IT'S TIME TO TRANSITION TO CLEAN ELECTRIC BUILDINGS

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BUILDING ELECTRIFICATION:

Constructing or converting homes and buildings to avoid burning fossil fuels for household uses

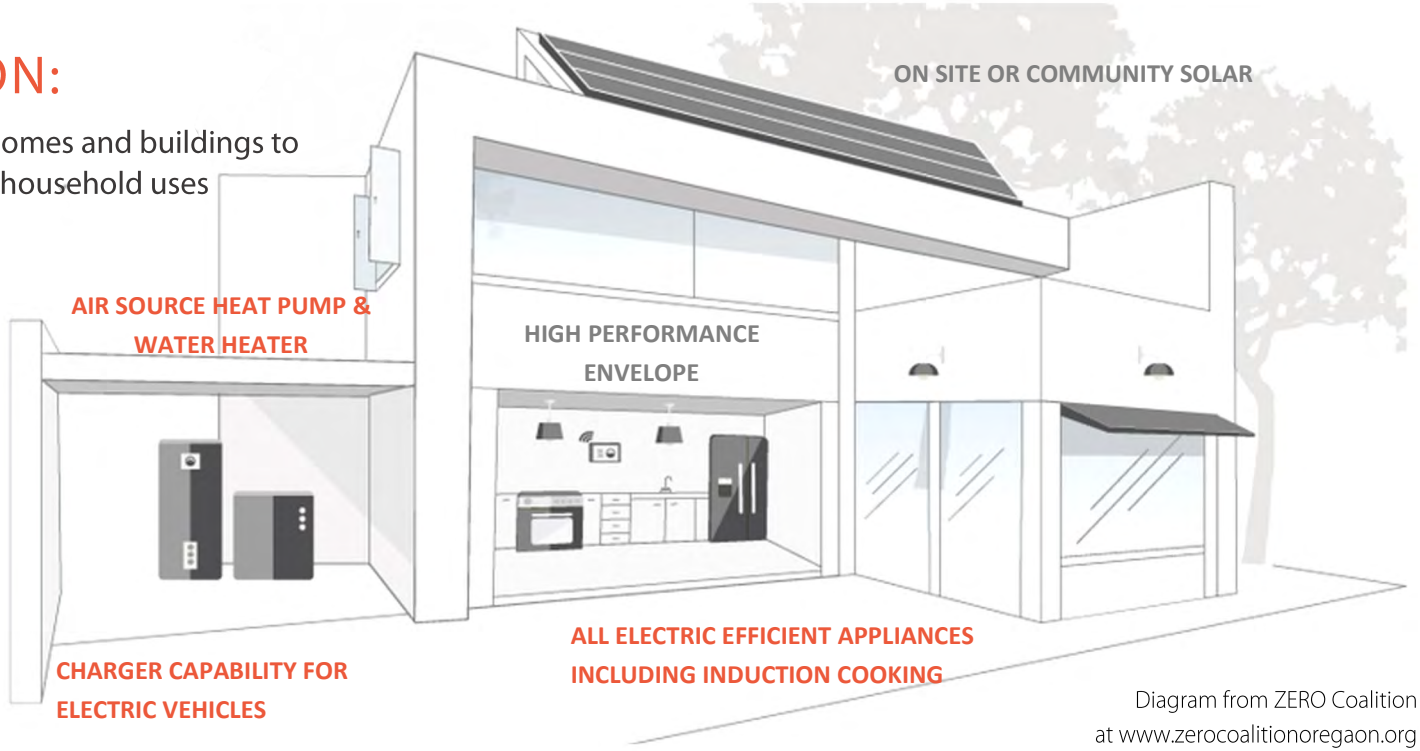

Diagram from ZERO Coalition at www.zerocoalitionoregaon.org

City of Las Cruces®

COST OF ELECTRIC VERSUS GAS AND ELECTRIC NEW HOMES

INTRODUCTION

Building electrification means eliminating the burning of natural gas and other fossil fuels within the home or other buildings by using electricity for space heating, water heating, cooking, and drying clothes. Electrification and decarbonization[i] of the electric grid work together to eliminate household greenhouse gas emissions while increasing safety, improving indoor air quality, and often saving money for both home builders and residents.

