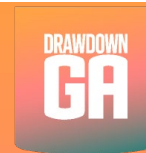


Why Demand-Side Response?

Demand-side response is a tool for clipping expensive and polluting demand peaks and tackling the intermittency of variable renewable energy in Georgia.

DSR can facilitate the integration of more solar energy, when coupled with:

- battery storage,
- smart devices,
- direct load control and
- real-time pricing.



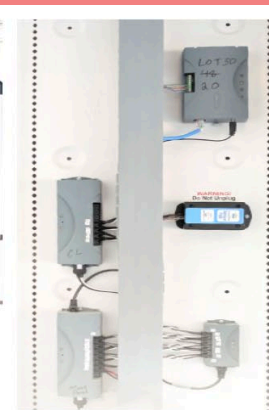
Altus at the Quarter by Pulte Homes (Atlanta)



**Puck programmable
Thermostat**



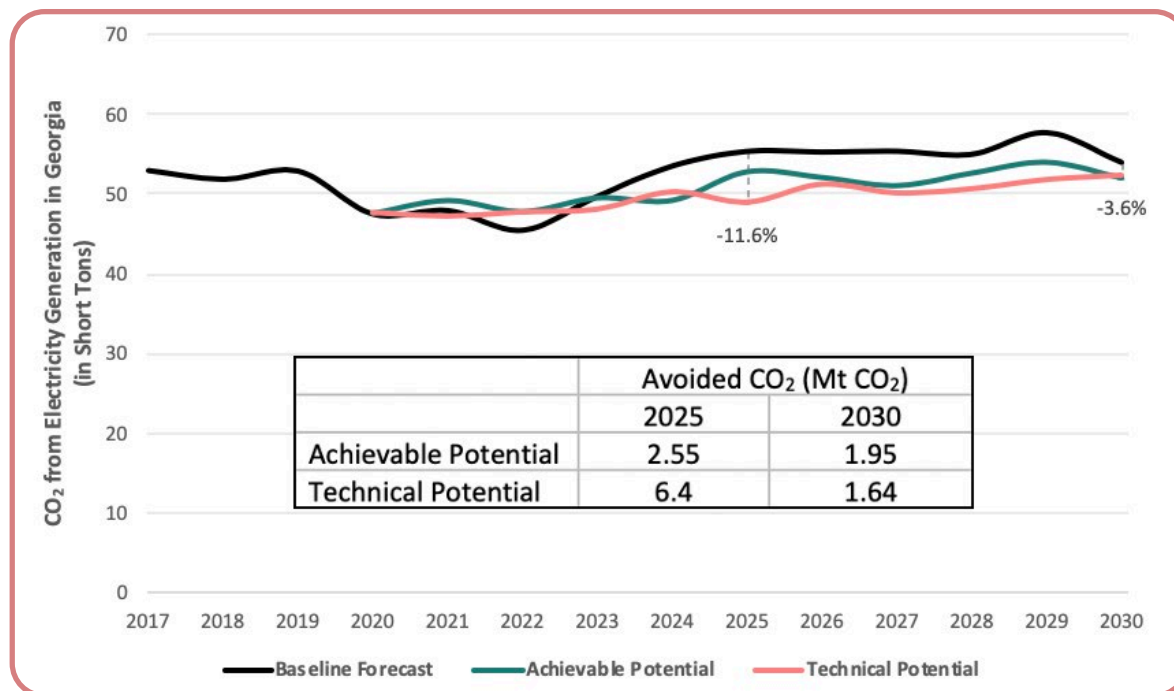
**Garage with two 5 KW lithium-ion batteries,
an EV charger, and a heat pump water heater**



**SiteSage circuit
monitoring system**

Demand-Side Response

Our working scenarios suggest sizable carbon mitigating potential by 2030



Baseline = GT-NEMS forecasts a 6.4 MtCO₂ rise in yearly emissions by 2030.

Achievable Potential = Reduction of 2 MtCO₂ in 2030, totaling **19.1 MtCO₂** between 2020 and 2030.

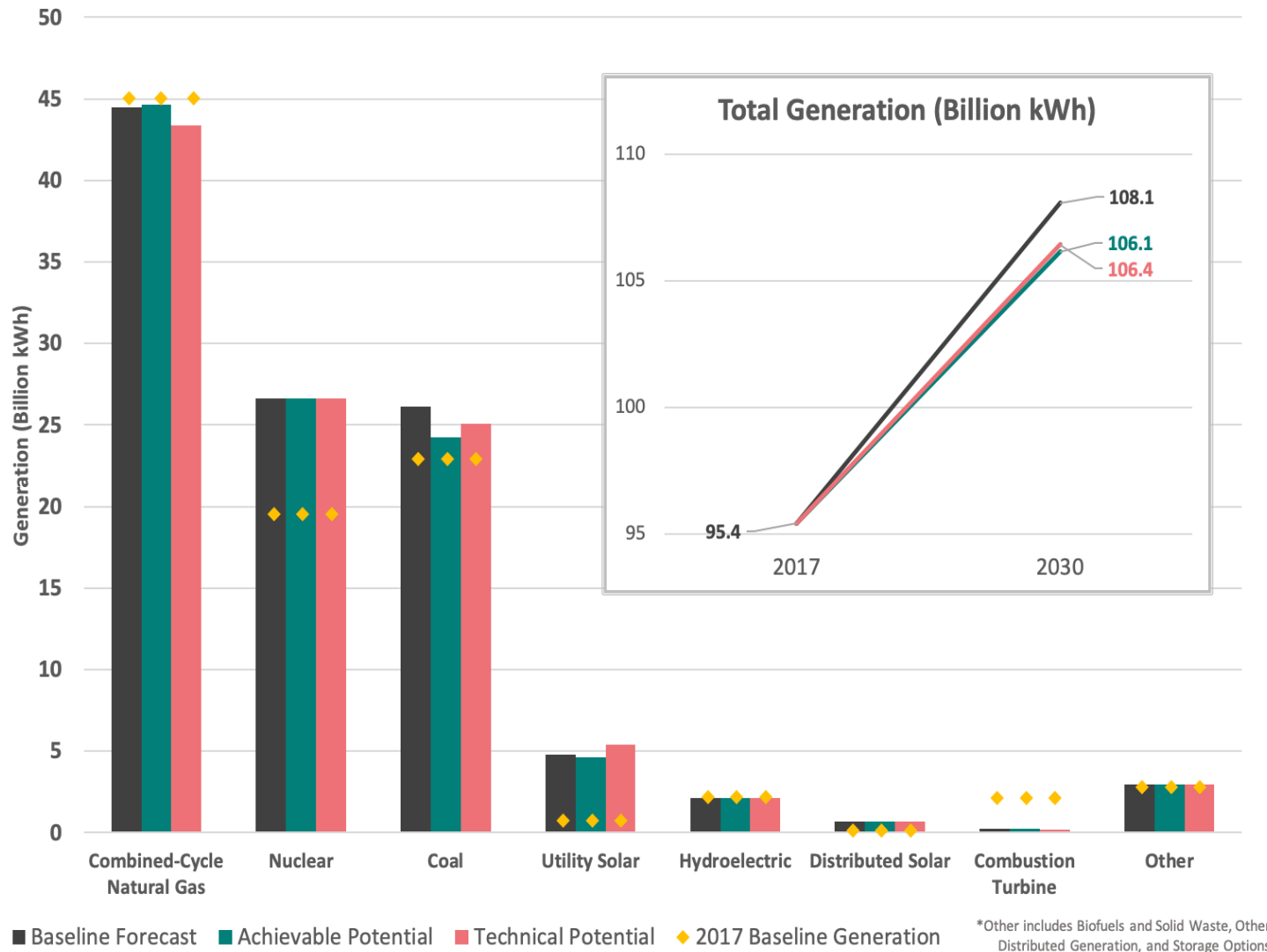
Technical Potential = Reduction of 1.6 MtCO₂ in 2030, totaling **31.3 MtCO₂** between 2020 and 2030.

