HOME AND BUILDING ELECTRIFICATION:

OPPORTUNITIES FOR NEW MEXICO

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BE BOLD. Shape the Future.

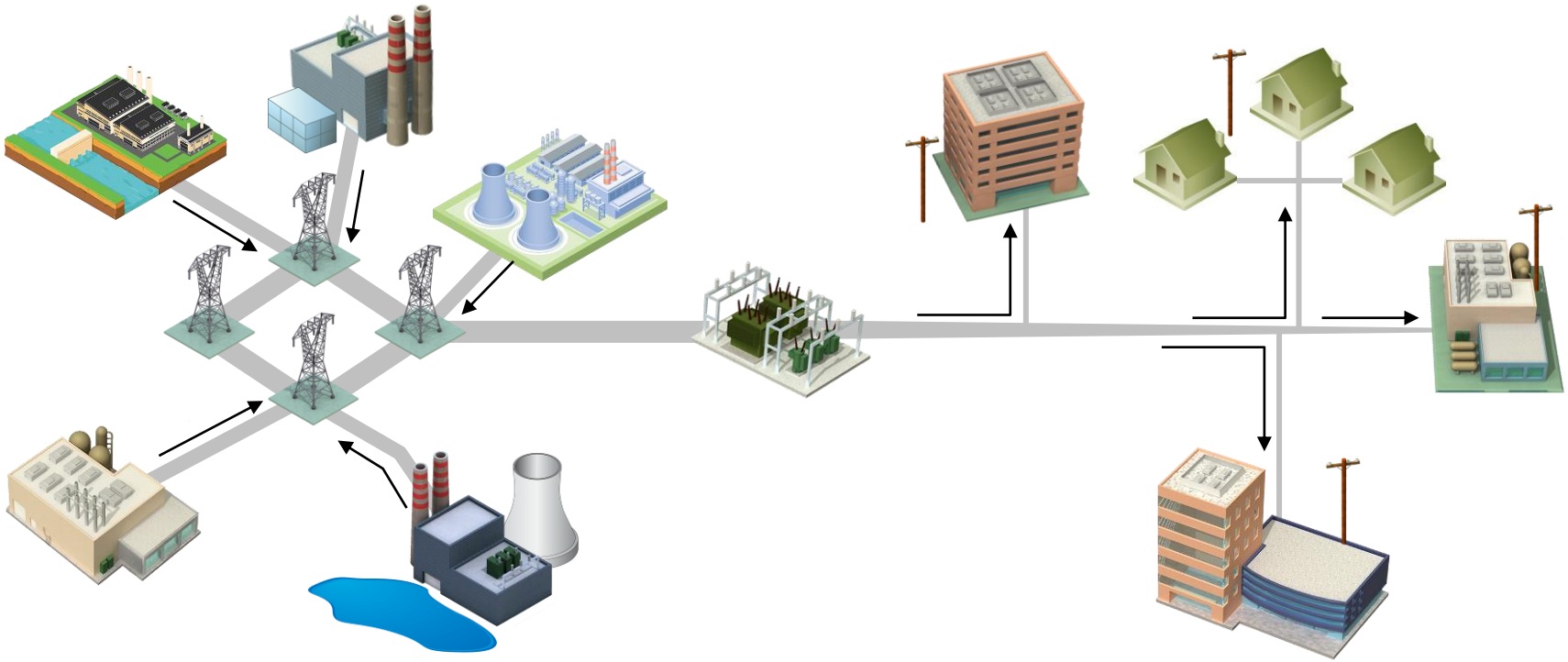
Motivation

- The United States has a long-term goal to decarbonize the electric grid[1]. This will require several market transformations across multiple sectors, including renewable power generation and storage options, increased electrification of end-use energy consumption and transition to demand-side management of residential and industrial loads.

- Electrification of multiple sectors (residential, commercial, industrial, transportation, etc) will require ubiquitous applications of power electronics of various ratings

