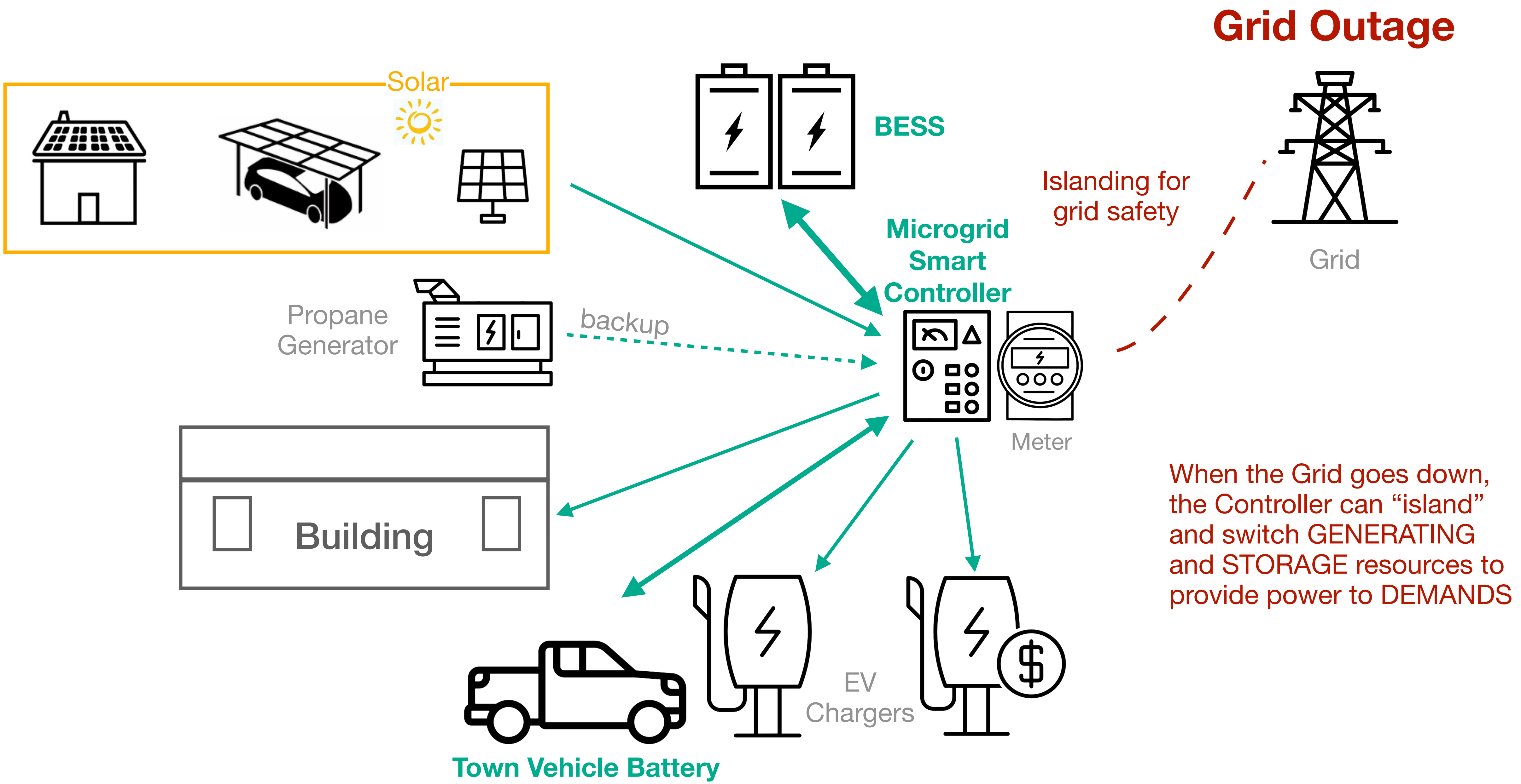
Microgrid Configuration

Tomorrow's Microgrid Resiliency



Microgrid Configuration

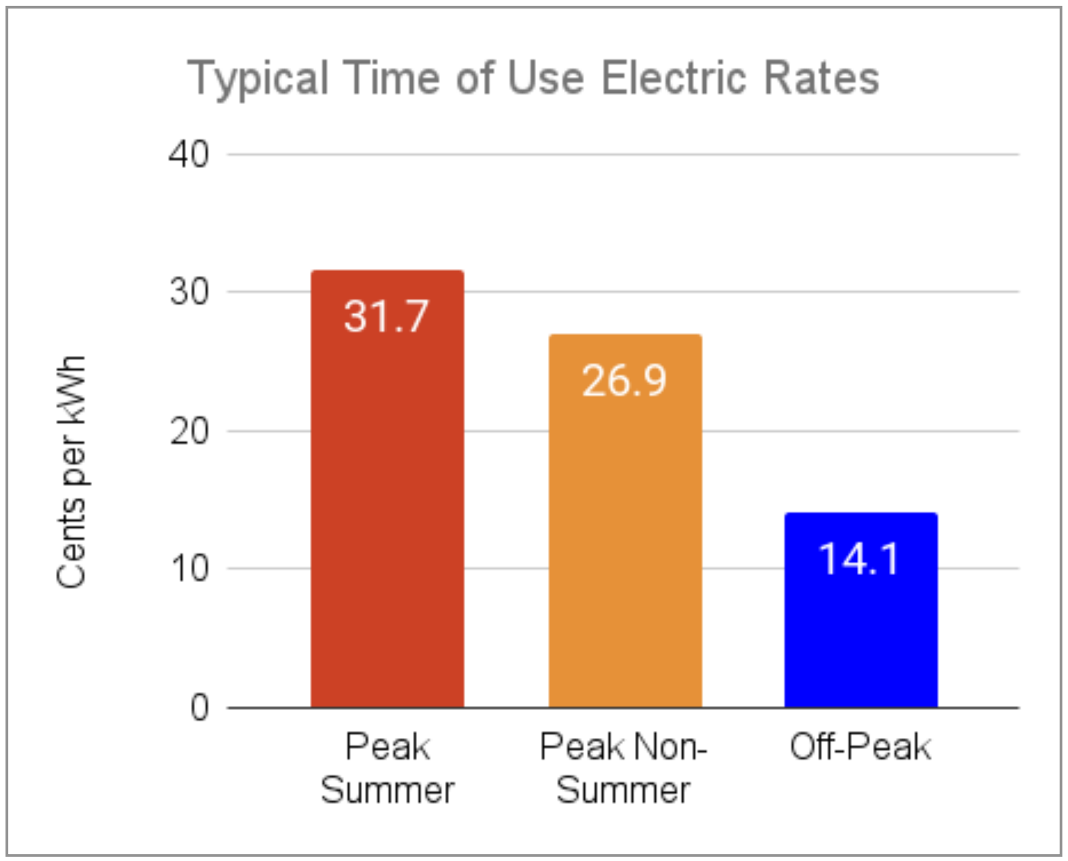
Tomorrow's Microgrid Resiliency



Why Solar Microgrids?

Time of Use rates

Volatile Climate & **Rising Costs**



Time of Use electric rate tariffs are becoming more prevalent.

When Cape Cod electric rates progress to include Time of Use, it will make Battery Energy Storage Systems (BESS) and Smart Controllers more cost effective.