1 MtCO₂e solution in 2030 = **187,000** households participating in a DSR program, shift 10% of their peak to off-peak demand.

- 8.5% of households served by Georgia Power.
- 4.39 kW peak load per household.

- +Bill savings for Georgia households
- +Low capital costs
- +Enables greater integration of solar
- +Less air pollution
- +Costs/tCO₂ averted = yearly average of \$5 to \$6

Electricity Generation in Georgia in 2030 Would be Significantly Cleaner with Demand-Side Response

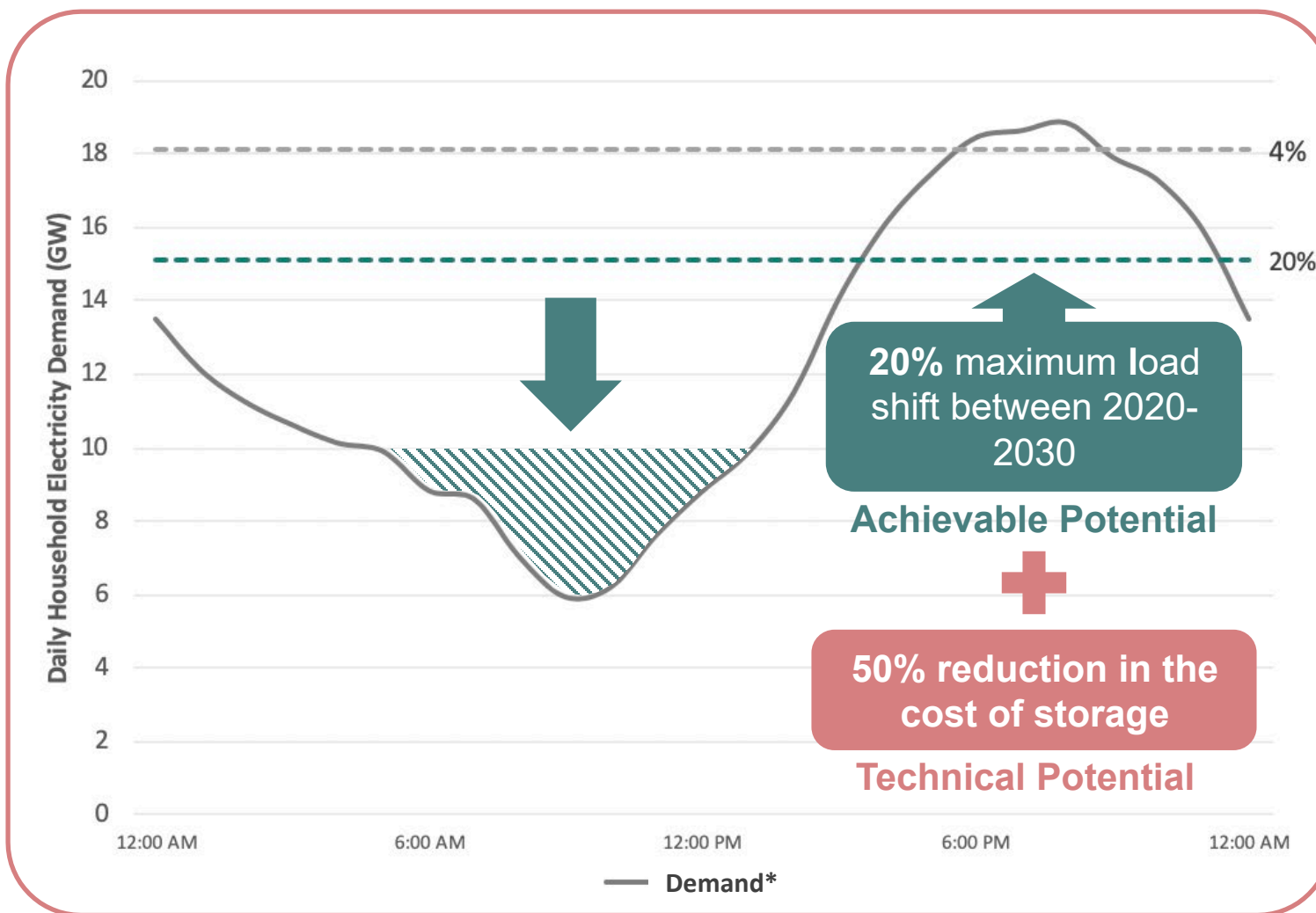


Baseline = Total generation grows **13%** from 2017 to 2030. Nuclear expands significantly; coal and utility solar also grow.

Achievable Potential = Total generation grows only **11%**, with coal growing less than in the baseline.

Technical Potential = Total generation grows only **11%**, displacing a combination of coal and natural gas compared to the baseline. Utility solar is the only resource that grows more rapidly than in the baseline.