Building an all-electric new home is usually less expensive than a mixed fuel home and is the cheapest way to electrify. In addition, the falling costs and rising efficiency of electric appliances, combined with rebates and tax incentives, often make even retrofits of existing homes cost-effective.

MYTHS & FACTS

Myth: All-electric new homes are more complicated and expensive than gas/electric homes

Fact: Building all-electric homes is simpler, faster, and cheaper since they don't need gas lines

Fact: Heat pumps replace both the air conditioner and furnace, and can eliminate ductwork

For decades, the typical new home in the Southwest has been heated by natural gas and cooled by an evaporative cooler or an air conditioner, with air conditioning increasingly common. Water heating and cooking has been provided by either electrical resistance heating or by natural gas.

Technological advances have made all-electric homes faster, simpler, and less expensive to build and operate than old-style electric plus gas homes, while also increasing comfort and safety.

Air-source heat pump technology, in particular, has advanced rapidly to reduce electricity costs through higher efficiency, improve comfort with variable-speed compressors, and do so even at very low outside temperatures. Induction stoves and heat pump water heaters produce faster, cleaner cooking and higher efficiency water heating. While relatively new, these technologies are not difficult or expensive to install and operate.

Four recent studies of gas versus electric home costs all found that while the cost of installing a high efficiency heat pump may be slightly more or less than installing an air conditioner plus a gas furnace, any difference is much smaller than the cost of gas piping and connection to a gas utility[ii]. All four studies also concluded that the life-cycle costs, which include the cost of energy over time as well as the cost of construction, are less for electricity than gas.

AIR-SOURCE HEAT PUMPS FOR SPACE HEATING

MYTHS & FACTS

Myth: Heat pumps are more expensive to buy and operate than gas furnaces

Myth: Heat pumps are less comfortable, and need a heat strip to work in low temperatures

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Fact: Heat pumps cost less than the total of air conditioning, furnace, and gas connection costs

Fact: Heat pumps usually cost less to run than furnaces, depending on gas and electric rates

Fact: New heat pumps keep temperature stable, without big temperature swings or drafts

Fact: Heat pumps work at low temps without heat strips (100% capacity at 5 deg F, if needed)

An air-source heat pump (ASHP) is essentially an air conditioner that is designed to be reversible, so that it can pump heat into the home in winter, as well as pump heat out of the home in summer. The fact that it moves heat rather than creates it means that it can be much more efficient than a natural gas furnace or electric resistance heater, and this is the reason that it often costs less to operate than either. According to one report, "Electric heat pumps generally offer the cheapest way to cleanly heat and cool single-family homes in all but the coldest parts of the United States"[iii].

ASHPs are especially well-suited to the relatively warm winters in the Southwest region, and advances in heat pump technology also enable them to function even in colder climates with very low outdoor air temperatures. Until recently, ASHPs needed an added electric heat strip to work in low temperatures, but that is no longer true. Mitsubishi, for example, has a line of cold-climate ASHPs that operate at 100% capacity at 5 degrees F (-15°C), and other manufacturers have similar products.

Some of the perception of high cost for air-source heat pumps may come from confusion with ground-source heat pumps, sometimes called geothermal heat pumps. Ground-source heat pumps are efficient because they take heat from the ground, which in winter is warmer than the air, but they are expensive to install because a network of pipes must be buried underground. Air-source heat pumps are easy to install, similar to an air conditioner, and avoid the extra cost of installing an underground pipe network or natural gas piping.

Newer heat pumps can be more comfortable because they avoid temperature cycling and periodic blasts of cold or hot air. Older heat pumps (and gas furnaces) control room temperature using an on/off method, so that the room cools off until the heater kicks on and starts blowing large volumes of air, causing a draft. Many modern heat pumps use variable-speed compressors to run continuously at a low level allowing a much more stable temperature and avoiding the need for high volumes of air output, while maintaining the ability to rapidly heat or cool when needed.