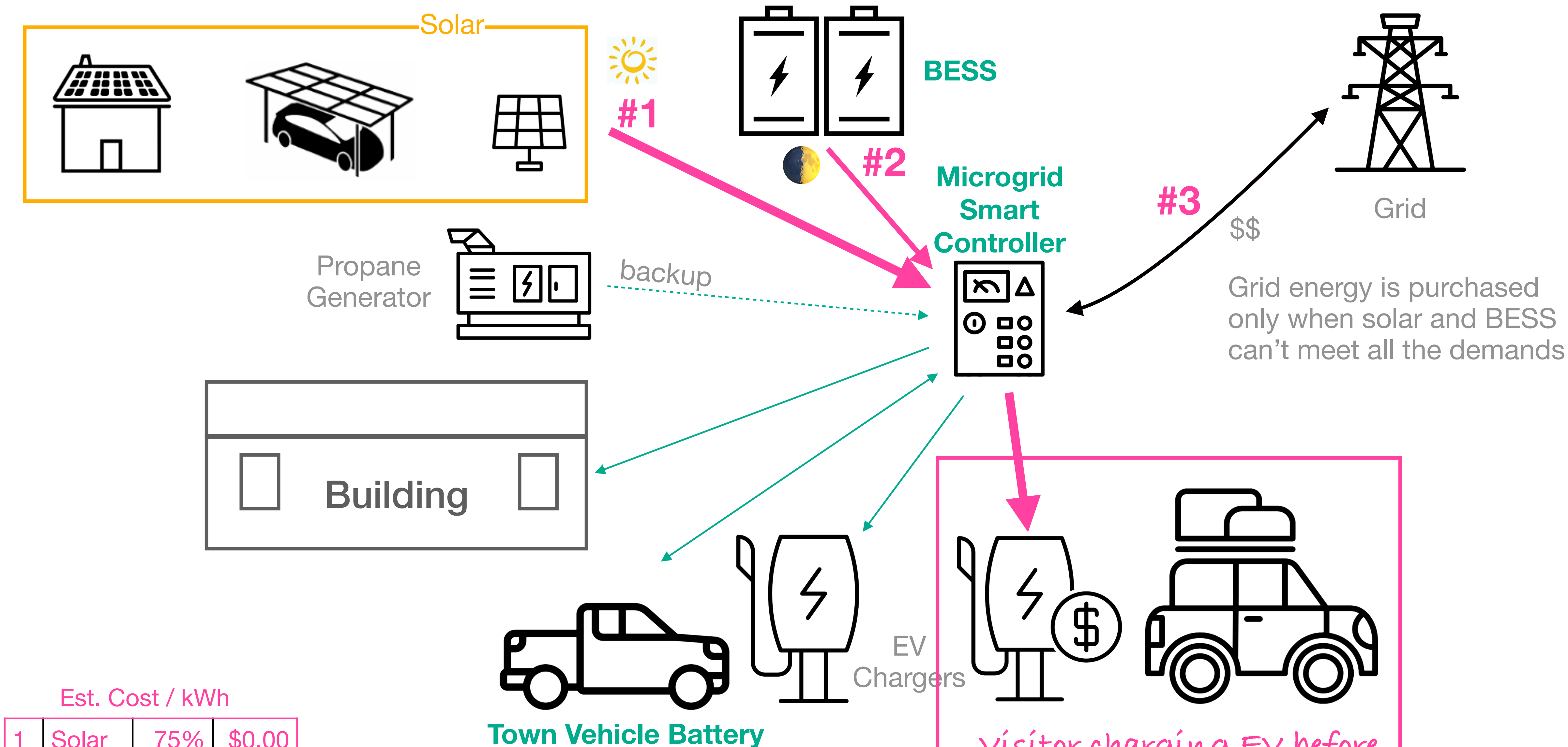
Power needed from the Grid during a Peak time can be drawn from the BESS.

The BESS can then be recharged when the sun next shines, or if needed earlier, during the next Off-Peak time, at about **1/2 the cost**.

