U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

Moab, Utah: Using Energy Data to Target Carbon Reductions from Building Energy Efficiency

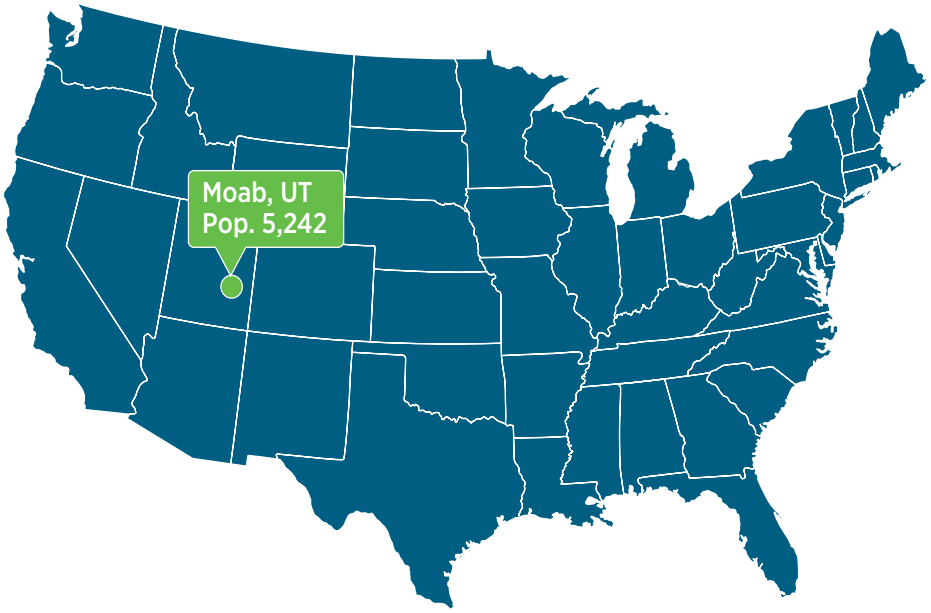
The City of Moab partnered with the Energy Department and the National Renewable Energy Laboratory (NREL) to demonstrate how data and analysis can inform more strategic energy decisions. NREL based its analysis in-part on the City Energy Profiles on the State and Local Energy Data (SLED) website (*eere.energy.gov/sled*). The profiles contain data compiled by SLED and the Cities Leading through Energy Analysis and Planning (Cities-LEAP) program. Cities across the country can follow the same approach and use data-driven analysis in their own energy planning.

City Energy Goal

Moab, Utah, recently established a community-wide goal of achieving 100% renewable electricity by 2032, a municipal government goal of 100% renewable electricity by 2027, and a goal to reduce greenhouse gas (GHG) emissions 80% by 2040.[1]

To develop strategies to achieve these goals, the City of Moab asked the following question: What is the relative energy and emissions reduction potential of building energy incentives?

CITY ENERGY: FROM DATA TO DECISIONS



> "Moab plans to utilize the SLED data to implement the most cost effective strategies toward our goals using a triple bottom line model through voluntary efforts with the residential and business community."
>
> – *Dr. Rosemarie Russo, Sustainability Director, City of Moab*

Data and Analysis

As Moab does not have a transit system and building codes are set at the state level, NREL's analysis focuses on building energy actions over which the city has jurisdiction. Cities-LEAP estimates regarding the city's building stock provide the foundation for the analysis.

The residential sector represents an estimated 66% of Moab's total building stock (see Figure 1). Commercial and

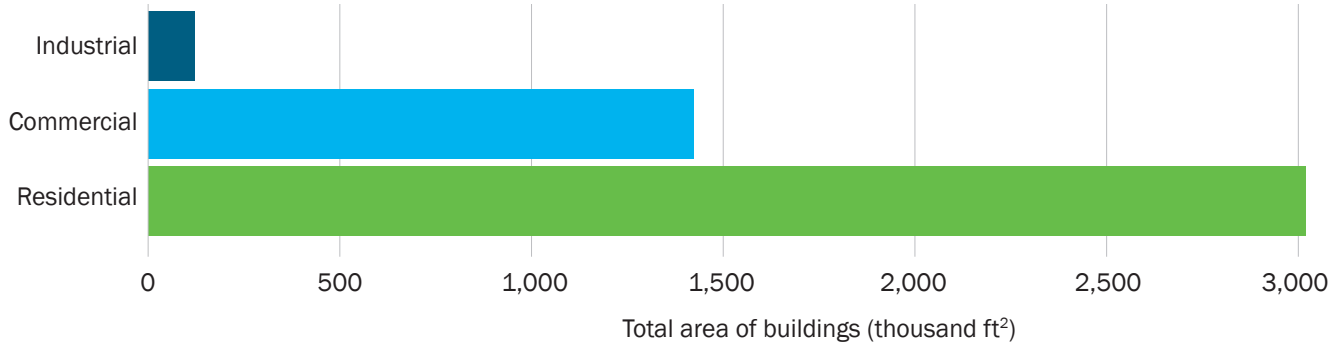


Figure 1. Total building stock area by sector (2013) in Moab, Utah (Source: SLED)