For new construction, the type of ASHPs known as mini-splits give builders an option to eliminate some or all ductwork. Mini-splits have one outdoor unit and multiple indoor units, connected by small coolant lines Instead of ductwork, removing the cost of installing air ducts. Not needing ducts also makes mini-splits an attractive option for retrofitting older homes, because they can provide efficient heating and cooling without adding ducts. Traditional air conditioners and heat pumps need return ducts, which are not always present with existing gas furnaces or evaporative coolers, creating an added cost of conversion in existing buildings.

HEAT PUMP WATER HEATERS

MYTHS & FACTS

Myth: Heat pump water heaters (HPWHs) are expensive, slow, and require extra venting

Fact: Rebates cover most or all of the cost difference of HPWHs, and pay-off is lower bills

Fact: HPWHs don't normally need venting, unlike gas, and are faster than other electric heaters

Heat pump water heaters (HPWHs) are somewhat more expensive than gas or conventional electric water heaters to buy, but they are much cheaper to operate, and rebates cover most (if not all) of the price difference. Consumer Reports said: "They use about 60 percent less energy than standard electric water heaters. And while they cost more than electric-only models, installation is similar and payback time is short."[iv]

Most new HPWHs now include a resistive heating element and are called "hybrid" water heaters[v]. This extra resistive heating element is less efficient but is used only occasionally. It enables the water heater to heat faster than either a pure heat pump or a traditional (resistive) electric water heater[vi] if necessary, for example when multiple people take hot showers.

HPWHs start at about $600 more than the lowest price gas or electric heaters[vii], but El Paso Electric (EPE) rebates[viii] and Energy Star Tax Credits[ix] eliminate that price differential for retrofits, and the Inflation Reduction Act (IRA) offers the potential of even more generous incentives for HPWHs in new construction[x]. Consumer Reports gave HPWHs much higher overall ratings[xi] than gas or traditional electric water heaters, largely because of their higher efficiency and much lower operating costs. HPWHs do require up to 1,000 cubic feet of space and a drain for condensate and require ventilation through a grate or louvered doors if installed in a small closet. But garage locations work well, with the sometimes-appreciated side effect that a HPWH cools the garage as it pumps heat into the water. Construction is simplified relative to a gas water heater because no exhaust vent to the outside is needed.

INDUCTION STOVES

MYTHS & FACTS

Myth: Induction stoves are expensive, need pricey cookware, and don't cook as well as gas

Facts: Induction stoves are now similar in cost to gas stoves, and use cast iron or steel cookware

Facts: Induction stoves cook fast and evenly, keep the kitchen cooler, and avoid toxic fumes

Modern induction cooktops are faster, more efficient, and safer than gas or electric resistance stoves. Induction cooktops use magnetic coils below a ceramic glass surface to send electromagnetic energy directly to your cookware, without heating the cooktop surface. This makes them faster[xii] and more efficient[xiii] than gas or radiant electric cooktops, and the efficiency translates to a cooler kitchen.

Induction ranges combine an induction cooktop with a more conventional electric oven. These ranges used to be pricey luxury items, but not today. Consumer Reports gave one induction range costing $993 an overall score of 87[xiv]. The best gas range (86 overall score) cost $3,239; over three times more for lower performance!

Bare bones gas stoves can be as cheap as $500, but all require expensive gas piping and infrastructure. And for qualifying homeowners, new Inflation Reduction Act incentives will be up to $840 for induction stoves and $500 for electric system upgrades, depending on income level[xv], and can completely cover the roughly $600 cost differential between a top-rated induction stove and a low-end gas stove.

The perception that cookware for induction stoves is uncommon or expensive is also outdated. If a magnet will stick to your cookware, it will work with an induction stove. If you do need new cookware, it is reasonably priced. One local retailer lists a 16-piece, non-stick set of induction-compatible cookware for $69.00 (November 2022).