Microgrid Configuration

Tomorrow's Microgrid

Summer Sunday



Est. Cost / kWh

1	Solar	75%	$0.00
2	BESS	15%	$0.00
3	Grid	10%	$0.21
Average/kWh			$0.02

50 kWh per visitor: 50 x (32-2) = $15.00
100 visitors = $1,500 per day revenue

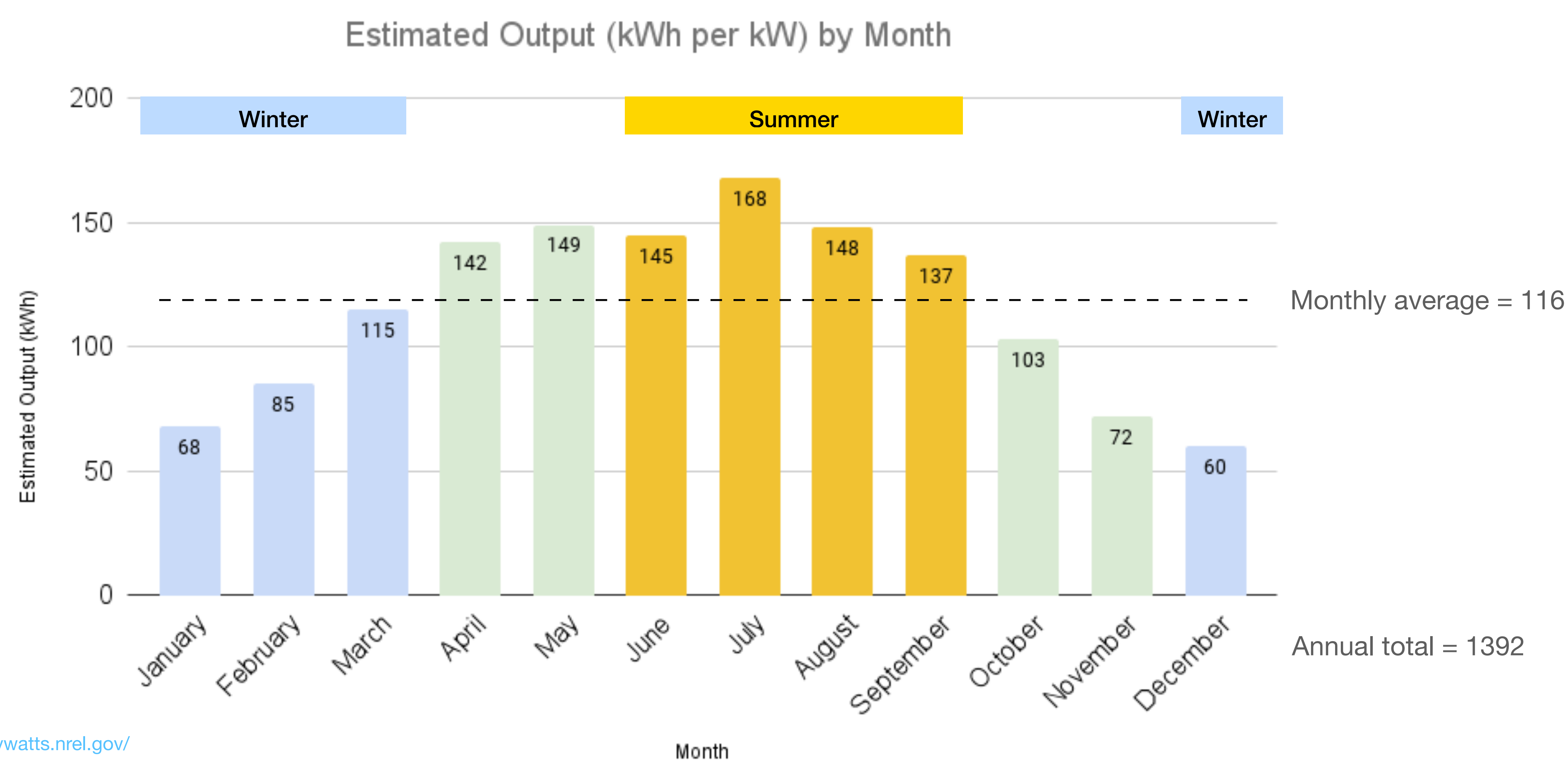
Visitor charging EV before
return trip home
Rate = $0.32/kWh

Balancing Solar Generation and Demands

- **Solar Generation is about 2X in Summer vs Winter**

➡ Summer population swells by 5X to 10X

➡ Excess generation in summer can be used to power retail EV charging for visitors and Community Solar



https://pvwatts.nrel.gov/

Balancing Solar Generation and Demands

Month to Month

- via Grid

- **Solar Generation exceeds Demand**
  - ➡ Sell Net Metering credits
  - ➡ Community Solar subscriptions
  - ➡ Increase Demand: more EV Chargers

- **Demand exceeds Solar Generation**
  - ➡ Purchase energy from the Grid
  - ➡ Increase Generation: more Solar
  - ➡ Reduce sale of electricity

Daily and Hourly

- via BESS

Why Solar Microgrids?

Volatile Climate & Rising Costs

Outer Cape Microgrid Optimization

The Outer Cape Microgrid Optimization (OCMO) project—led by NSTAR Electric Company (dba Eversource Energy)—aims to implement a distributed energy resource management system (DERMS) to improve regional energy reliability and resiliency in the Cape Cod, MA area.

Surrounded by water on three sides, Cape Cod customers are especially vulnerable to power outages caused by New England's increasingly frequent and extreme weather.

The DERMS would coordinate customer-owned distributed energy resources (DERs)—like solar panels, smart thermostats, or batteries—with an existing 24.9 MW battery energy storage system owned by Eversource that serves as the main resource for the current microgrid in the area. The project would enhance the existing regional microgrid with a DERMS that is capable of dispatching customer-owned clean energy to extend the duration it can operate for customer resilience.

https://www.energy.gov/oced/distributed-energy-systems-demonstrations-selected-projects

Solar Capacity by Hub Location

Each location has varying solar capacity

- **Roof**: area, ridges and gables, and orientation to the sun
- **Parking**: areas for canopies, if not shaded by trees