[1] *Resolution 13-2017 "A Resolution of the Moab City Council and Mayor Establishing Renewable Energy and Greenhouse Gas Emissions Reduction Goals for Moab City,"* https://moabcity.org/documentcenter/view/1385.

industrial buildings comprise an estimated 31% and 3% of the city's total building stock, respectively. Single-family dwellings represent approximately 71% of the total residential building area (see Figure 2) and about 70% of the total number of residential buildings. Excluding duplexes, multi-unit buildings collectively comprise approximately 7% of the total residential built area. Moab also has a sizeable manufactured housing sector, which accounts for approximately 17% of the residential housing stock by area and 25% of the total number of residential buildings.

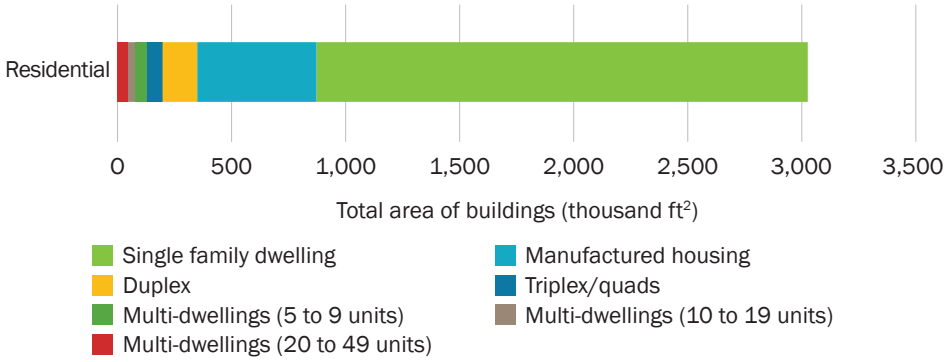


Figure 2. Total area of residential building stock by type (2013) in Moab, Utah (Source: SLED)

The commercial sector is the highest electricity-consuming sector in Moab. An analysis of commercial buildings in the CoStar Realty database, available on SLED, indicates that a benchmarking policy addressing properties at or above 10,000 square feet would apply to more than 20 properties and more than 600,000 square feet (see Figure 3). Multifamily properties included in the CoStar data generally have 20 units or more and are based on different data sources than the multi-dwelling building types included in the Figure 2 residential analysis.

Smaller communities like Moab tend to have a less diversified commercial building stock and may need to adjust policies like building energy disclosure ordinances to better fit the local situation. Alternatively, addressing the specific large buildings and industries individually may offer a more effective approach.

Understanding the energy requirements of typical commercial facilities can aid in developing appropriate policies and programs. Table 1 highlights the highest commercial electricity and natural gas consuming industries in Moab.

In Moab, as in many cities, healthcare activities and establishments rank high in both electricity and natural gas consumption, particularly on a per-facility basis, making them potential high-impact opportunities for low transaction cost energy savings. Accommodation and food and beverage services and establishments are also significant energy users in Moab (likely due to tourism) and present a similar opportunity.

