# Colorado Near-Term Policy Advising

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EVOLVED ENERGY RESEARCH

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# Background

Colorado has a new governor, Jared Polis, who has made progress on energy & environment one of his legislative priorities. Combined with a receptive attitude from Xcel Colorado, the state may be able to make strides on energy policy that will set the course for reaching longer-term goals, namely 45% CO2 reduction in 2030 and net-neutral in 2050. Achieving such a rapid and sweeping transformation of the energy economy in Colorado, while protecting businesses and consumers, smart decisions will be needed concerning policy implementation, and this starts in 2019.

This whitepaper builds on previous EDF analysis, which examines the current and future carbon inventories for the state of Colorado, and addresses two topics in separable-parts:

- Wedge Analysis & Potential Policy Levers
  A wedges analysis for 2030 investigating a series of actions with estimated costs by sector, exploring how specific actions can address the emissions gap. This portion of the paper includes a qualitative discussion of possible policy drivers that could support the actions investigated in the wedges analysis
- Carbon Policy Discussion
  A broader discussion of policy mechanisms contrasting carbon pricing and sectoral specific policies in light of what EER has learned about the changes required for the energy system

# Wedge Analysis to 2030

## Emission savings and cost estimates from quantitative analysis

This whitepaper presents a wedge analysis for Colorado in 2030. A wedge analysis examines how many emissions can be reduced with a particular set of measures over a given timeframe as compared to a base case. Wedge analyses typically consider a timeframe that aligns with major long-term emission reductions goals and support policymakers understanding how different measures can stack together to achieve an emissions reduction target.

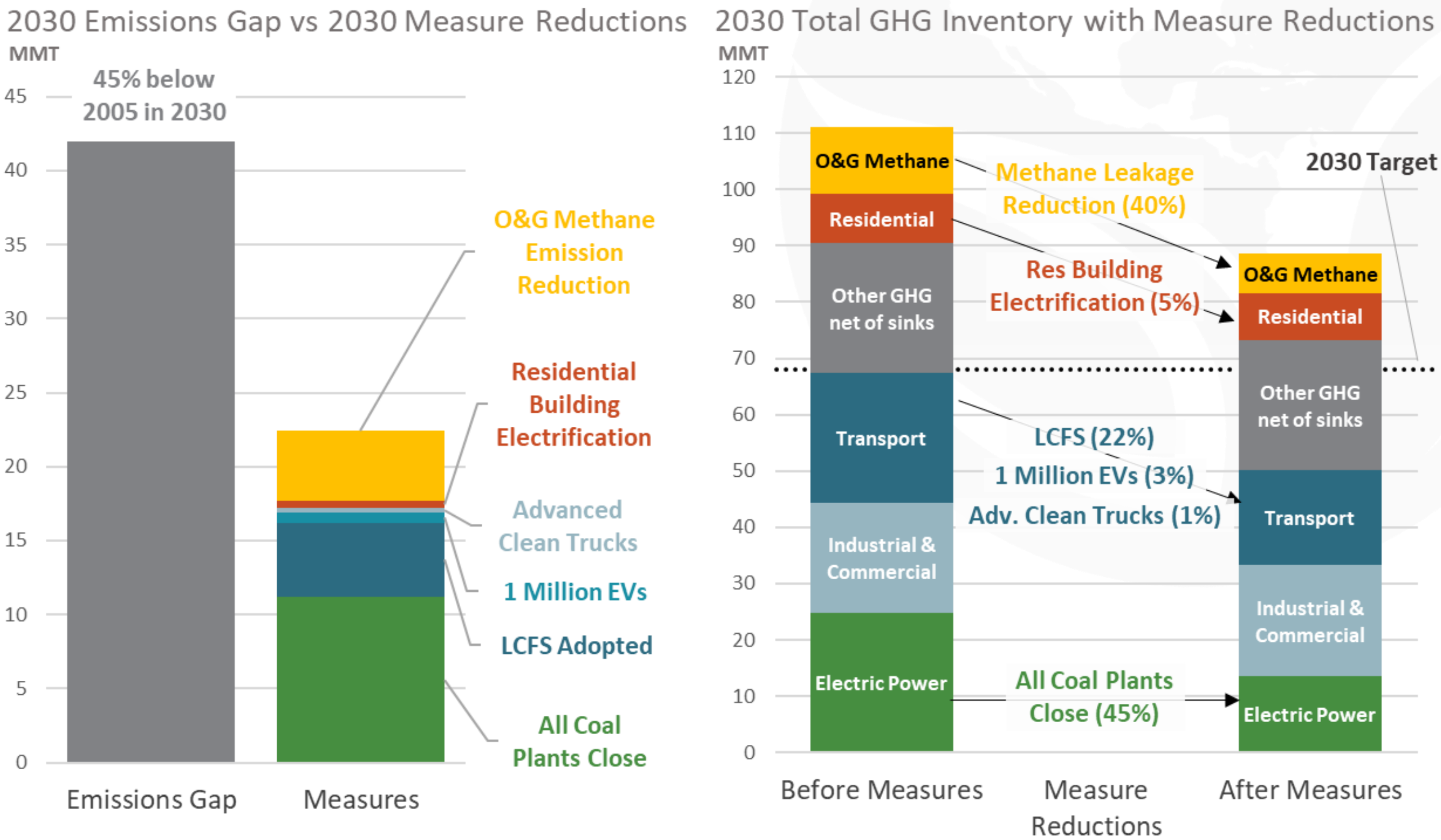
Our wedge analysis is based on a downscaling of a census-division EnergyPATHWAYS model with some simplifications to enable fast turn-around of the results. EnergyPATHWAYS is a bottom-up energy system tool tracking energy infrastructure for different scenarios, including stocks for buildings, industry, and transportation. While this wedge analysis targets 2030, we provide additional context for how the 2030 results compare to a trajectory necessary to achieve ambitious 2050 emission reductions, based on other Evolved Energy Research deep decarbonization pathway studies.