Public Safety Facility

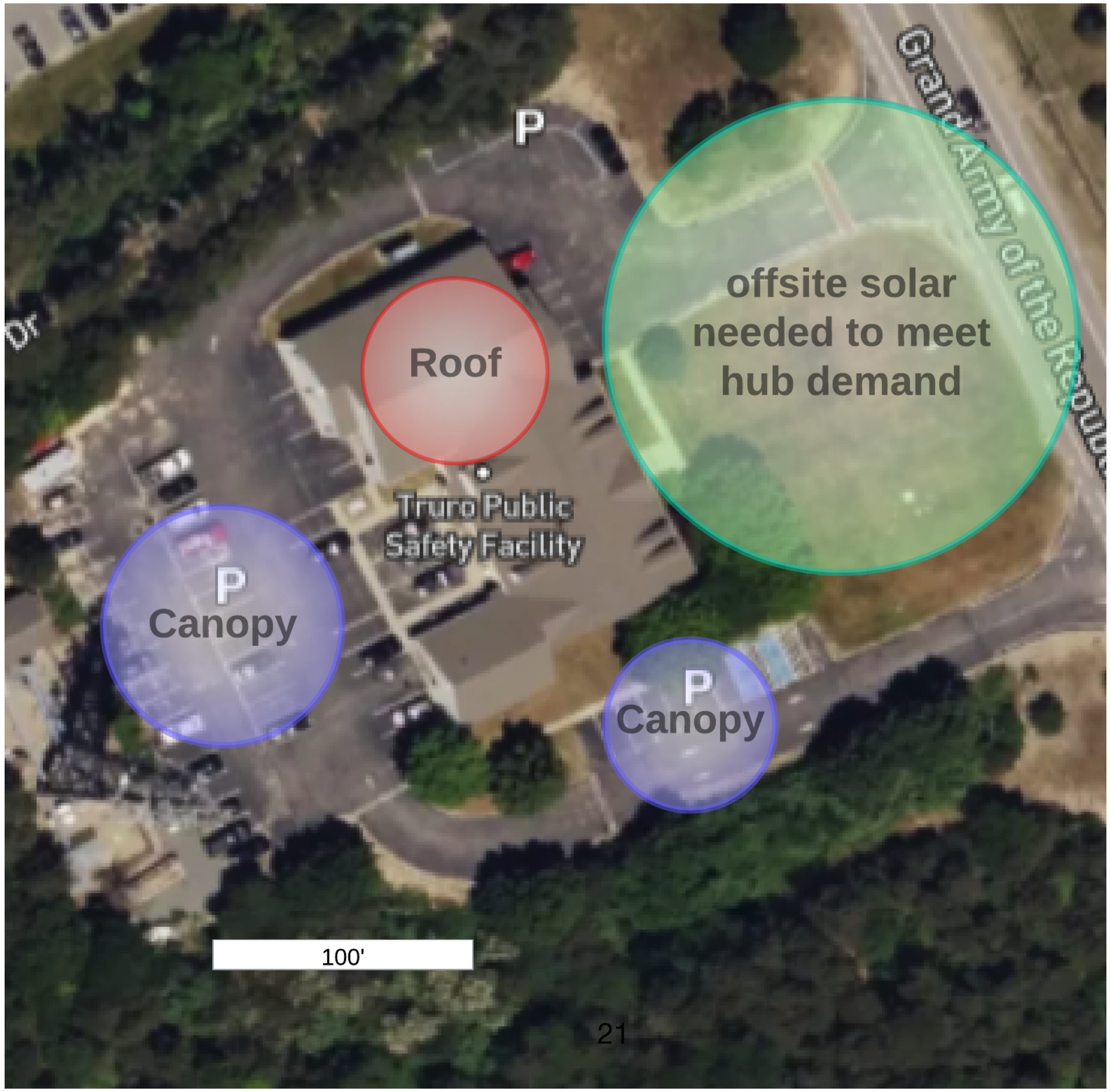
Solar Capacity varies by Hub Location

Insufficient space means solar is needed from offsite

- Area of red/purple circles are capacity of solar
- Green circle is solar still needed but no room at this Hub

Public Safety Facility

A more dense and challenging location



Supplemental offsite solar is needed to meet total energy demand of this Hub.

We have plenty of room at the Landfill for this needed solar.