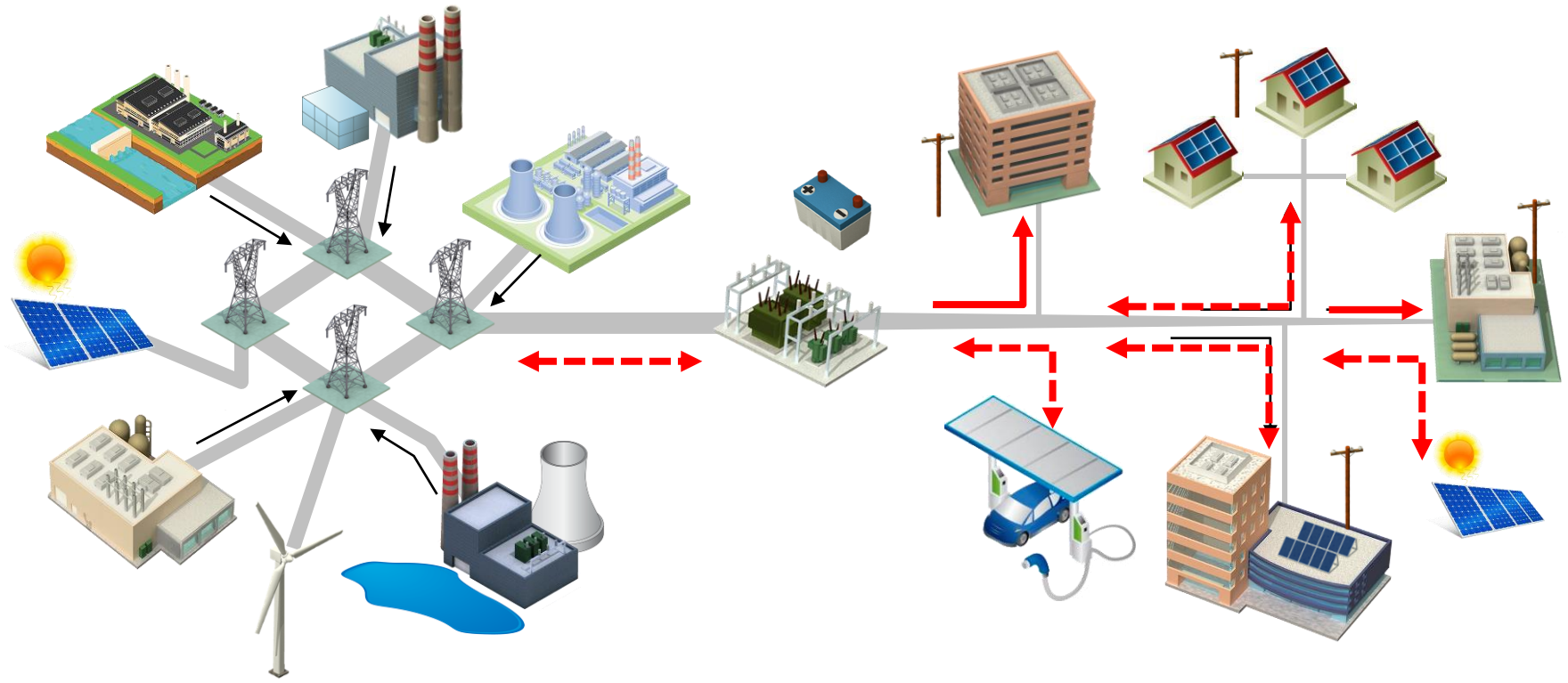
[1] The White House. 2021. “President Biden Signs Executive Order Catalyzing America’s Clean Energy Economy Through Federal Sustainability.” https://www.whitehouse.gov/briefing-room/statements-releases/2021/12/08/fact-sheet-president-biden-signs-executive-order-catalyzing-americas-clean-energy-economy-through-federal-sustainability/

Yesterday's Power System …
One Way Power Flow



Generation-Transmission **Substation** **Distribution System**

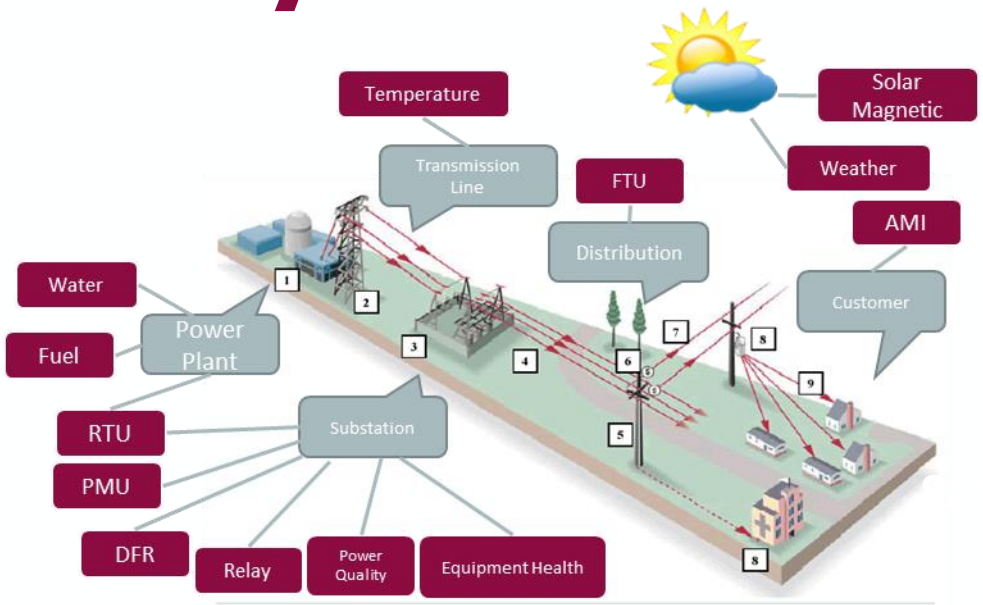
Today's Power System …
Two Way Power and Information Flow



