

Retrofitting the Built Environment: A high impact solution for reducing carbon emissions in Georgia









We asked a focus group about the following technologies for retrofitting:

- Improving air sealing/insulation
- LED lighting
- High-efficiency heat pumps & water heaters
- Smart thermostats;
- Automated control systems
- Water-saving devices
- Alternative roof designs (green roofs or cool roofs)
- Improved windows
- Recommissioning / retro-commissioning
- Deadband range expansion





Potential for Carbon Reduction Estimation

DRAWDOWN GA

Market penetration scenarios for forecasting the energy and CO₂ savings by 2030 for the existing building stock:

- **1.** Achievable potential: cumulative retrofit rate of 20% for deep residential retrofits and for the cost-effective commercial retrofit solutions.
 - Low achievable = individually cost-effective technologies (8%)
 - High achievable = cost-effective bundle of technologies (8%)
- 2. Technical potential: cumulative retrofit rate of 50% for all retrofit solutions.

Methodology:

- Cumulative retrofit rates are based on annual energy efficiency potentials from various state/utility analyses (cumulative retrofit rate of 20% = 2.5% annual retrofit rate* 8 years)
- Baseline delivered energy ranges were calculated using SCOUT and data from the latest Residential Energy Consumption Survey –RECS and Commercial Building Energy Consumption Survey–CBECS
- CO₂ savings from energy savings were calculated using Georgia-specific emission factors.

Private Costs and Benefits Estimation - Achievable Potential

Assumptions

Technologies

- Smart Thermostats/Building Automation
- LED Lighting
- Insulation
- Water Heaters
- Heat Pumps
- Windows (Residential)
- Recommissioning

Cumulative retrofit rate by 2030

Technology	ST	LED	INS	WH	HP
Residential	20%	20%	20%	20%	20%
Technology	BA	LED	RECOM	INS	HP
Commercial	20%	20%	20%	0%	0%

Financial

- Discount rate = 12%
- Values are based on current estimated installed costs for retrofitting, with a learning rate of 3% between now and 2030 and constant relative savings over the lifespan of each technology using an energy price of \$0.08/kWh for commercial and \$0.10/kWh for residential.
- Difference in maintenance and other costs are negligible
- Administrative costs were excluded

Results

NPV Private Costs	NPV Private Benefits		
\$2.5B – \$5.4B initial costs	\$2.0B – \$8.0B avoided energy costs		

SCOUT

ENERGY EFFICIENCY & M SCOUT

ECM Summaries Analysis Results

Baseline Energy Calculator

Source Code 🗹

+ - Baseline Energy Calculator*

The Baseline Energy Calculator yields the estimated energy use and CO₂ emissions associated with losses through the building envelope, appliances and devices within residential and commercial buildings in the United States. The energy use and CO₂ emissions can be divided by building type, climate zone, technology, and other factors indicated below. CO₂ emissions reported here do not include direct emissions associated with losses of working fluids from heating, cooling, water heating, and refrigeration systems.

To obtain an estimate for an energy use segment of interest, the applicable category selections must be made below. In each category shown, at least one selection is required. In some categories, multiple selections are permitted. Follow the numbered steps below, making the desired selections at each step. Once selections have been made in each category, click the 'Calculate' button at the bottom right of the screen to obtain the energy use and associated CO₂ emissions results. Initial results may cleared by clicking the 'Reset' button or updated by clicking the 'Calculate' button again.

The underlying data for this calculator are from the 2019 Annual Energy Outlook (AEO) z released by the U.S. Energy Information Administration (EIA).

	1. Select a projection year	Segment Size
1. Projection Year	2030 🗢	
2. Climate Zone		6.2 Quads
3. Building Type		(Primary Energy)
4. End Use/Technology		277
		(CO ₂ Emissions)
Previous	Next 🕨	Reset Calculate

Tool developed by the U.S. Department of Energy for estimating the national energy impacts of residential and commercial building energy conservation measures

https://scout.energy.gov/baseline-energycalculator.html

Current State of Retrofitting in Georgia

No state-wide program. Georgia Power offers:

- Incentives for single family homes for energy saving solutions (\$50 - \$300 up to a combined maximum of \$1,000)
- Rebates on residential LED lighting and other energy savings options.
- Incentives for commercial buildings for energy saving solutions (up to \$75,000/building/year).

Georgia Environmental Finance Authority offers:

 Low-interest financing for energy efficiency and renewable energy projects for local governments at water, sewer, and solid waste facilities.

Georgia Baseline – Delivered Energy (quads)



Nationwide demolish rate is about 2% GA residential is closer to 1% and commercial is closer to 3%

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Drawdown potential in Georgia in 2030



1 MtCO₂e solution in 2030 = retrofitting around 20% of Georgia's single-family residential homes (approximately 600,000 homes) to achieve an average energy savings of 20% per home by 2030.

Baseline = From 44.1 MtCO₂e in 2017 for commercial and residential buildings, GT-NEMS growth rate forecasts ~43 MtCO₂e in GA in 2030.

Achievable Potential = Reduction of 2.6-4 MtCO₂e in 2030, considering a cumulative retrofit rate of 20% for deep residential retrofits and for the cost-effective commercial retrofit solutions by 2030.

Technical Potential = Reduction of **9-13.7 MtCO₂e** in 2030, with a cumulative retrofit rate of 50% for all retrofit solutions by 2030.

+Less air pollution
+Local jobs
+Less energy burden
+Public health benefits
-High upfront cost





Stakeholder Analysis of Retrofitting



Interactions with other solutions

Demand Response

 Building automation can enable demand-response better by reducing the demand for electricity during utility's peak hours.

Rooftop Solar, Solar Farms & Community Solar

 Low-carbon electricity would reduce the carbon reduction potential of retrofitting buildings



FORESTS &

Retrofitting: Challenges and Possible Initiatives





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Other considerations



Challenges

- High upfront costs
- Information asymmetry
- Transaction and administrative costs
- Principal-agent problems
- Split/misplaced incentives and subsidies.
- Lack of a decoupling policy in Georgia
- Issues arising from discount rates of individuals and businesses

Promising Policies

- Electricity decoupling, providing easier access to capital at attractive interest rates
- Programs such as on-bill financing and property assessed clean energy (PACE)
- Information campaigns to reduce information asymmetry
- Improved standards
- Information campaigns to promote more energy-efficient replacements of equipment at end-of-life





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