Demand-Side Response Achievable & Technical Methodology



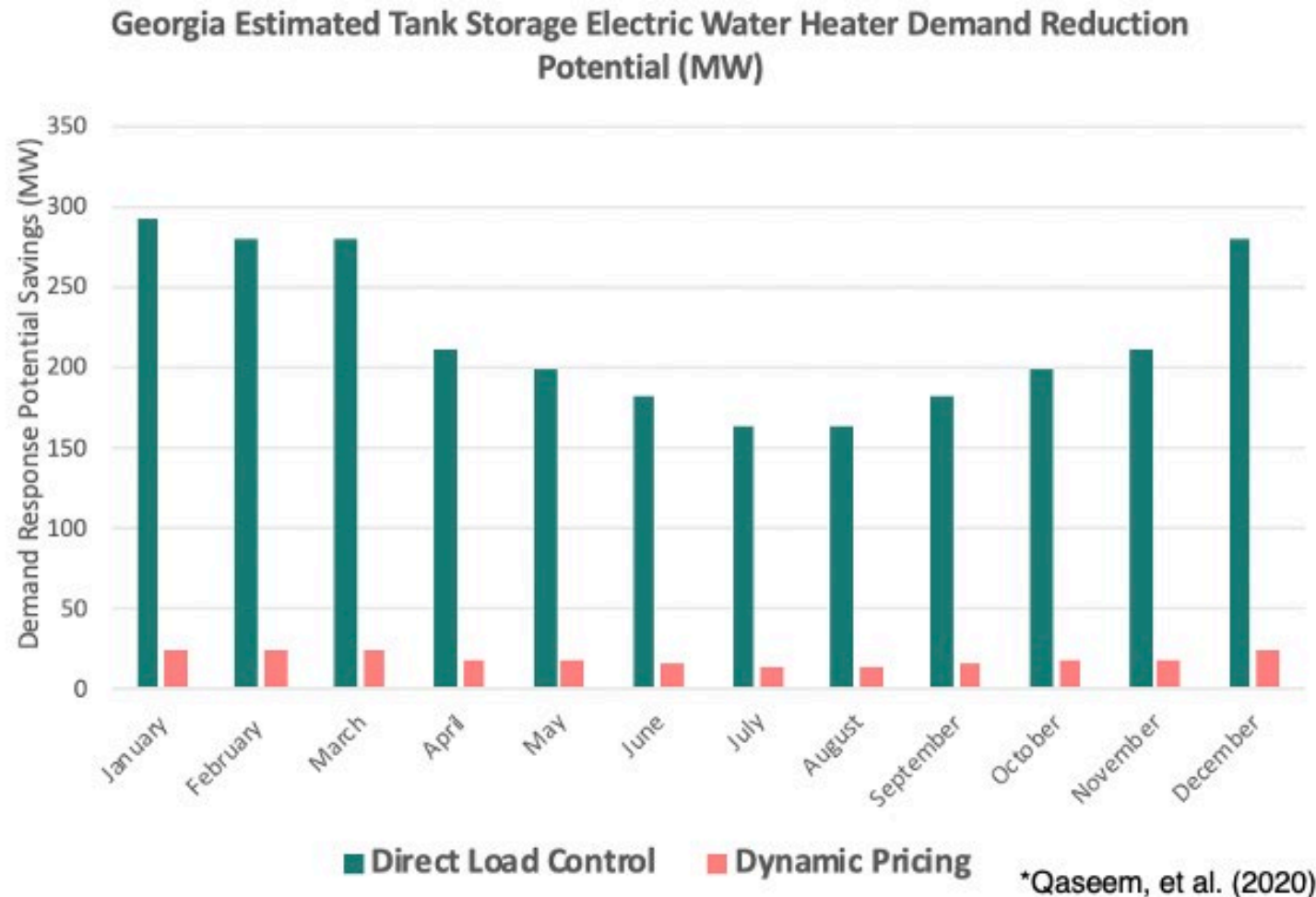
For the three scenarios approximately 100 on-peak hours were modeled by GT-NEMS with the following parameters set for each.

Under the baseline forecast, a maximum load shift of 4% is assumed.

The achievable potential increases the maximum load shift to 20% between 2020 and 2030.

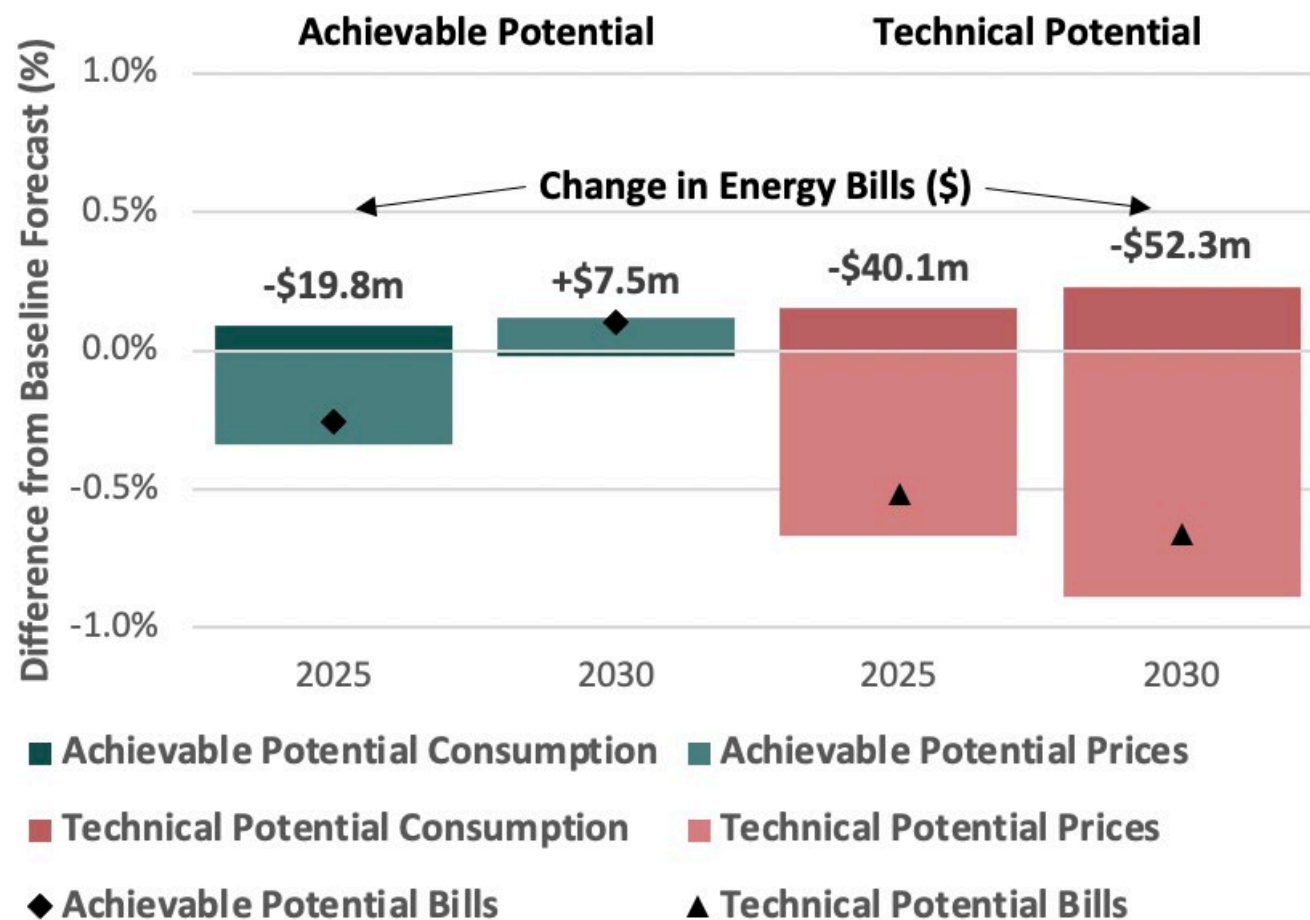
The larger technical potential, in addition to the 20% maximum load shift, also models for a 50% reduction in the cost of storage.