Generation-Transmission ⟷ **Substation** ⟷ **Distribution System**

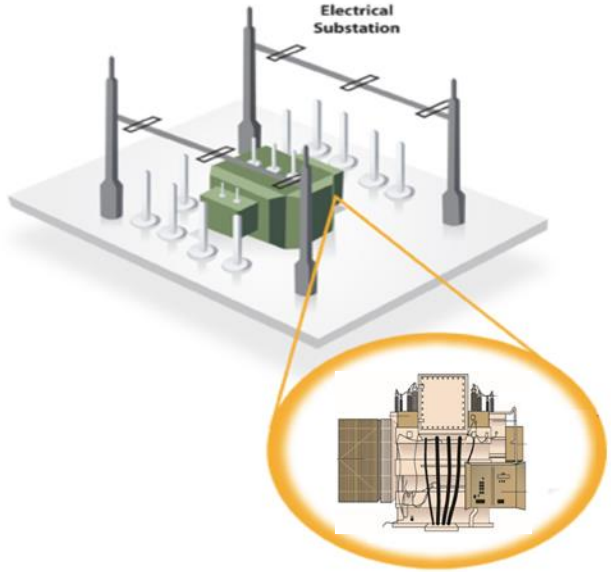
SunShot U.S. Department of Energy

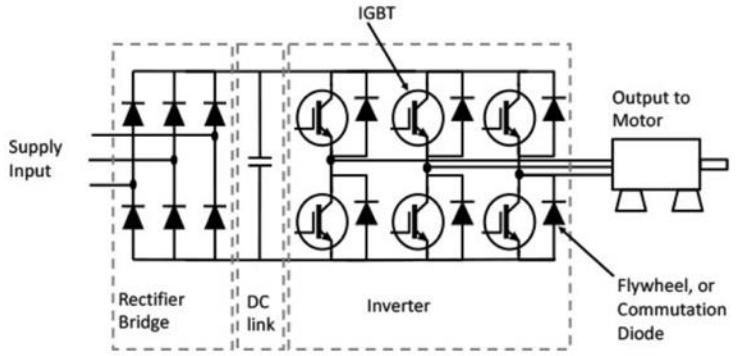
Where to Electrify : System-Wide Application Space