## Results

| Measure | Baseline | Measure Description | $/Tonne CO2e | MMT in 2030 | Consistency with DDP |
|---|---|---|---|---|---|
| **Coal Plant Closures by 2030** | Baseline projects coal plant retirement schedules based on the gap analysis. | Retire all coal plants by 2030, replaced with a mix of RPS resources and gas generation. | $54 | 11.2 | High: DDP sees no role for coal past the 2030 timeframe. |
| **Low Carbon Fuel Standard (LCFS) Adoption** | No LCFS. | Implement California's LCFS Carbon Intensity Standards for diesel and gasoline. 20% reduction in both by 2020. [1] | $243 | 5.0 | Medium: Biofuels for diesel (heavy-duty) applications is very consistent with deep decarbonization analyses. Gasoline is generally *displaced* by electrification instead of *replaced* by biofuels given their limited quantities. Higher gasoline prices, however, may facilitate faster electrification. |
| **EV deployment** | US projected share of EV deployment. | Deploy 1M electric vehicles by 2030 in the light-duty electric sector. | $36 | .73 | High: Vehicle electrification in the light-duty sector is one of the few completely necessary policy outcomes. One million vehicles by 2030 in a vehicle population of 5 million is consistent with the acceleration of uptake rates in a deep decarbonization pathway. |
| **Advanced Clean Trucks** | No adoption of electric vehicles. | 15% adoption of electric HDV and MDV trucks in 2025 acceleration to 30% by 2030. | -$91 | .26 | High: Electrification of heavy-duty application, specifically many short-haul applications, is a key deep decarbonization strategy to reduce overall demand for fuels. |
| **Residential Building Electrification** | No fuel switching. Maintain the share of electric/gas homes by end-use. | Electrify 500,000 of Colorado homes by 2030 for space heating, water heating, and cooking. | $41 | .46 | High: Residential electrification is a key strategy by 2050, and the rates of adoption, which imply 500,000 electrified homes by 2030, are consistent with deep decarbonization uptake. |
| **Oil and Gas Methane Leakage Reduction[2]** | No leakage reduction beyond the gap analysis. | Focus on leakage from the ~20% of emission categories that account for 80% of all methane emissions. | $2 | 4.8 | N/A: Other DDP work focuses on CO2 only. These emission reductions decrease the level of energy required by the rest of the energy economy. |