Implementation Approach

Long term view - Do it right from the start

- Full Transparency for Taxpayers
  - ✓ Whole Government Approach
  - ✓ Accounting as a Multi-year Revolving Fund
- Phased Implementation Over Time
  - ▸ Hub Location phasing
  - ▸ Microgrid component phasing within Hubs
- Leverage Successes at each Phase
  - ★ Revenues from early phases can offset later costs

Implementation Approach

Build a Model of Our Energy Future

- Inventory of all Energy Assets
  - ✓Solar Panels
  - ✓Generators
  - ✓Vehicles
  - ✓Charging Stations
- Document Solar Capacity of each location
  - ✓5 Hubs & Landfills
  - ✓Other Smaller Structures
- Integrate into a Comprehensive Model
  - ✓Sync model to the Muni Decarb Roadmap
  - ✓Update the model annually to guide decision making

What Are Our Next Steps?

With focus on an initial Phase 1 project

1. Estimate Cost for a Phase 1 Project at a Hub
2. Staff Education
3. Select Board Approval
4. Community Engagement and Education
5. Free Cash/Borrowing Authorization at ATM
6. RFP and Contract for Phase 1 Project

Implementation Strategy

Create a municipal phased master plan

Resilient Hub Locations

Serve as Solar Microgrids

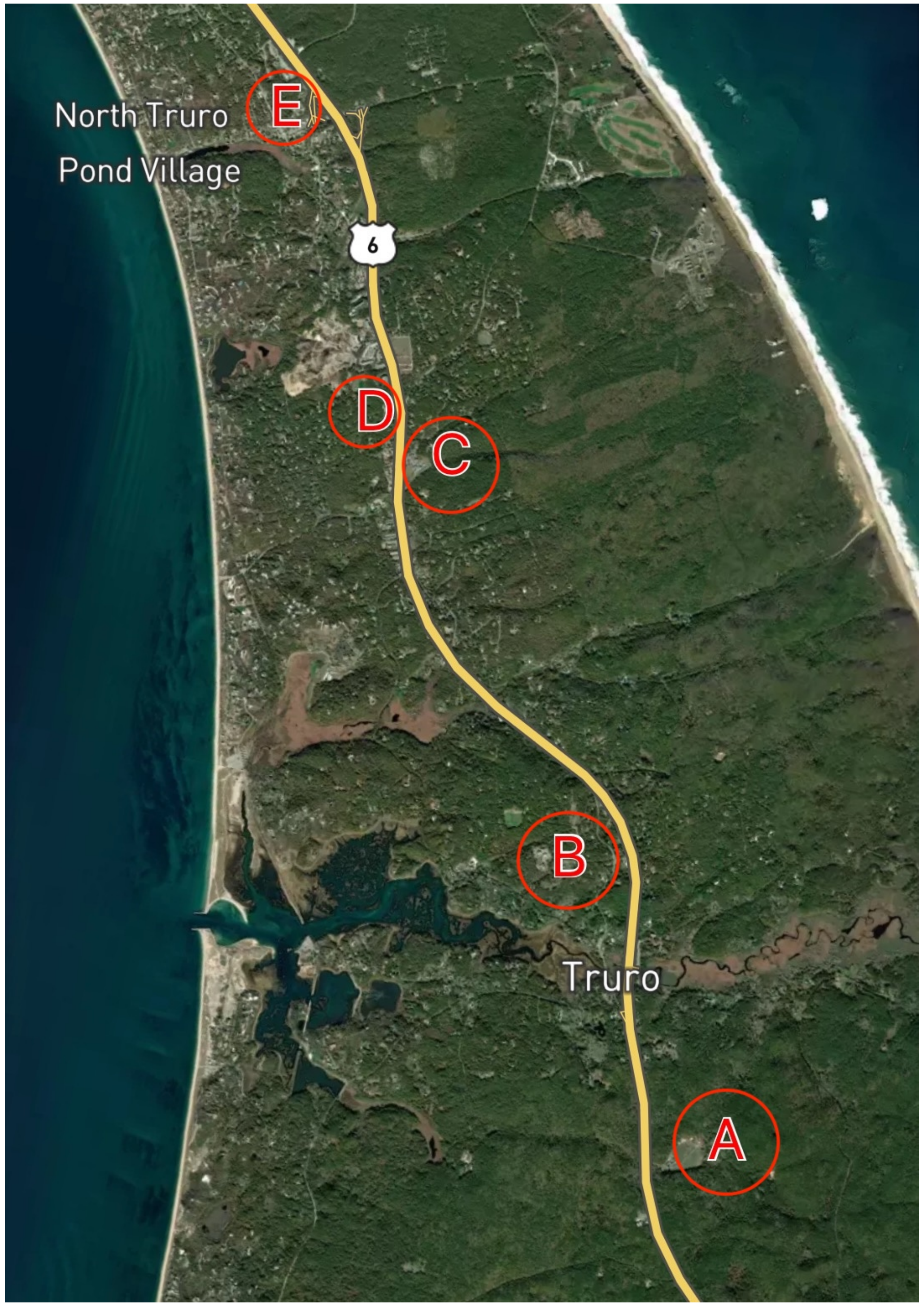
A. Transfer Station

B. Town Hall Hill

C. School/Walsh

D. Public Safety Facility

E. Community Center/Library



Solar Capacity by Hub Location

Each location has varying solar capacity

- **Roof**: area, ridges and gables, and orientation to the sun
- **Parking**: areas for canopies, if not shaded by trees