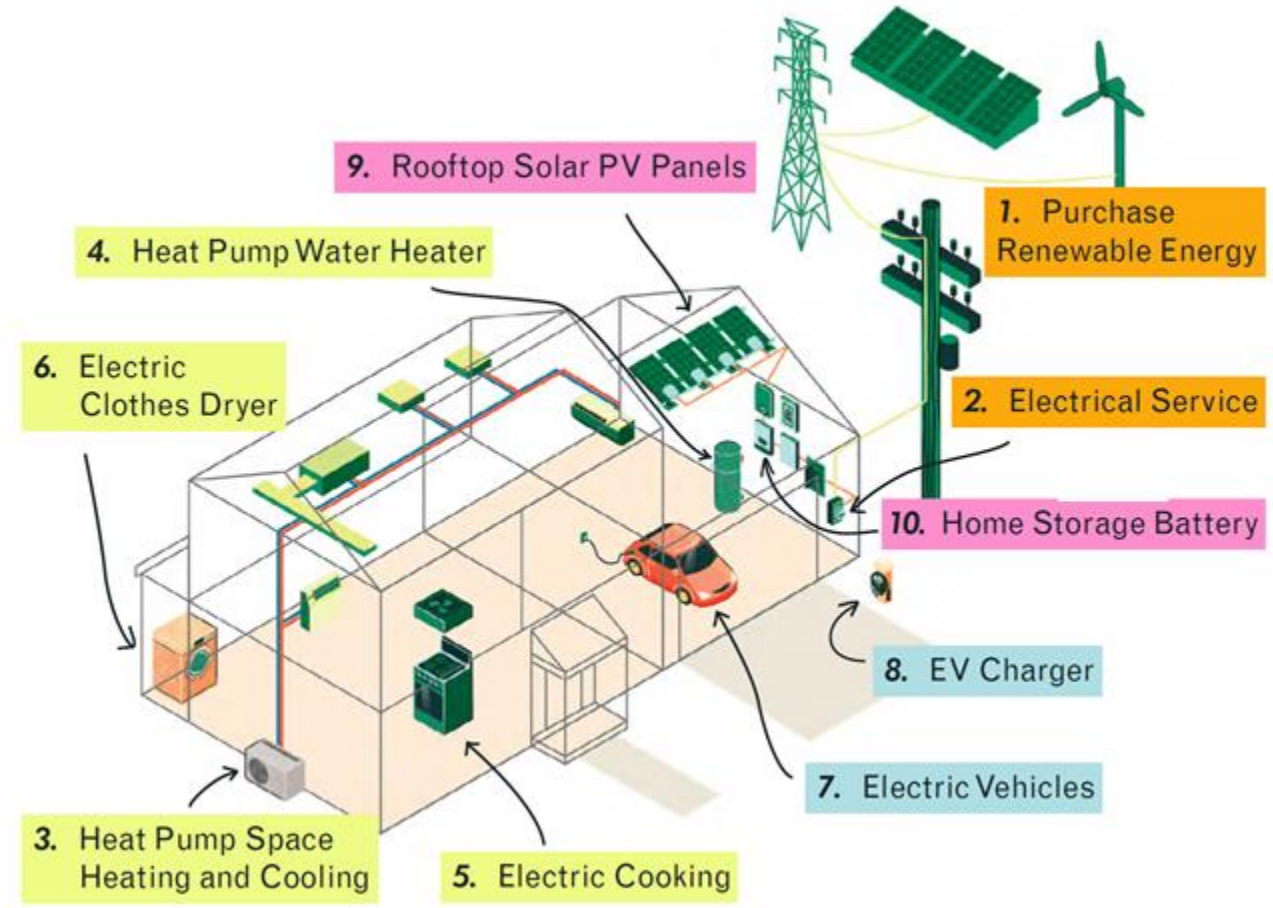
Modified from Duke Energy

https://www.progress-energy.com/florida/home/safety-information/storm-safety-tips/restoration.page?





Where to Electrify: Residential Applications



"Electrify Everything in Your Home: A Guide to Comfy, Healthy, Carbon-Free Living ", Rewiring America, https://www.rewiringamerica.org/electrify-home-guide

Electrification of Buildings

US DOE in May 2021 issued A National Roadmap for Grid-Interactive Efficient Buildings https://gebroadmap.lbl.gov

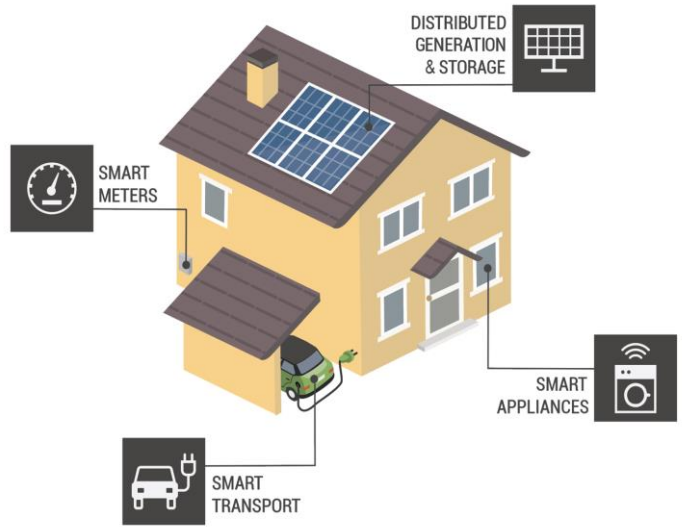
- Buildings that are not only efficient but also flexible.
- DOE estimates that with only mid adoption of GEB technologies (Adoption based on middle of the range of achievable adoption estimates) the US power grid can realize the following by 2030:
  - 284 TWHs in annual electricity savings;
  - 78 GWs in peak electricity demand savings;
  - $13B in annual system value.