[1] Cost are based on level of reduction from: https://stillwaterassociates.com/projecting-the-costs-of-californias-cap-trade-and-low-carbon-fuel-standard-programs/

[2] This analysis was preformed separately from the other measures. The other measures are adapted from a downscaling analysis. This measure is a back-of-the-envelope estimate based on a 2014 study prepared for EDF by ICF International: http://www.edf.org/sites/default/files/methane_cost_curve_report.pdf




The measures included in this analysis address just over half of the 45 MMT emissions gap from the earlier EDF analysis. Closing all coal-fired power plants and O&G methane leakage reduction are the most impactful measures in their respective sectors. Of all sectors targeted by measures, the transportation sector has the greatest remaining emissions.

The results above are presented here as a snapshot of 2030 emission reductions as we believe determinations around policy timing and implementation are too subjective to defensibly present a time series of emission savings through 2030. Based on the projected 2030 emission inventories from the gap analysis, the power sector is the most promising sector to contribute to the remaining emissions gap with additional effort. But additional reductions from other sectors will likely be needed as well.

## Notes on the methodology behind the results

This analysis framework was selected to avoid the possibility of double-counting. All measures were implemented in order in the model, so this represents their impact above and beyond the impact of other measures. Depending on the ordering of measures in the analysis, there may be some allocational impacts (i.e., if you added EVs before retiring coal) but it would not affect the total potential reductions from all measures.

Changes in the emission intensity of Colorado's power system are reflected in emission abatement estimates from electrification measures, including EV deployment. The marginal electricity used to satisfy increased electricity demand from EVs and other electrification must satisfy the State's RPS obligations but is otherwise satisfied by thermal generation. The analysis did not include an emissions intensity standard.

The cost per tonne of CO2e figures above represents the net present value of the change in levelized costs divided by the net present value of the change in emissions (see the example below). This means that for an EV, the net impact would be represented below. We do not conduct this at the level of individual vehicles, so the values we show in the report are the impact of the entire measure.

**Example calculation for $/tonne of CO2**

| **NPV Numerator ($)** | |
|---|---|
| EV Purchase Cost | $30,000 |
| EV Maintenance Costs | $5,000 |
| EV Electricity Costs | $15,000 |
| ICE Purchase Cost | -$20,000 |
| ICE Maintenance Cost | -$7,500 |
| ICE Fuel Costs | -$20,000 |
| **Total NPV Costs** | **$2,500** |
| | |
| **NPV Denominator (tonnes CO2)** | |
| ICE Fuel Emissions | 70 |
| EV Electricity Emissions | 20 |
| **Total NPV Emissions Savings** | **50** |
| | |
| **Abatement Cost ($/tonne)** | $50.00 |

## Analytical shortcomings and next steps for improvements

While downscaling based analysis can offer key insights at a more localized level in the context of a much larger system, there are some notable limitations in this analysis driven by compressed timeline:

- This analysis has no calibration to existing state-level energy demands and equipment stocks.
- Measures are implemented through 2030 (though costs and emissions savings persist through 2050), but an assessment of the attractiveness of each measure would need to consider the role each of these strategies plays through 2050.
- Mid-term costs and emissions savings are not a reliable predictor of the relative importance of measures to a cost-effective long-term pathway. EVs, for example, are a critical piece of any deep decarbonization pathway but these results don't suggest that

strongly enough. Similarly, the effectiveness of an LCFS policy is likely to plateau in 2030 and may direct high-value resources to modest value uses (biomass to gasoline) where there are alternatives(electricity) at the expense of other, higher value uses.

- With the limited time, we could only implement a relatively limited set of approaches. Many strategies, including electrification, become more attractive with additional complementary policies (higher RPS, etc.).
- Policy timing and implementation decisions may affect cost and emissions and will shape the impacts of different measures.
- O&G methane emission reductions are estimated through a separate analysis based on the 2014 EDF/ICF study on the potential for reducing upstream leakage in the natural gas system and assumes the same level of reductions and cost for CO as the national study
- The LCFS analysis is limited to estimates of costs based the level of emission intensity reduction drawing on California's LCFS experience. This approach provides no information about the possible measures deployed for LCFS compliance, nor the level of emission savings from each measure.