Induction stoves are safer since the lower temperature cooktop surface minimizes the chance of burns, and more importantly because they avoid the toxic fumes associated with indoor gas combustion. Peak indoor air pollution from gas stoves can reach levels that would be illegal outdoors[xvi], including poisons like nitrogen dioxide, carbon monoxide, and formaldehyde. Nitrogen dioxide from gas stoves has been shown to increase immediate symptoms of asthma in children by 42 percent, and long-term diagnoses of asthma by 24 percent[xvii].

IMPACT ON THE ELECTRIC GRID

MYTHS & FACTS

Myth: Electrification can't happen without increasing the capacity of the electric grid

Myth: Our electricity mostly comes from burning gas, so electrification doesn't help anything

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Facts: Our electric grid has excess, unused capacity in the winter, when heat pumps are used

Facts: Biggest source of our electricity is nuclear, not gas, and solar energy is increasing rapidly

A growing use of air-source heat pumps (ASHPs) for space heating will not require a larger grid because in summer they use no more electricity than an air conditioner, and only increase the use of electricity in winter, when there is excess grid capacity. Since the grid's peak demand in our region has long been driven by summer air conditioning, the infrastructure to meet this demand is already in place. In fact, when more electricity is used to heat homes and businesses during the off-peak winter season, the fixed costs of the grid are spread over a larger base and the average price of electricity should actually decrease.

Heat pump water heaters (HPWHs), like ASHPs, can actually improve grid efficiency, in this case by heating water at night when electricity is abundant, and storing that hot water for later use when electricity is more precious. In fact, utilities are exploring the use of HPWHs as assets to increase grid flexibility[xviii]. Electric stoves use very little energy compared to space conditioning and water heating[xix], so their occasional use during the summer peak hours is very unlikely to affect the electrical grid.

Another mistaken assumption is that our electricity mostly comes from burning gas, and that electrification won't help reduce carbon emissions until the electric utilities complete the transition to clean energy. Under New Mexico's Energy Transition Act, the 20 percent of El Paso Electric's (EPE) electricity that is delivered to New Mexico is required to be 40% renewable by 2025 and 100% zero carbon by 2045[xx]. In fact, most of EPE's energy already comes from zero-carbon (nuclear or renewable) resources[xxi], and multiple big utility-scale solar plants are currently under construction, approved, or in the planning stages. If EPE's latest application for an additional solar facility is approved, 50.8% of the energy they provide to NM is projected to come from renewable resources in 2025[xxii]. When the very large (non-renewable) nuclear contribution is added (48.5% of total system energy in 2020[xxiii]), it is clear that the vast majority of energy provided by EPE in New Mexico will be zero carbon in just a few years.

SOCIAL EQUITY

The argument that low and moderate income (LMI) households need natural gas because it is the cheapest energy for heating is no longer true. The much higher efficiency of heat pumps means that they use far less energy, so that they often cost less to operate than a gas furnace. The difference in cost for the purchase of new, high efficiency electric appliances can be substantially offset or completely covered by federal incentives, especially for LMI households. The new High Efficiency Electric Homes Rebates Act (HEEHR) program, part of the Inflation Reduction Act (IRA), includes up to $14,000 in electrification incentives for income qualified households, and is only one of several IRA programs that will help LMI households transition away from fossil fuels[xxiv]. New construction is explicitly listed as eligible for these rebates, although details will depend on the state IRA implementation plan. There are ways to electrify that could unwisely raise costs, for instance if gas furnaces are replaced by electrical resistance heaters, but that is wasteful and ill-advised.

In fact, building homes that use natural gas creates both financial and health hazards for LMI households. The cost of natural gas fuel has more than doubled in the last year [xxv], and is expected to keep rising in the near term. In the longer term, an effect called a death spiral is expected as more affluent homeowners install solar panels and heat pumps and stop using gas. This means that the gas system operations and maintenance costs are borne by fewer people, raising costs and motivating even more customers to disconnect. LMI customers suffer disproportionally from these rising gas costs when they are unable to disengage from gas, either because they are renters, or because they don't have the capital to replace all their appliances with efficient electric ones.