ENERGY: The Power to TRANSITION NM's Economy, Grid Alternatives, iWest 2022

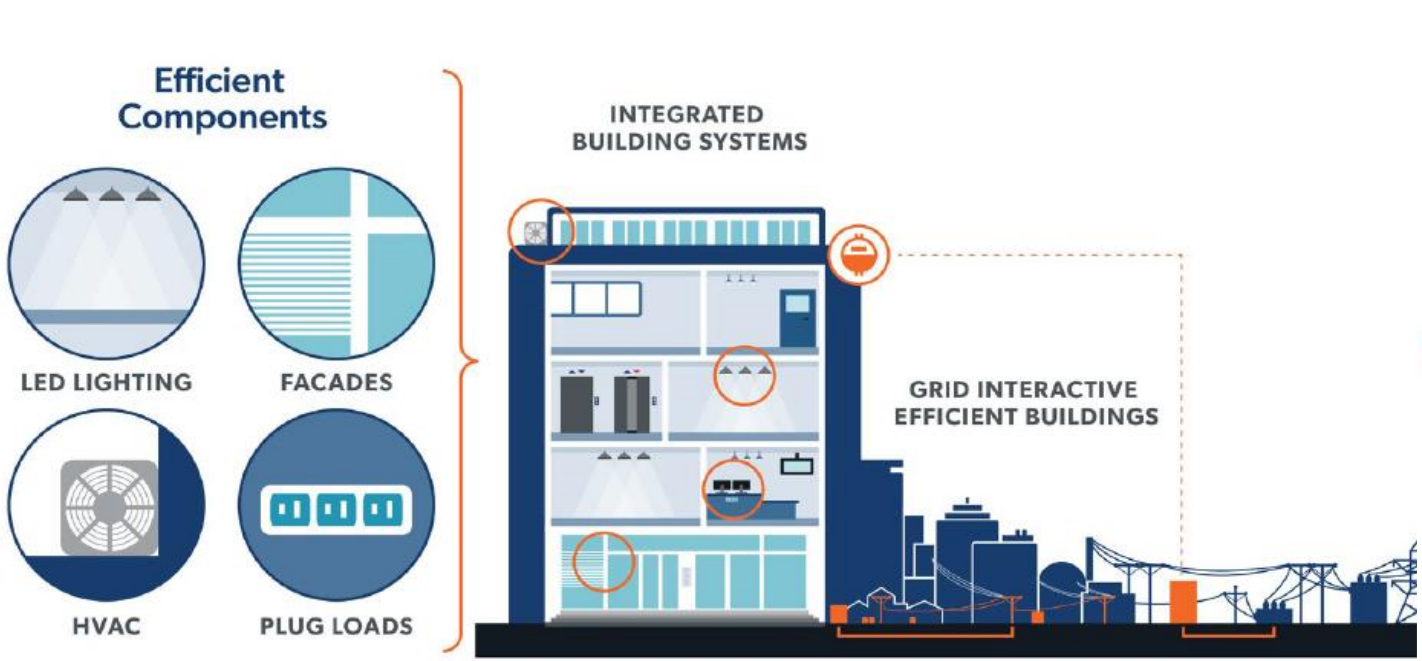
https://www.nmenergymanufacturing.com/wp-content/uploads/2021/09/Energy-The-Power-to...-.pdf

Benefits of smart and electrified buildings?

- Safety !
- Well paying jobs !
- Reliability and longer lifetime of equipment
- Resiliency to natural and man-made threats
- Higher efficiency of energy utilization
- Higher efficiency of Renewables utilization
- Customer flexibility and customer choice
- Energy savings, therefore energy bill savings
- Better quality of life for consumers



Electrification as a new efficient and flexible resource for energy demand:



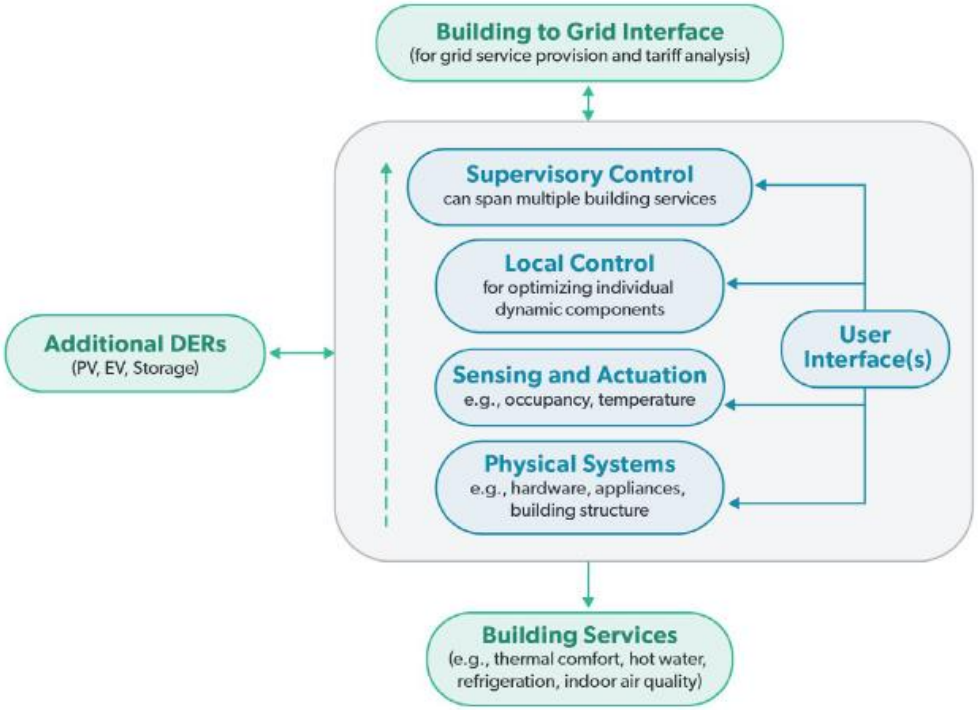


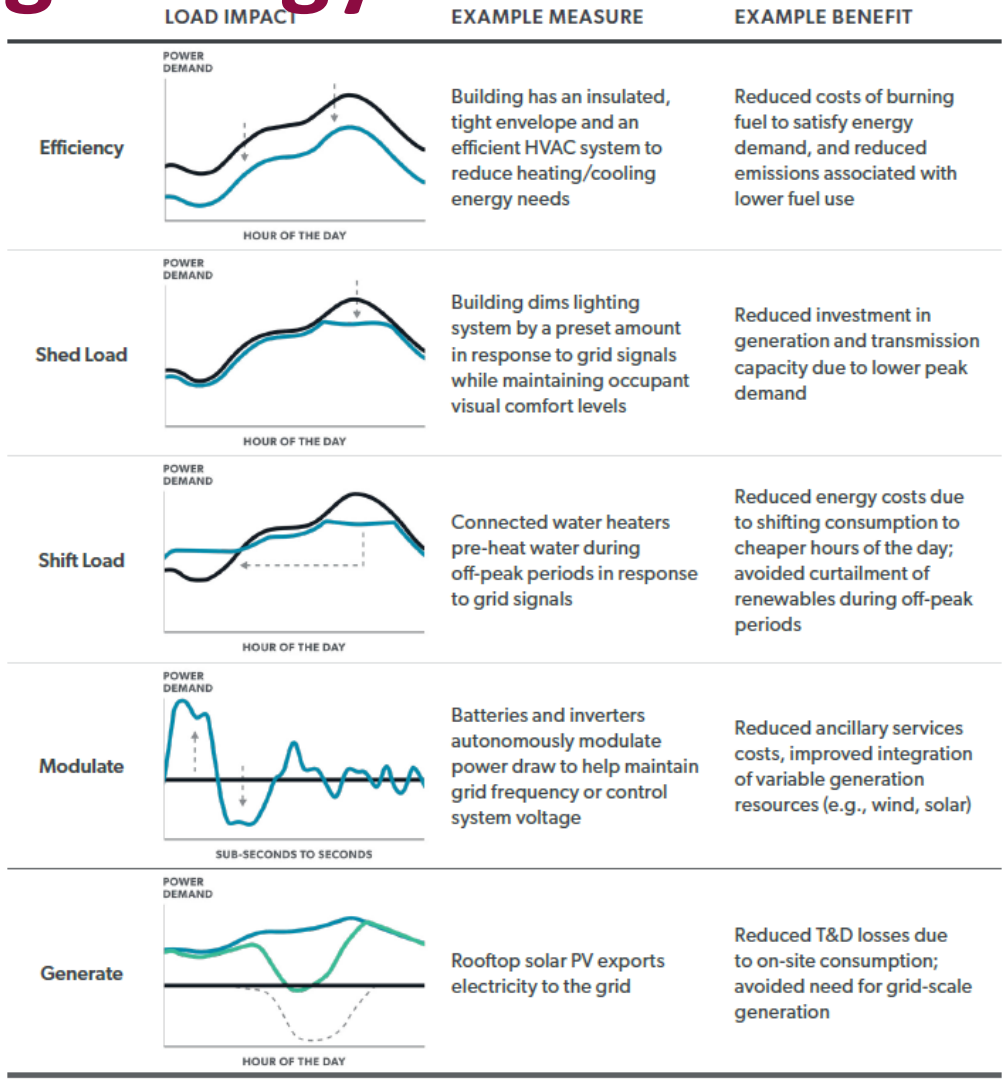
Illustration of a commercial Grid Efficient Building (GEB), or, for residential HAN), efficient components and communications
[Ref: Satchwell, Andrew, Mary Ann Piette, Aditya Khandekar, Jessica Granderson, Natalie Mims Frick, Ryan Hledik, Ahmad Faruqui et al. "A National Roadmap for Grid-Interactive Efficient Buildings." (2021).

Electrification of building energy controls

California 2019 Residential Compliance Manual

Appendix H - Demand Responsive Controls

- Demand response is an increasingly important function of buildings as distributed energy resources become more common and customers have access to time of use electricity rates and incentive programs designed to encourage demand side optimization.
- Demand response occurs on a range of timescales, from seconds to seasons, and represents any demand change in response to grid or economic needs.
- In addition to current time of use electricity rates, utilities in the future will likely connect electricity costs to high frequency fluctuations in both the supply and demand for electricity.
- Appropriate demand responsive controls allow building operators to maintain the quality of services a building provides and reduce the total cost of energy by automating a building's response to changes in electricity rates.



[Ref: Satchwell, Andrew, Mary Ann Piette, Aditya Khandekar, Jessica Granderson, Natalie Mims Frick, Ryan Hledik, Ahmad Faruqui et al. "A National Roadmap for Grid-Interactive Efficient Buildings." (2021).