Water Heating and HVAC are Key Technologies for Demand-Side Response in Georgia



Direct load control delivers more carbon drawdown than dynamic pricing.

Georgia households would see lower electricity prices and bills, saving ~\$8.7 million each year over the decade

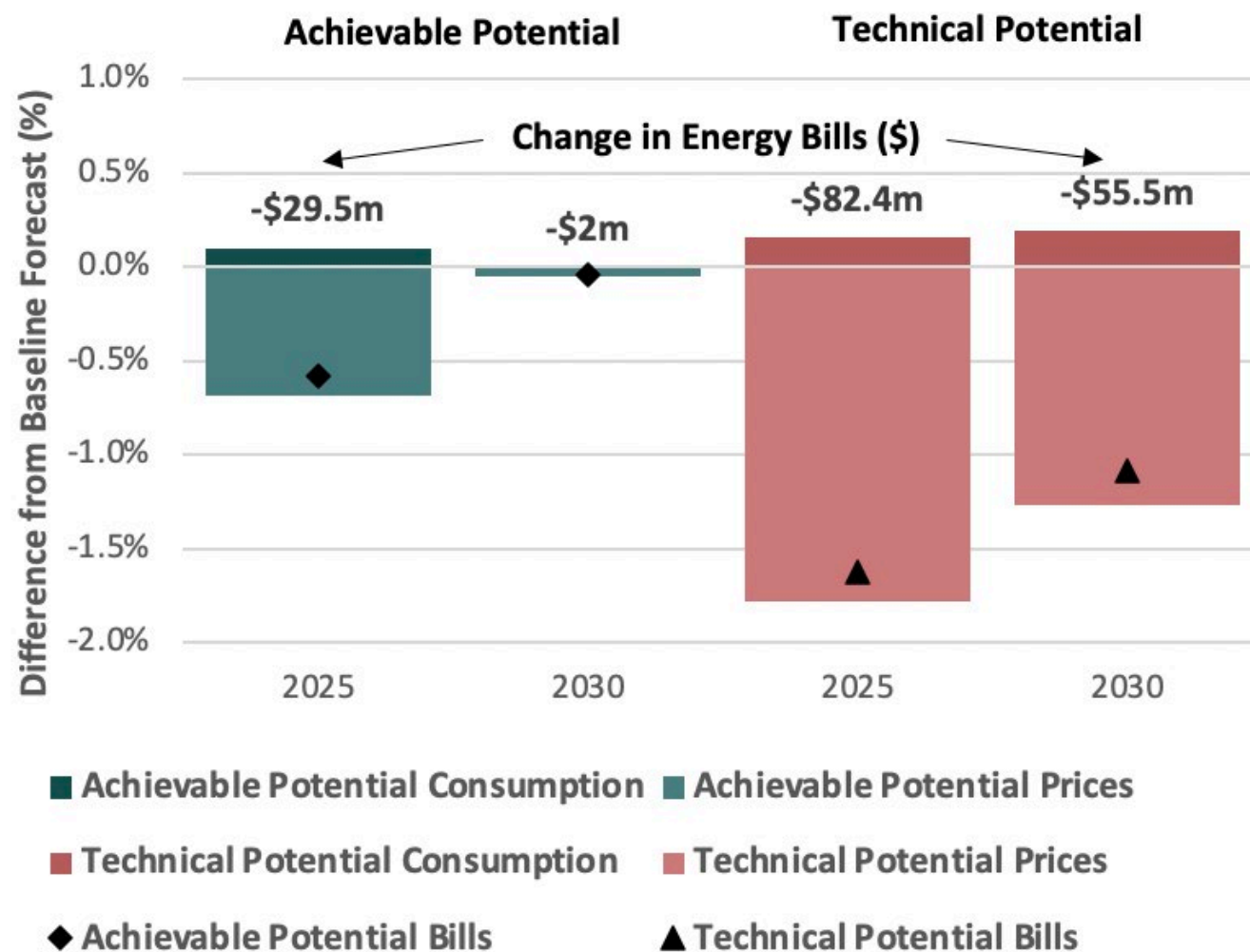


Baseline = Prices increase from 11.9¢/kWh in 2017 to 13.4¢/kWh by 2030.

Achievable Potential = Prices are on average **0.15%** lower over the decade, saving Georgia households **~\$87 million**.

Technical Potential = Prices are on average **0.51%** lower over the decade, saving Georgia households **~\$330 million**.

Georgia businesses would see lower electricity prices and bills, saving ~\$15.5 million each year over the decade