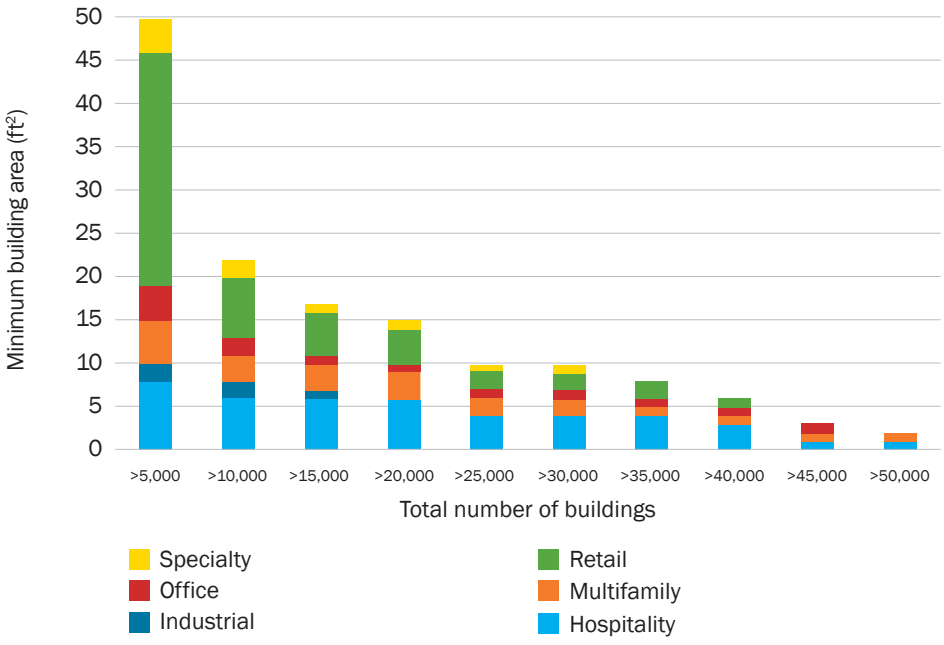


Figure 3. Count of commercial buildings by area and type in Moab, Utah (Source: SLED)

City Energy Policy Options

Using a Cities-LEAP study on the carbon abatement potential of city-level energy actions, along with City of Moab staff inputs and adjustments, NREL generated a calculator for GHG emissions reductions potential from common city-level actions. Building energy efficiency incentives in Moab have the highest GHG emissions reduction potential compared to other common city energy actions,

[2] E. O'Shaughnessy et al., *Estimating the National Carbon Abatement Potential of City Policies: A Data-Driven Approach*, National Renewable Energy Laboratory (2016), NREL-67101, http://www.nrel.gov/docs/fy17osti/67101.pdf and https://energy.gov/node/2104835.

Table 1. Estimated Annual Energy Consumption by Commercial Activity (2013) in Moab, Utah

Commercial activities: Top 5 electricity-consuming industries	Number of establishments	Electricity use (MWh)	Rank
Food services and drinking Places	25	4,064	1
Food and beverage stores	4	3,411	2
Hospitals	1	2,983	3
Accommodation	22	1,975	4
Nonstore retailers	2	692	5
Commercial activities: Top 5 natural gas-consuming industries	**Number of establishments**	**Natural gas use (Mcf)**	**Rank**
Hospitals	1	11,282	1
Food services and drinking places	25	6,831	2
Accommodation	22	3,866	3
Food and beverage Stores	4	3,380	4
Ambulatory health care services	9	1,890	5

Source: SLED, Buildings and Industry Summary for Moab, Utah.

assuming a mandatory commercial building energy benchmarking program is implemented with an 85% participation rate (see Figure 4).

Building energy incentives apply to the existing building stock with different approaches for the residential and commercial sectors. Some common options for city-level action include the following:

- Financial incentives for home weatherization, energy audits, HVAC (heating, ventilation, and air conditioning) upgrades, and energy efficient appliances
- Benchmarking policies to increase transparency in commercial building energy use, which literature suggests are correlated with reductions in building energy intensity.

Evaluating the relative energy savings potential of energy efficiency programs for different sectors may help to target city actions for Moab. Table 2 highlights initial, course estimates of building efficiency approaches based on current electricity consumption per building, average participation rate ranges, and an assumed conservative 5% electricity use reduction per participating building. The impact of voluntary commercial and residential programs depends on participation rates.

This initial analysis indicates that both voluntary and mandatory commercial building efficiency programs may result in more electricity savings than residential programs.[3]

An NREL analysis of potential energy cost savings in single-family detached homes in each state based on a detailed modeling of 350,000 representative individual