Public Safety Facility


Crisply Implement
Before Incentives
Sunset after 2033


We need to Start NOW
Let's harvest the Sun
to help Truro!

Additional Slides

Solar Microgrids

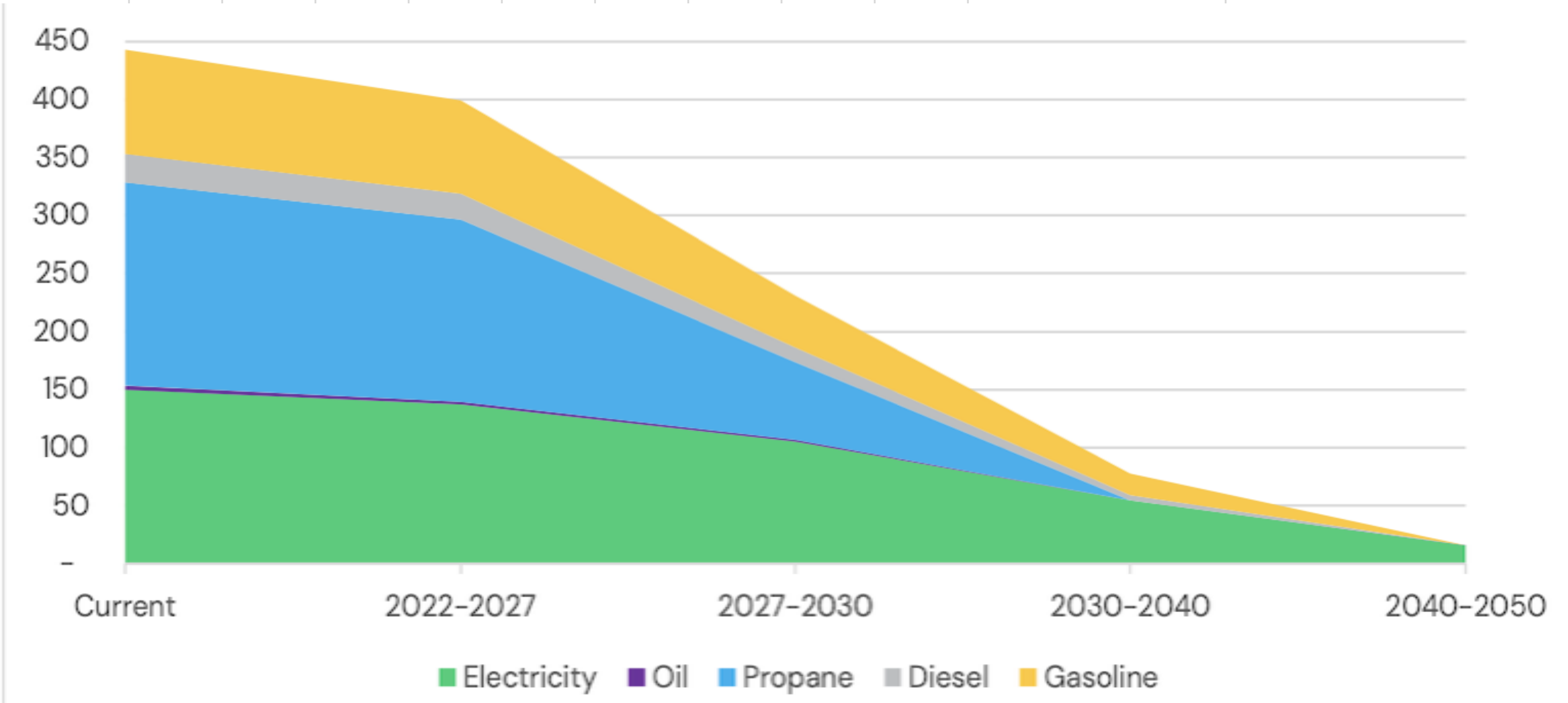
Implementation

Early Beginnings of a Model

	Annual MWh		Phase 1			Phase 2			Phase 3A			Phase 3B 7 yrs	Phase 4 10 yrs
			2025	2026	2027	2028	2029	2030	2031	2032	2033	2034-40	2041-50
A	**Transfer Station**												
		solar - canopy				50	50	50	50	50	50	50	50
		ff generator	backup										
		BESS											
		controls											
	Landfill	solar - ground				250	250	250	500	500	750	1000	1000
	Burn Dump	solar - ground									150	150	150
B	**Town Hall Hill**												
		solar - roof				50	50	50	50	50	50	50	50
		solar - canopy				150	150	150	150	150	150	150	150
		ff generator	backup										
		BESS											
		controls											
C	**School/Walsh**												
		solar - roof	35	35	35	75	75	75	75	75	75	75	75
		solar - canopy					100	100	100	100	100	100	100
		ff generator	backup										
		BESS											
		controls											
D	**Public Safety**												
		solar - roof					50	50	50	50	50	50	50
		solar - canopy					100	100	100	100	100	100	100
		ff generator	backup										
		BESS											
		controls											

	Annual MWh		Phase 1			Phase 2			Phase 3A			Phase 3B 7 yrs	Phase 4 10 yrs
			2025	2026	2027	2028	2029	2030	2031	2032	2033	2034-40	2041-50
E	**ComCtr/Library**												
		solar - roof						100	100	100	100	100	100
		solar - canopy						200	200	200	200	200	200
		ff generator	backup										
		BESS											
		controls											
	Other buildings												
		solar - roof											
	Total Solar generation		**35**	**35**	**35**	**575**	**825**	**1125**	**1375**	**1375**	**1775**	**2025**	**2025**
	2016 PPE		**600**	**595**	**590**	**585**	**580**	**575**	**570**	**565**	**560**	**540**	**510**
	Electricity DEMAND		**500**	**600**	**700**	**800**	**900**	**1000**	**1250**	**1500**	**1750**	**2000**	**2200**
	Muni Surplus (need)		**135**	**30**	**(75)**	**360**	**505**	**700**	**695**	**440**	**585**	**565**	**335**
	EV Retail demand		10	20	30	40	50	60	70	80	90	100	110
	Total Surplus (need)		**125**	**10**	**(105)**	**320**	**455**	**640**	**625**	**360**	**495**	**465**	**225**
	Decarb Roadmap Reduction		5%	10%	**13%**	27%	41%	**55%**	58%	62%	65%	**89%**	**97%**