While there are limitations to this analysis, we believe the fundamental approach to wedge analysis is sound. Another iteration of this analysis could make meaningful improvements to both accuracy and level of insight from the results by addressing the following items:

- Refine the downscaling methodology with updated data and appropriate benchmarking to state values.
- Extend the wedges analysis through 2050 for baseline and emission reduction measures, consider 2030 results along with 2050 results for appropriate context.
- Consider a broader set of sector-specific strategies that fit together for 2050-target compliant pathways.
- Develop least-cost supply portfolios to understand the composition of the electricity sector as well as new linkages between liquid fuels and biomass and electricity supply

# Wedge Analysis: Supporting Policy

A qualitative discussion of potential policy levers to enable these measures

## Electricity sector measures

Policy tools to incent coal retirements by cooperative and municipal utilities are a priority given these utilities are responsible for 40% of Colorado electricity sales and Xcel Energy has already committed to an 80% reduction of emissions from 2005 by 2030. Given the autonomy of cooperative and municipal utilities, a legislative action, rather than regulatory action, will likely be required. Promising potential policy levers include:

- ### Raise the RPS requirement
  Increasing the RPS requirements, particularly for cooperative and municipal utilities, will force renewable adoption that may not otherwise occur even if the renewables are economical compared to fossil generators. More renewables will pressure higher-cost coal plants to retire. However, a higher RPS doesn't guarantee that coal plants will retire. Decision making around coal plants in Colorado, as with other parts of the county, is not

always done solely on an economic basis, particularly for large generation & transmission co-operatives in the state[3].

- ### Emissions intensity standard

  A carbon emission intensity standard, or emissions performance standard, could serve as a vehicle to reduce emissions from coal plants. An emission intensity standard would likely be challenging to enact but would directly pressure coal plants to retire (or pursue emissions capture retrofits) without explicitly defining which resources should replace them. California has a long-standing emission performance standard, which does not cap total emissions, but had almost eliminated coal-fired generation from the state prior to AB-32's implementation.

- ### Enable transitions from mine closures

  Closing enough coal plants in Colorado will likely mean shuttering many of the remaining coal plants in the western part of the state. A durable policy mechanism that closes the coal plants will likely provide some level of support or job training in communities which depend heavily on these mines, which could be impacted by plant closures.

## Transportation sector measures

Driving abatement for transportation is a major challenge for almost all jurisdictions, particularly in car-centric states with long travel distances like Colorado. Policy opportunities to enable the measures analyzed here include:

- ### Fully utilize VW settlement money to lower barriers to EV adoption

  Prioritize of deploying charging infrastructure and raising EV awareness amongst potential buyers with the settlement funds. EV adoption continues to be hampered by awareness, range and charging concerns[4]. State policy can be uniquely valuable in addressing this for Colorado but must balance effective use of State resources effectively with enabling the market to create opportunities. As battery technology continues to improve and range increases, EV awareness, and charging availability/range concerns will become less significant barriers.

- ### Leverage partnerships to enable and support EV deployment

  Continue to engage in REV West, which will continue to be an effective platform for raising awareness and for partnering with neighboring states to achieve greater impact. Xcel Energy may be a helpful partner in rolling out a broader charging network, as electrification will fit with their objectives around decarbonization and a shifting utility business model. Finally, consider opportunities to decrease barriers and incent fleets/markets where the lower cost of EV operation is already changing purchasing decisions. These large customers, like ride-sharing companies, face a different set of barriers than individual consumers and may already see an opportunity to realize savings from EVs, and may be desirable partners to increase EV deployment.

[3] Tri-State Generation serves roughly 10% of load in the State, and is an example of a G&T cooperative with significant opportunity to move away from coal to lower cost renewables: https://www.rmi.org/wp-content/uploads/2018/08/RMI_Low_Cost_Energy_Future_for_Western_Cooperatives_2018.pdf

[4] https://www.nrel.gov/docs/fy18osti/70371.pdf

- **Upon additional study, pursue an LCFS like California's policy if cost-effective, and it works with 2050 objectives**

  The LCFS results in this analysis suggest that the policy could be costly but drive a meaningful level of emission reductions, and this analysis mirrors California's updated policy of a 20% reduction by 2030. Looking at these wedge analysis results for 2030 without the broader context of 2050 results seems to suggest that the LCFS could play a significant role in a 2050 pathway. Our analytical experience bears out a different conclusion and finds that LCFS efforts alone plateau before reaching the level of deployment required for 2050 goals.