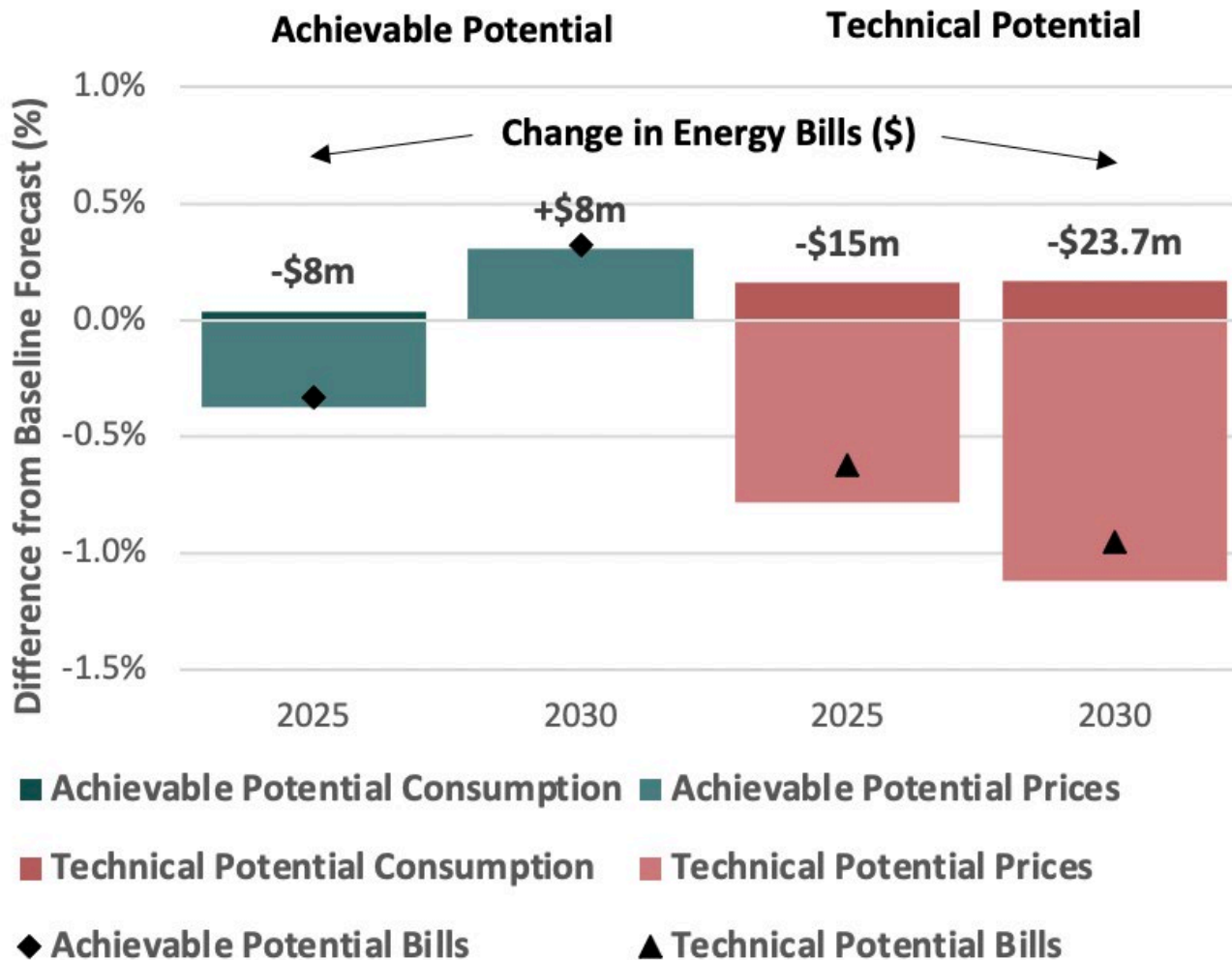


Baseline = Prices increase from 9.4¢/kWh in 2017 to 10¢/kWh by 2030.

Achievable Potential = Prices are on average **0.33%** lower over the decade, saving Georgia businesses **~\$155 million**.

Technical Potential = Prices are on average **1.17%** lower over the decade, saving Georgia businesses **~\$585 million**.

Georgia Industry would see lower electricity prices and bills, saving ~\$2.4 million each year over the decade



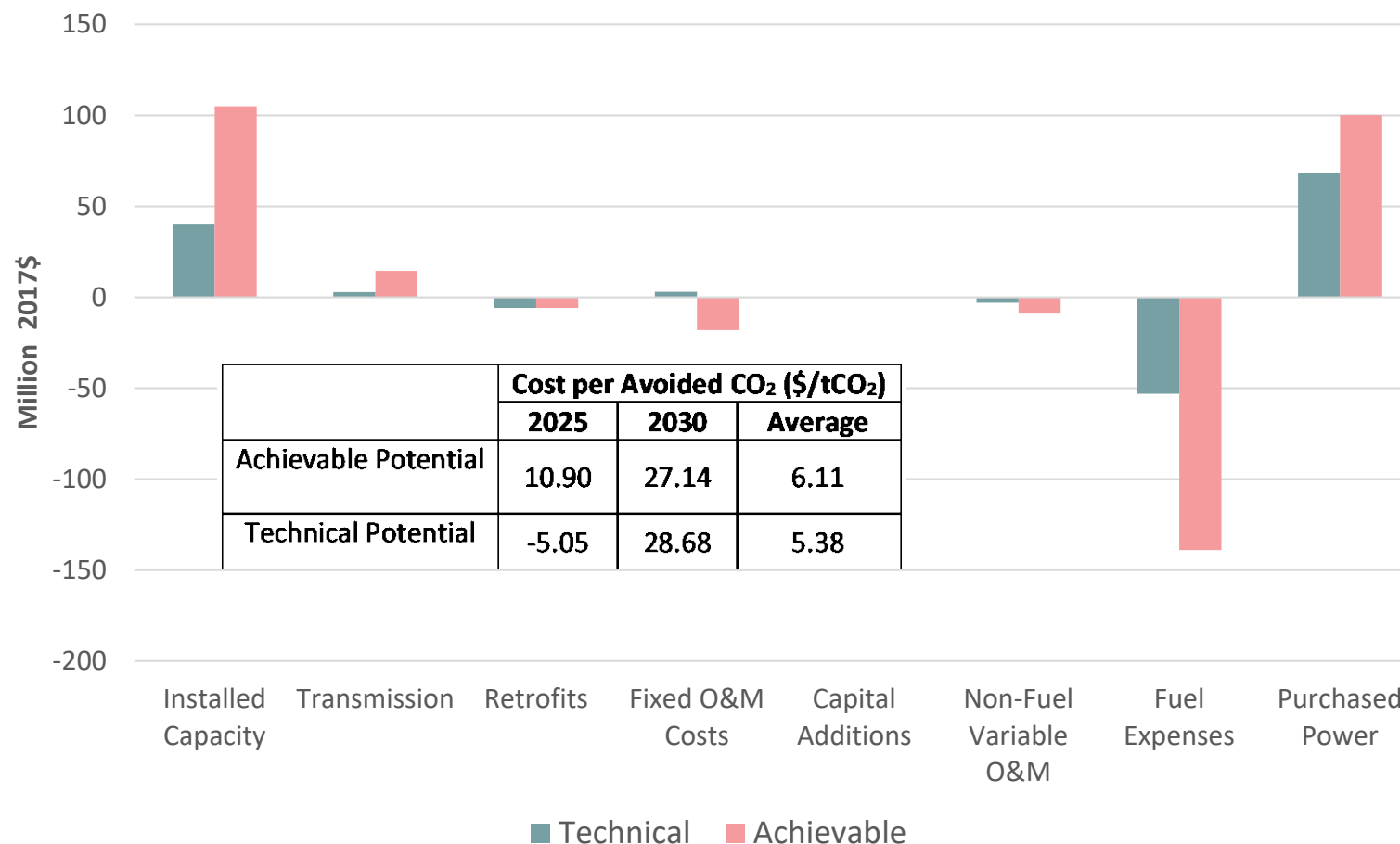
Baseline = Prices increase from 6.7¢/kWh in 2017 to 6.9¢/kWh by 2030.