Annual MWh	Phase 1			Phase 2			Phase 3A			Phase 3B 7 yrs	Phase 4 10 yrs
	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034-40	2041-50



Battery Energy Storage Systems

Storing energy to provide backup and reduce costs during normal operations

Battery Energy Storage Systems (BESS) are energy storage solutions that are becoming increasingly crucial for grid stability and renewable energy integration.

BESS Technology and Applications

- These systems typically use lithium-ion batteries, similar to those in EVs but at larger scale
- They serve multiple functions: grid stabilization, peak shaving, renewable energy storage, and backup power
- Can range from small microgrid systems to utility-scale installations

Cost Reduction Drivers

1. Manufacturing Scale: As battery production increases for both EVs and stationary storage, economies of scale are reducing costs
2. Technology Improvements: Better chemistry and manufacturing processes are increasing energy density and reducing material costs
3. Supply Chain Development: More mature supply chains and competition among manufacturers
4. Learning Curve Effects: As installation and operation experience grows, soft costs decrease
5. Material Innovation: New cathode and anode materials are reducing dependence on expensive metals

Battery Energy Storage Systems

Microgrids as a second life for EV batteries?

When EV batteries reach about 70-80% of their original capacity, they're often still suitable for less demanding stationary storage applications where weight is not an issue.

The process:

1. Assessment & Collection:
   - Batteries are evaluated for remaining capacity and health
   - Those meeting specific criteria are selected for repurposing
2. Reconditioning:
   - Batteries are disassembled and tested at the module level
   - Faulty modules are removed
   - Remaining modules are reconfigured for stationary storage requirements
   - New battery management systems are installed to optimize for stationary use
3. Integration:
   - Reconditioned batteries are assembled into new storage systems
   - Additional cooling and safety systems are added
   - Control systems are programmed for microgrid applications

This approach has several benefits:

✓ Extends battery life before final recycling
✓ Reduces overall system costs for microgrids
✓ Decreases environmental impact