The health hazards of using gas are more immediate and more concerning. As noted earlier, burning gas in the home releases poisons including carbon monoxide, formaldehyde, and nitrogen dioxide, causing asthma and other problems, especially in children. Multiple factors increase indoor pollution risks for lower income households, including smaller home size, inadequate stovetop ventilation, and using gas stoves for heat when heaters are broken or ineffective. Building new housing with gas appliances creates an unnecessary risk that future occupants will be exposed to these pollutants.

MYTHS & FACTS

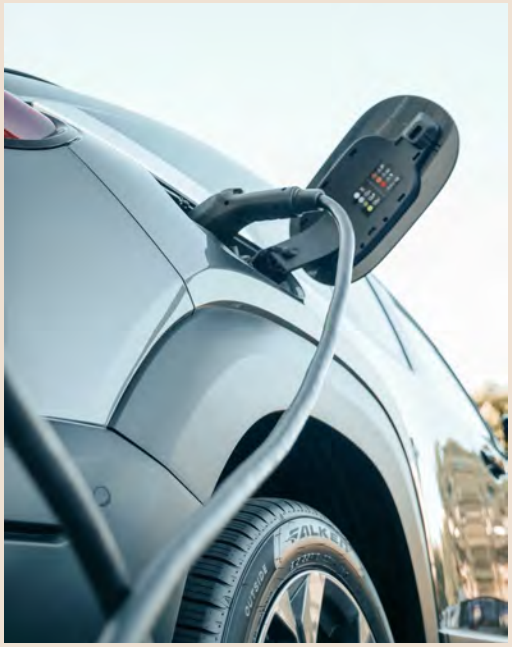
Myth: Low and moderate-income households need gas because it is the cheapest energy source

Facts: Heating with gas is often more expensive than heating with efficient electric heat pumps

Facts: Natural gas exposes LMI households to risks of cost spirals and health issues like asthma.

ELECTRIC VEHICLES

While electric vehicles (EVs) are not a permanent part of the home, most EV owners charge at home, and EVs are an important piece of a lower cost, cleaner, and more resilient energy future. The initial cost of EVs historically has been higher than gasoline vehicles, but prices have been decreasing. The IRA's elimination of manufacturer sales caps means that a 2023 Chevrolet Bolt EV (MSRP $26,595, 200 horsepower, 259-mile range[xxvi]) costs less than $20,000 after the $7,500 federal rebate. EV fuel costs are far lower than gasoline vehicles, averaging $485 per year versus $1,117[xxvii], and maintenance expenses are small because there is no need to change oil, fan belts, air filters, timing belts, spark plugs, and other items. Every electric car sold in the United States has a battery warranty that extends to at least eight years or 100,000 miles[xxviii].



EVs are cleaner because despite their larger greenhouse gas emissions during manufacturing, they don't pollute during operation, and they have 64% lower life-cycle greenhouse gas emissions than gasoline vehicles[xxix]. They help create a more efficient and resilient electric grid because most EVs are charged at night when electricity is plentiful, and they can store energy for off-peak use. El Paso Electric recognizes this benefit and encourages charging at night by offering two types of highly discounted EV charging rates, including one with a base rate of less than a penny per kilowatt-hour compared to the standard summer residential rate of about seven cents[xxx] (before additional fuel and other surcharges).

CONCLUSION

Building all-electric homes as part of a transition away from fossil fuels saves money, both in the construction phase and in the ongoing cost of operation. We also need to move away from fossil fuels to prevent the worst effects of climate change and avoid building new gas-fueled homes that will lock in carbon dioxide emissions for years to come. Retrofitting existing homes to be all-electric is more expensive, but savings from higher efficiency, as well as incentives and rebates, mean they can also be cost-effective.