Achievable Potential = Prices are on average **0.12%** lower over the decade, saving industry in Georgia **~\$24 million**.

Technical Potential = Prices are on average **0.61%** lower over the decade, saving industry in Georgia **~\$141 million**.

Marginal Increase in Overall Utility Resource Costs But With Notable Decrease in Fuel Expenses

2030 Change in Utility Resource Costs



Under the baseline forecast, utility costs will increase by approximately \$240 million by 2030.

The achievable potential increases these costs by \$52 million in 2030, equal to \$27.14 per ton of avoided CO₂. (\$6.11 when averaged over the decade)

The larger technical potential increases these costs by \$47 million in 2030, equal to \$28.68 per ton of avoided CO₂. (\$5.38 decade average)

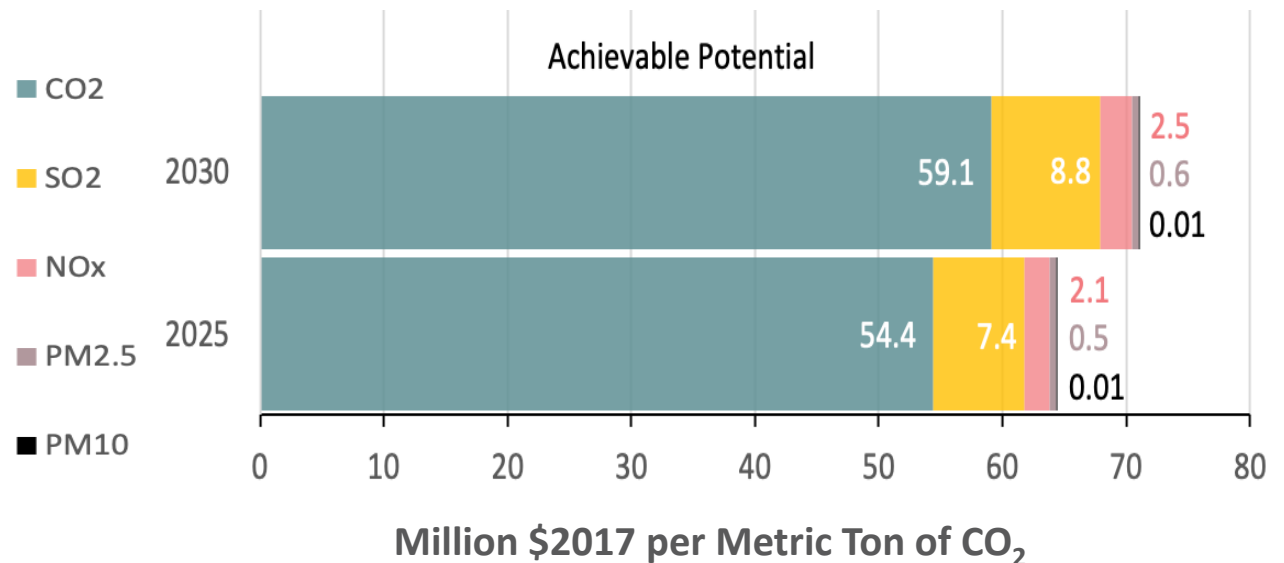
Under both potentials, increases in installed capacity, transmission, and purchased power costs offset savings from retrofit, O&M, and fuel expenses.

Sizable Environmental and Public Health Benefits from Emissions Reduction in Georgia

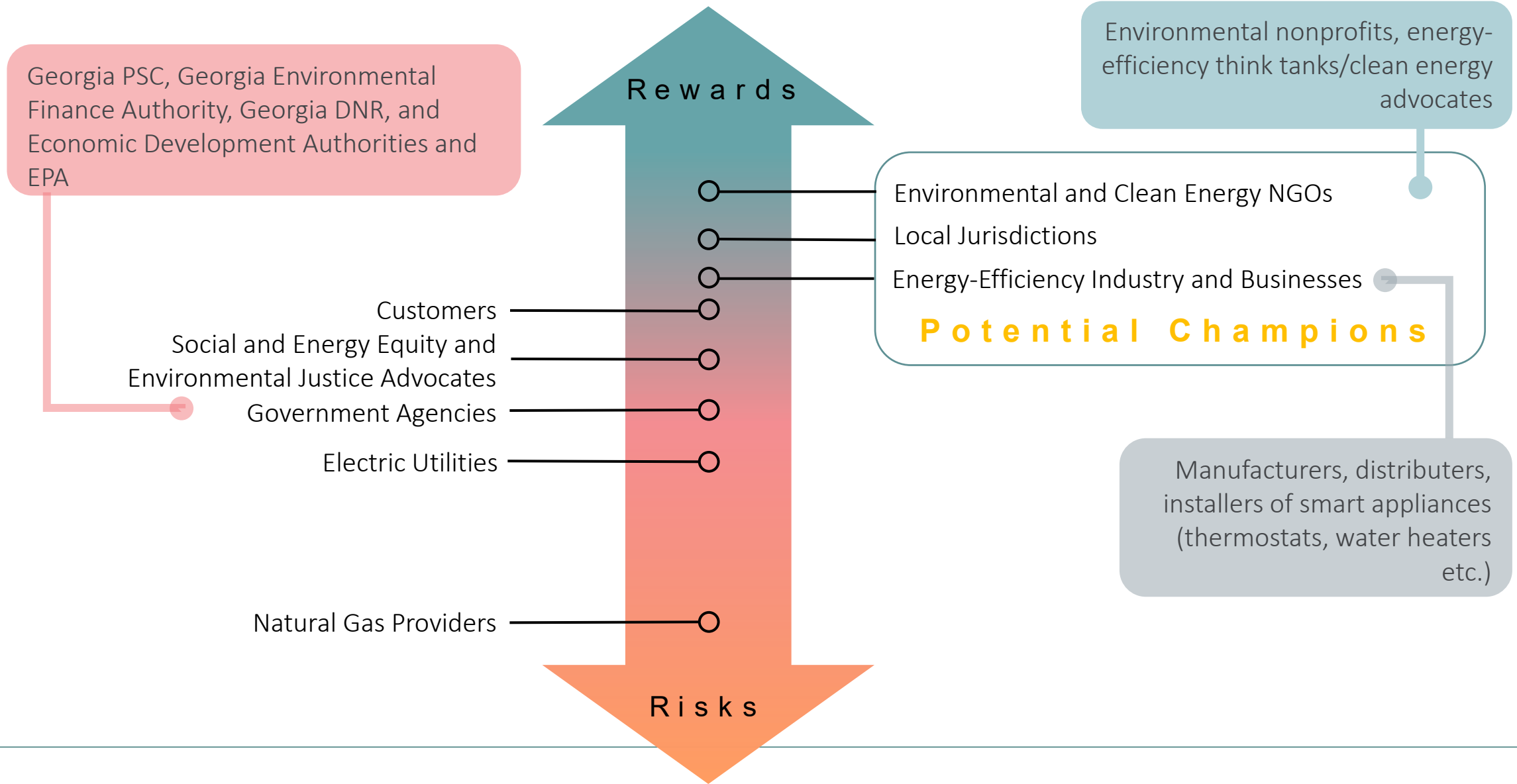


- Lower SO₂ and NO_x levels result in fewer respiratory illnesses such as asthma, particularly in children.
- Reducing fine particulates has significant health benefits:
 - especially for children – lower incidence of preterm birth, low-birth weight, and autism spectrum disorder.
 - also for adults – fewer premature deaths, heart attacks, and respiratory illnesses.
- Other important benefits include increased workforce productivity and quality of life.