  A concern with the LCFS approach is the possibility of pushing the market to an undesirable outcome in the broader context of the State's objectives. An example of this is early in California's experience with the LCFS; significant research and litigation were undertaken over the accounting of biofuels concerning emissions from indirect land-use change. Getting the accounting wrong could have driven higher emissions than sticking with gasoline. Similar consideration should be taken with an LCFS for Colorado, particularly with diverting biomass feedstocks to replace gasoline at the expense of potential higher value uses not considered in this analysis.

  An LCFS can provide useful early stage incentives for transit planners, EV manufacturers, and consumers, but most policies target modest emission reductions[5]. LCFS attempt to balance not-picking winners against slower emission reductions. It's possible to enable a path to much faster emission reductions by forcing the market toward the desired technology adoption or away from losers. The LCFS approach can be contrasted with banning the sale of gasoline and diesel ICE, as we have seen in the UK and France, which also doesn't pick alternatives but is likely to enable much faster deployment on a path to 2050.

  We would caution that additional study of an LCFS is needed before recommending the adoption of an LCFS for Colorado. If the State adopts an LCFS, it would be wise to align as of the policy as California's efforts. This would serve to capture the benefit of California's extensive research efforts around LCFS design, as well as leverage the size of Colorado and California's market together for greater impact in driving investments in new technologies and fuels.
- **Establish an Advance Clean Trucks policy**

  Push for a policy that aligns with California's Advance Clean Truck polices to make an even larger, consistent market for electrified MDV and HDV trucks, which can go on the road at cost savings to society.

## Residential electrification measures

Utility program offerings will be critical to increasing fuel-switching away from natural gas to electricity. Policy opportunities to enable greater electrification include:

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[5] See a survey of LCFS policies as of 2017 on pg 7:
https://institute.smartprosperity.ca/sites/default/files/lowcarbonfuelstandards-web.pdf

- ### Support cooperative and municipal utility electrification programs
  Some distribution cooperative and municipal utilities lack the capacity to develop effective electrification programs or may face limits on programs from their generation provider. Draw on electrification lessons learned from the Northeast[6], which has been successful in cost-effectively increasing the penetration of heat pumps, to create programs to support utilities designing and deploying effective electrification programs. The Colorado Energy Office might be an effective vehicle to deliver these services, targeting delivered fuel customers for retrofits and engaging directly with generation and transmission cooperatives.
- ### Engage gas utilities about the future of their gas distribution systems
  Actively engage Xcel Energy about the future of their gas delivery system in Colorado, and how they can restructure their EE and incentive offerings to align with a future of significantly diminished gas flow on their distribution system. Part of that engagement is encouraging more electric-only housing developments as new construction continues in Xcel's territory.
  For all the Colorado PUC jurisdictional gas utilities, examine how accelerated depreciation of gas pipeline infrastructure together with revised incentive and program offerings can work to develop gas distribution pipeline strategies that fit will a low carbon pathway.

## Oil & Gas methane leakage reduction measures

These measures appear low cost from an emission reductions standpoint, but are likely to face significant opposition from existing vested interest:

- ### Increase the frequency of inspections and reporting under the LDAR program
  Colorado is unique for having a Leak Detection and Repair (LDAR) program that covers both new and existing facilities. It is an effective existing mechanism, that can be enhanced with great frequency, which will increase program costs, but drive greater low-cost emission reductions.
- ### Expand the LADR to require updates for the most cost-effective measures
  The EDF study finds several measures that will on net save producers, processors, and transporters of natural gas money by capturing more of the product they are selling. After review of these findings with stakeholders to formulate policy, LADR could be expanded to require some of these updates.

[6] https://www.veic.org/resource-library/driving-the-heat-pump-market-lessons-learned-from-the-northeast

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