NM Building Electrification: market potential

Capacity of Net-Metered Energy 2018 in MW for All Technologies

Investor-Owned Utility	Residential	Commercial	Industrial	Total	Solar Only Total	Solar Percent of Total
Public Service Co of NM	81.6	50.4	0.0	132.0	132.0	100.0
El Paso Electric Co	16.2	3.9	0.0	20.1	20.1	99.9
Southwestern Public Service Co	0.6	7.0	0.5	8.1	8.1	100.0
Cooperatives						
Central New Mexico El Coop, Inc	1.5	0.4	0.0	1.9	1.8	92.8
Central Valley Elec Coop, Inc	0.1	0.0	0.0	0.1	0.1	99.3
Columbus Electric Coop, Inc	0.2	0.1	0.2	0.5	0.5	99.6
Continental Divide El Coop Inc	-	-	-	-	-	-
Farmers Electric Coop, Inc - (NM)	0.2	0.1	0.0	0.3	0.2	64.3
Jemez Mountains Elec Coop, Inc	1.1	0.3	0.0	1.4	1.4	100.0
Kit Carson Electric Coop, Inc	2.0	0.7	0.0	2.6	2.5	95.9
Lea County Electric Coop, Inc	-	-	-	-	-	-
Mora-San Miguel Elec Coop	0.6	0.0	0.0	0.6	0.6	100.0
Navopache Electric Coop, Inc	0.0	0.0	0.0	0.0	0.0	86.0
Otero County Electric Coop Inc	3.5	1.3	0.0	4.8	4.8	99.8
Rio Grande Electric Coop, Inc	-	-	-	-	-	-
Roosevelt County Elec Coop Inc	-	-	-	-	-	-
Sierra Electric Coop, Inc	0.2	0.0	0.0	0.3	0.3	100.0
Socorro Electric Coop, Inc	0.4	0.4	0.0	0.8	0.8	100.0
Southwestern Electric Coop Inc - (NM)	0.1	0.0	0.0	0.1	0.1	50.0
Springer Electric Coop, Inc	0.0	0.0	0.0	0.1	0.1	100.0
Tri-County Electric Coop, Inc	-	-	-	-	-	-
Public Utilities						
City of Farmington - (NM)	0.5	0.1	0.0	0.7	0.7	100.0
City of Gallup - (NM)	0.1	0.1	0.0	0.2	0.2	100.0
Los Alamos County	0.6	0.0	0.0	0.6	0.6	100.0
Navajo Tribal Utility Authority	-	-	-	-	-	-