Ultimately electrification is a choice that is economical, prevents irreparable harm to the environment, and makes our homes safer, healthier, and more comfortable.

Endnotes

[i]Decarbonization means reducing the amount of carbon dioxide emitted by the generation of electricity, and is mandatory under New Mexico law, especially the Energy Transition Act, Senate Bill 489, 54th Legislature, State of New Mexico, First Session, 2019, page 65: https://www.nmlegis.gov/Sessions/19%20Regular/final/SB0489.pdf

[ii]*The Economics of All-Electric New Construction in Utah*; 2022 Energy & Environmental Economics, Inc: https://www.ethree.com/economics-of-all-electric-new-construction-in-utah;

Benefits of Heat Pumps for Southwest Homes, May 2022, Southwest Energy Efficiency Project (SWEEP), Neil Kolway & David Petroy: https://swenergy.org/pubs/southwest-heat-pump-study-2022 ;

Electrification of Commercial and Residential Buildings – An evaluation of the system options, economics, and strategies to achieve electrification of buildings, November 2020, Group14 Engineering, PBC: https://www.communityenergyinc.com/wp-content/uploads/Building-Electrification-Study-Group14-2020-11.09.pdf;

The Economics of Electrifying Buildings: How Electric Space and Water Heating Supports Decarbonization of Residential Buildings; Billimoria, Sherri, Mike Henchen, Leia Guccione, and Leah Louis-Prescott, Rocky Mountain Institute, 2018: http://www.rmi.org/insights/reports/economics-electrifying-buildings

[iii]*Analysis of Electric and Gas Decarbonization Options for Homes and Apartments*, Nadel, S., and L. Fadali. 2022: www.aceee.org/research-report/b2205.

[iv]Consumer Reports, Water Heater Buying Guide, Updated May 13, 2021, accessed October 2022: https://www.consumerreports.org/appliances/water-heaters/buying-guide/

[v]El Paso Electric's website notes "HPWHs are commonly referred to as hybrid electric water heaters. … Some models are called "hybrid" because they can switch modes to operate like a standard electric model when needed" https://www.epesaver.com/service/heat-pump-water-heaters/

[vi]Comparison of Rheem 50-gallon electric models XE50T12CS55U1 and hybrid (heat pump) model XE50T10H45U0 shows the traditional electric model provides 63 gallons of hot water in the first hour, compared to 65 for the heat pump. The Home Depot website (on 10/10/2022) shows a warranty of 10 years for the HPWH, compared to 6 years for electric, a price differential of $610 ($1399-$789), and an annual savings of $320 ($424-$104): https://www.homedepot.com/b/Plumbing-Water-Heaters-Tank-Water-Heaters/50-gal/N-5yc1vZ2fkoqepZ1z1t3pn

[vii]Consumer Reports Electric Heat Pump price range $1000-$1800, Electric Tanked $400-$600, Gas Tanked $400-$1300: https://www.consumerreports.org/products/water-heaters-32960/gas-water-heater-32970/view2/

[viii]El Paso Electric's Residential Comprehensive Program offers a $300 rebate for heat pump water heaters: https://www.epesaver.com/service/heat-pump-water-heaters/

[ix]The Federal Tax Credit for Electric Heat Pump Water Heaters is $300: https://www.energystar.gov/about/federal_tax_credits/non_business_energy_property_tax_credits

[x]Up to $1,750 for HPWH under an-income qualified electrification project (Sect 50122(c)(3)(A)(i)): https://www.congress.gov/bill/117th-congress/house-bill/5376/text

[xi]Consumer Reports, Water Heater Ratings; Electric Heat Pump Overall Score 96, Electric Tanked Overall Score 56, Gas Tanked Overall Score 68 (Gas and Electric Tankless scored 51 and 55): https://www.consumerreports.org/products/water-heaters-32960/electric-water-heater-200221/view2/