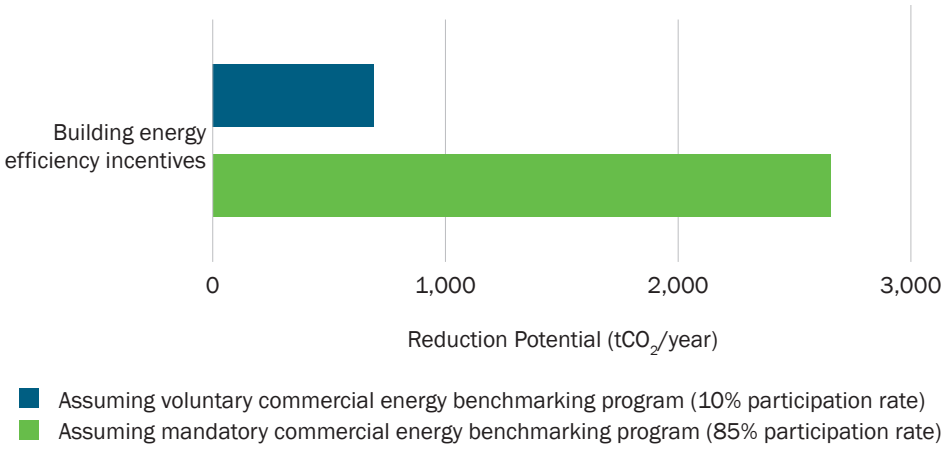


Figure 4. Figure 4. Estimated annual GHG reduction potential of commercial building energy benchmarking programs for Moab, Utah (Source: Based on an NREL carbon abatement potential study [*energy.gov/node/2104835*], city-provided data, and SLED)

[3] Actual program participation rates may vary significantly. Program participation rates are based on analysis presented in O'Shaughnessy et al.

Table 2. Estimated Annual Energy Consumption Reduction Potential from Energy Efficiency Program Participation in Moab, Utah

	Commercial and industrial (voluntary)	Commercial and industrial (mandated)	Residential (voluntary)
Assumed participation rates*	10%	85%	4%–16%
Number of buildings†	317	317	2,119
Average annual electricity consumption per establishment or household (MWh)‡	176	176	8
Average natural gas consumption per establishment or household (MCF)§	198	198	44
Estimated participation**	32 buildings	270 buildings	85–339 buildings
Assumed 5% annual energy reduction per building (electric/gas)	8.8 MWh/9.9 MCF	8.8 MWh/9.9 MCF	0.4 MWh/2.2 MCF
Potential reduction in energy consumption (electric/gas), assuming a 5% reduction in electricity and natural gas consumption per building	282 MWh/317 MCF	2,376 MWh/2,673 MCF	34–136MWh/ 187–746 MCF

Source: SLED, Buildings and Industry Summary for Moab, Utah.

* Based on research in O'Shaughnessy et al. † Data from SLED Building Stock Summary for Moab, Utah. ‡ Data from SLED Electricity Usage for Moab, Utah.

§ Based on utility-provided data, as the data was separated by sector and a total number of accounts was provided. Average annual residential natural gas consumption per customer by state can be found at *https://www.aga.org/annual-statistics/energy-consumption*.

** Calculated from multiplying assumed participation rate by number of buildings.

houses[4] found that the following are the most cost-effective energy efficiency measures in Utah:

1. Installing smart thermostats
2. Upgrading washing machines to ENERGY STAR® at wear-out
3. Upgrading electric furnaces to variable-speed heat pumps at wear-out
4. Installing LED lighting
5. Adding 1-inch (R-5) wall sheathing insulation at siding wear-out
6. Adding cellulose or fiberglass cavity insulation to uninsulated wood frame walls.

Resources

The following resources may be useful to guide further research and action steps to increase building energy efficiency:

Residential Energy Efficiency

- Guide for Benchmarking Residential Energy Efficiency Program Progress: *http://energy.gov/eere/better-buildings-residential-network/downloads/guide-benchmarking-residential-energy-efficiency*

Commercial Energy Efficiency

- Commercial Building Energy Rating and Disclosure Policies: *http://www.imt.org/resources/detail/commercial-building-energy-rating-and-disclosure-policies*
- American Society of Heating, Refrigerating and Air-Conditioning Engineers stretch code, a compliance option of the International Green Construction Code: *https://www.ashrae.org/resources--publications/bookstore/standard-189-1*
- Commercial Buildings Advanced Energy Retrofit Guides: *http://energy.gov/eere/buildings/advanced-energy-retrofit-guides*

In the SLED Local Energy Action Toolbox, find additional resources for energy efficiency and renewable energy measures and options for municipal operations: *http://apps1.eere.energy.gov/sled/cleap.html*.

Cities-LEAP is a project funded by the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE). It is part of an effort by EERE's Strategic Priorities and Impact Analysis Team to empower state and local decision makers with data-driven analysis. ■

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For more information, visit:
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[4] The analysis provides probability distributions for more than 100 building component variables as a function of general building parameters. Source: E. Wilson et al., Electric End-Use Energy Efficiency Potential in the U.S. Single-Family Housing Stock, National Renewable Energy Laboratory (2017), p. 101, http://www.nrel.gov/docs/fy17osti/65667.pdf.