- The monetary benefits of reduced SO₂, NO_x, PM₁₀, and PM_{2.5} in the achievable scenario totals \$21 million in 2030.
- Adding the avoided costs from CO₂ brings the total to \$123 million in 2030.



Stakeholder Analysis of Demand-Side Response



Demand Response Solution Interactions

Rooftop Solar

Demand Response increases capacity for solar integration through load management.

Electric Vehicles

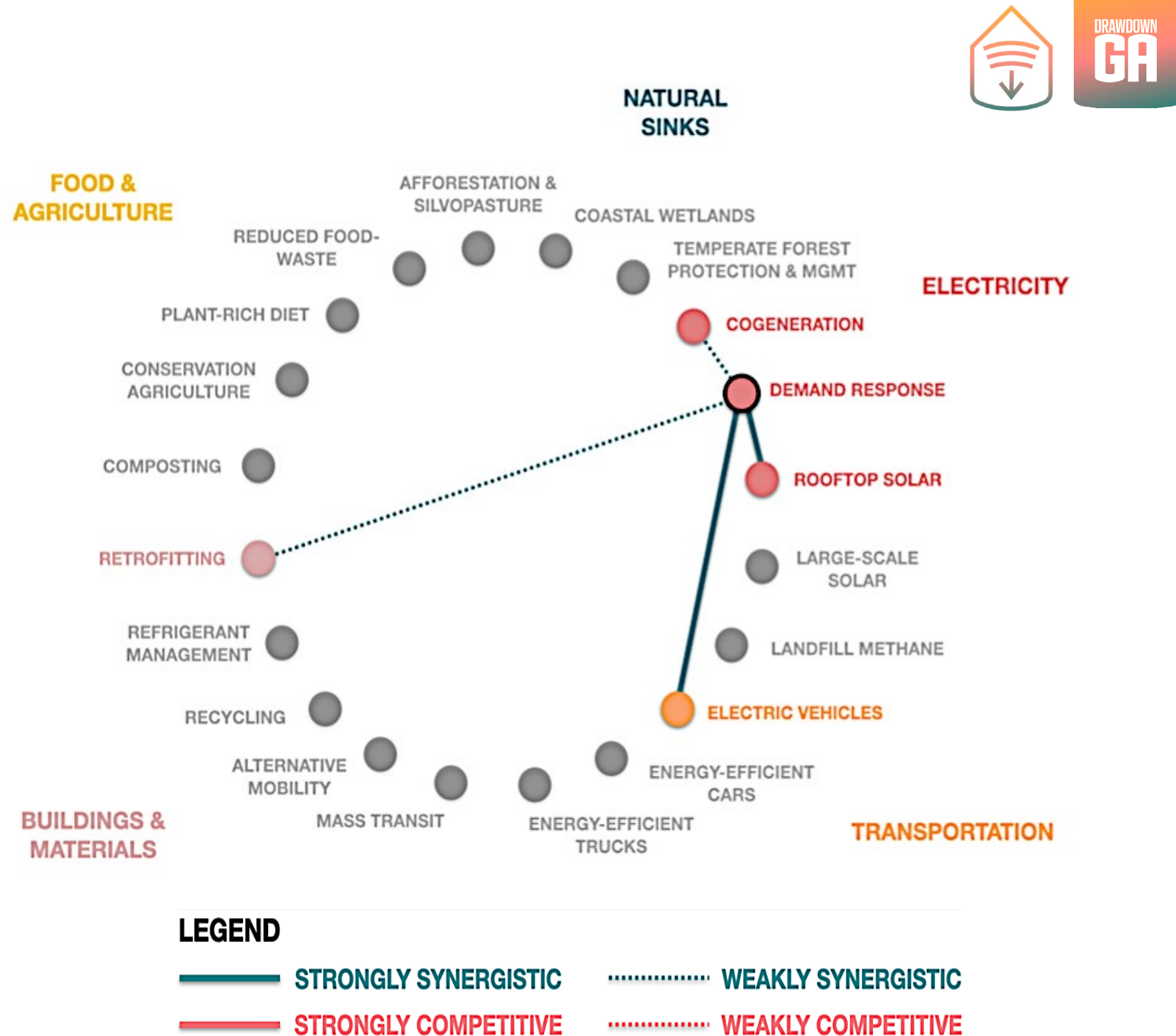
Demand Response can curtail EV charging during peak demand lowering costs. Alternatively, EVs can provide home storage for peak hours use.

Cogeneration

Reduce levels of wasted on-site renewable generation.

Retrofitting

Option during retrofitting (smart thermostats, electric water heaters etc.)