[xii]Consumer Reports September 2022: "gas ranges, even high-power ones, tend to be slowest to bring water to a boil"; induction ranges "boil faster and simmer more steadily, and any adjustment you make to a burner happens immediately because the elements themselves don't get hot.": https://www.consumerreports.org/appliances/ranges/buying-guide/

[xiii]According to the federal Energy Star website, "The per unit efficiency of induction Cooking Tops is about 5-10% more efficient than conventional electric resistance units and about 3 times more efficient than gas.": https://www.energystar.gov/about/2021_residential_induction_cooking_tops

[xiv]Frigidare Gallery GCRI3058AF, price listed as $1,160, overall score 87 (lowest price on 10/18/2022 was $993 with free shipping); https://www.consumerreports.org/products/ranges-28974/electric-induction-ranges-37181/view2/

[xv]https://www.aceee.org/policy-brief/2022/09/home-energy-upgrade-incentives-programs-inflation-reduction-act-and-other

[xvi]https://rmi.org/insight/gas-stoves-pollution-health/

[xvii]https://www.smithsonianmag.com/smart-news/gas-stoves-are-worse-for-climate-and-health-than-previously-thought-180979494/

[xviii]https://www.greentechmedia.com/articles/read/energyhub-shows-that-heat-pump-water-heaters-can-be-demand-response-assets

[xix]U.S. Energy Information Administration, 2015 Residential Energy Consumption Survey; Slide 15 shows space conditioning total 32%, water heating 14%, and cooking one of many smaller, non-quantified energy users.

[xx]Renewable energy includes solar, wind, geothermal, hydropower, and biomass, but not nuclear. Zero carbon includes renewables plus nuclear energy. Energy Transition Act, Senate Bill 489, 54th Legislature, State of New Mexico, First Session, 2019, page 62-64: https://www.nmlegis.gov/Sessions/19%20Regular/final/SB0489.pdf

[xxi]EPE's 2021 Amended Integrated Resource Plan, January 7, 2022, page 69; Figure 12, EPE 2020 Energy Fuel Mix chart shows Nuclear 48.5%, Natural Gas 46.2%, Renewable 3.2%, and Purchased Power 2.1%.

[xxii]EPE's Application for Approval of its 2022 Renewable Energy Act Plan; New Mexico Public Regulation Commission (NM PRC) Case No. 22-00093-UT, page 439 of 605-page pdf file, Table VM-3, Projected RPS % line. Available at https://www.nm-prc.org/case-lookup-e-docket/ (log-in as guest, then put case no in search box).

[xxiii]EPE's 2021 Amended Integrated Resource Plan, January 7, 2022, page 69; Figure 12, EPE 2020 Energy Fuel Mix chart shows Nuclear 48.5% of total system energy. Note that in 2025, the nuclear energy delivered to NM will be less than 48.5% of the NM total, for two reasons: because the overall system energy will grow over time, making nuclear energy a smaller fraction of the total, and because one of the three nuclear generators will no longer provide energy to NM. A rough calculation yields an estimate that nuclear will form 30% of NM energy in 2025.

[xxiv]https://www.rewiringamerica.org/policy/high-efficiency-electric-home-rebate-act

[xxv]Las Cruces Utilities, Cost of Gas Charge, $3.92 per dekatherm in September 2021, $8.30 in September 2022.

[xxvi]https://www.caranddriver.com/chevrolet/bolt-ev

[xxvii]https://www.forbes.com/sites/jeffmcmahon/2018/01/14/electric-vehicles-cost-less-than-half-as-much-to-drive/

[xxviii]https://www.autoweek.com/news/green-cars/a38658354/electric-car-battery-life-explained/

[xxix]https://media.ford.com/content/fordmedia/fna/us/en/news/2022/03/04/new-study-finds-greater-greenhouse-gas-reductions-for-pickup-tru.html

[xxx]: EV charging rate is $0.00764 per kWh, and Residential Summer Rate is $0.06999 per kWh: https://www.epelectric.com/customers/rates-and-regulations/residential-rates-and-information/new-mexico-rate-tariffs-rules-and-regulations