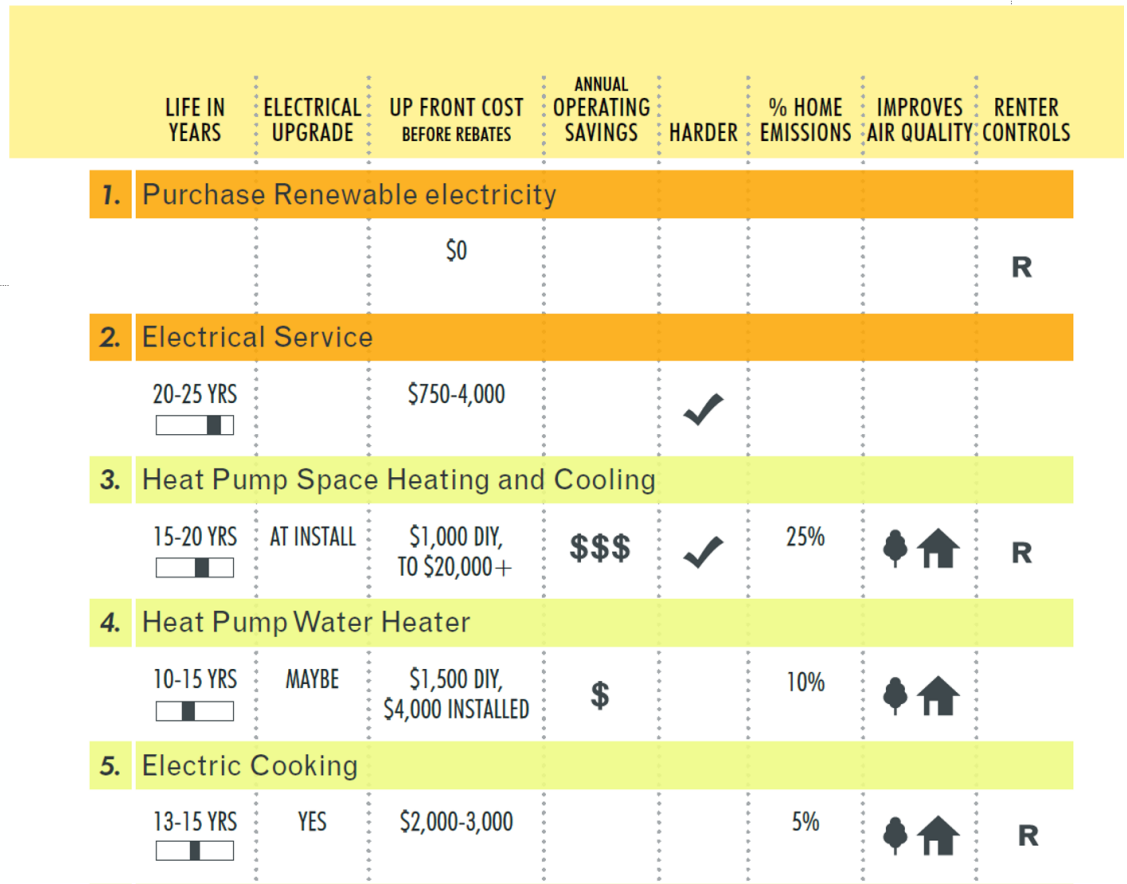
Savings Summary Tables

Region	HVAC	Water Heating	Lighting	Electronics	Refrigeration	Appliances	Total
Southwest	3,500	1,141	1,143	668	1,285	1,094	8,831
California	7,620	2,516	2,841	1,338	3,777	1,709	19,801
Texas	15,068	4,831	3,780	1,340	3,379	2,472	30,870
Southeast	43,105	19,430	12,579	4,350	12,495	7,593	99,551
Upper Midwest	6,207	2,939	2,509	1,275	2,660	2,204	17,794
Northeast	6,153	2,772	3,423	1,508	4,036	1,838	19,730
Northwest	5,543	2,261	1,934	1,173	2,446	1,693	15,049
Lakes / Mid Atl.	18,963	8,359	9,087	3,740	9,116	4,751	54,015
Rocky Mountains	1,589	483	559	280	599	458	3,968
Lower Midwest	6,398	2,322	1,858	746	1,791	1,394	14,509
TOTAL	114,145	47,053	39,712	16,417	41,584	25,205	284,117

TABLE 10: ENERGY SAVINGS BY REGION AND END USE IN 2030

[Ref: Satchwell, Andrew, Mary Ann Piette, Aditya Khandekar, Jessica Granderson, Natalie Mims Frick, Ryan Hledik, Ahmad Faruqui et al. "A National Roadmap for Grid-Interactive Efficient Buildings." (2021).

Savings potential for real customers



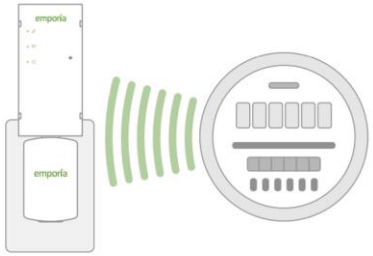
	LIFE IN YEARS	ELECTRICAL UPGRADE	UP FRONT COST BEFORE REBATES	ANNUAL OPERATING SAVINGS	HARDER	% HOME EMISSIONS	IMPROVES AIR QUALITY	RENTER CONTROLS
1. Purchase Renewable electricity			$0					R
2. Electrical Service	20-25 YRS		$750-4,000		✓			
3. Heat Pump Space Heating and Cooling	15-20 YRS	AT INSTALL	$1,000 DIY, TO $20,000+	$$$	✓	25%		R
4. Heat Pump Water Heater	10-15 YRS	MAYBE	$1,500 DIY, $4,000 INSTALLED	$		10%		
5. Electric Cooking	13-15 YRS	YES	$2,000-3,000			5%		R
6. Electric Clothes Dryer	10-13 YRS	MAYBE	$1,000-2,000	$$		3%		R
7. Electric Vehicles	20-25 YRS		$10K (USED) AND UP	$$$		50%		R
8. EV Charger (240V EVSE)	10-15 YRS	YES	$500-2,500					R
9. Rooftop Solar PV Panels	20-30 YRS	AT INSTALL	$15,000-30,000	$$$	✓	HELPS ALL		
10. Home Battery Storage	5-15 YRS[6]		$10,000-20,000	$	✓	HELPS ALL		

KEY:
$ SAVE $50+ PER YEAR
$$ SAVE $200+ PER YEAR
$$$ SAVE $500+ PER YEAR
INDOOR & OUTDOOR
OUTDOOR

"Electrify Everything in Your Home: A Guide to Comfy, Healthy, Carbon-Free Living ", Rewiring America, https://www.rewiringamerica.org/electrify-home-guide

Smart Home options

- Well paying jobs
  - Manufacturing opportunities for NM
  - Installation and maintenance jobs
  - R&D potential
- Higher efficiency of energy utilization
- Customer flexibility and customer choice
- Energy savings, therefore energy bill savings
- Better quality of life for consumers



July 6th, 2021

New Mexico Energy Manufacturing

Non-Wires Grid Alternatives: Behind-The-Meter

Olga Lavrova, NMSU
Daren Zigich, EMNRD

"Deploying an Advanced Metering Infrastructure (AMI) is a fundamental early step to grid modernization. AMI provides the framework for meeting one of the Modern Grid's Principal Characteristics – Motivation and Inclusion of the Consumer"
From: Strategy, NETL Modern Grid, "Advanced metering infrastructure."
US Department of Energy Office of Electricity and Energy Reliability (2008).

Contents

In conclusion

- New Mexico and Southwest have a significant potential for electrification of broad range of industrial and residential sectors;
- Economic, societal and technological benefits will contribute to energy equality and can specifically benefit LMI and underserved populations;
- Electrification of residential and industrial applications will accelerate achievement of the New Mexico's Energy Transition Act goals.

Thank you