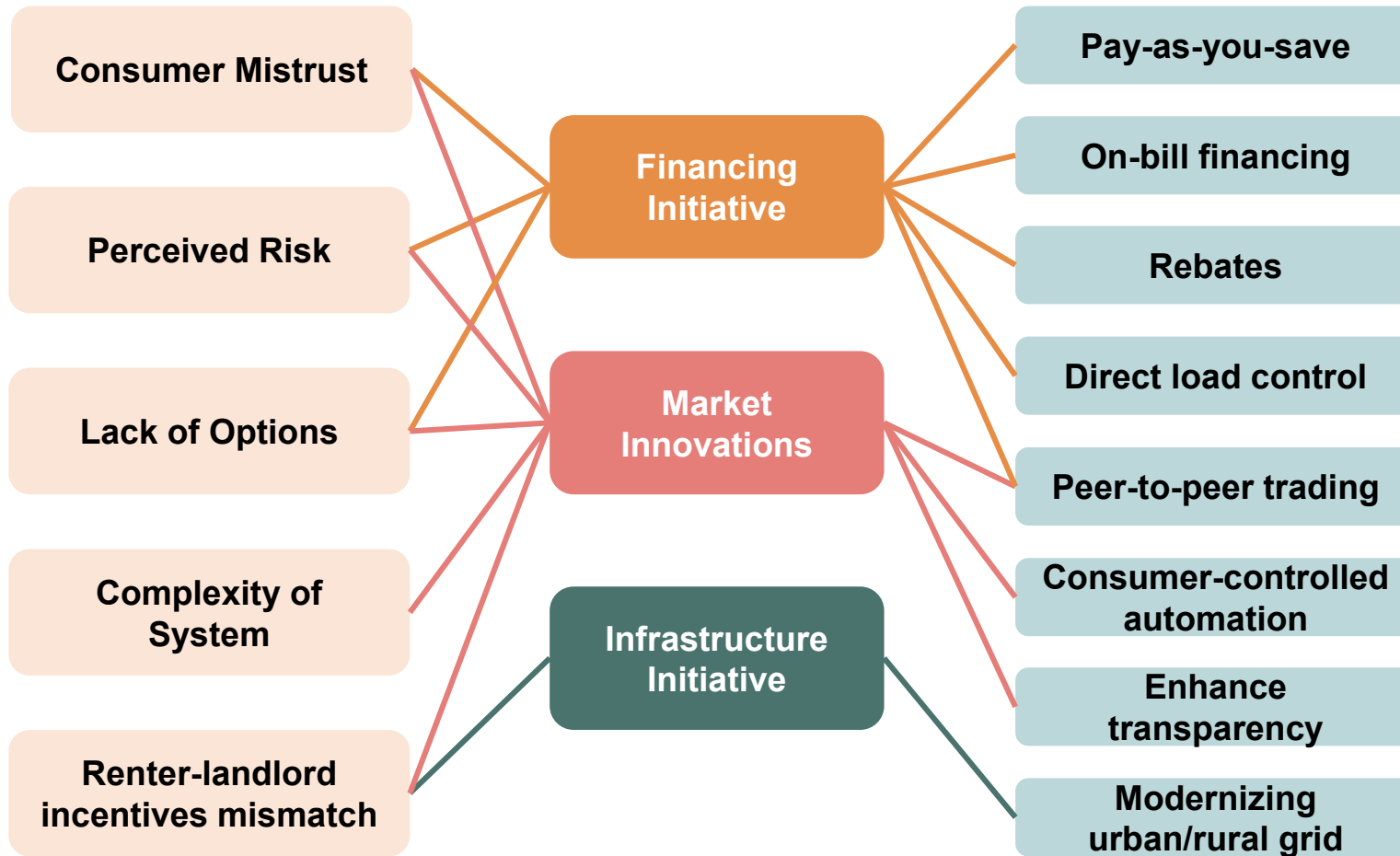


Challenges and Possible Initiatives for Demand Response in Georgia

Barriers & Challenges

Possible Initiatives

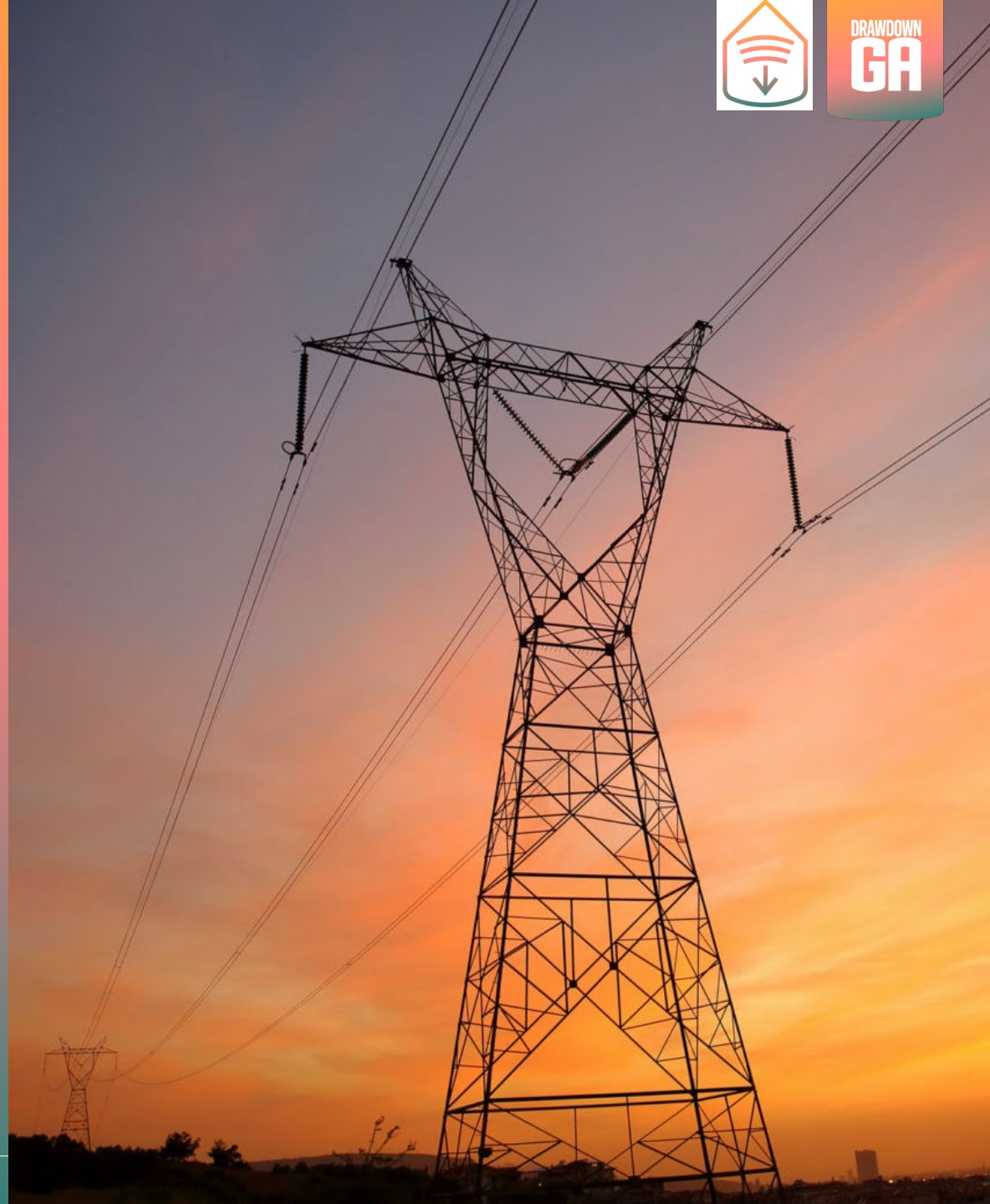
Tools & Accelerants



Demand-Side Response

A solution for Georgia that;

- Reduces carbon emissions
- Saves consumers money
- Features low costs for utility providers
- Is compatible with other solutions





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