ENERGY INNOVATION
POLICY & TECHNOLOGY LLC

www.energyinnovation.org
98 Battery Street Suite 202; San Francisco, CA 94111
policy@energyinnovation.org

US STATE POLICY OPTIONS TO CUT CLIMATE IMPACT

ENERGY INNOVATION ● AUGUST 2019

CONTENTS (BY SECTOR)

Leading states have many policy options to reduce greenhouse gas emissions. To find those that deliver lower energy bills, great jobs, and sharp reductions in carbon emissions, it is necessary to first examine both the current sources of emissions in-state, and see which sectors are likely to see growth in the future. It will then will become clearer which of the following policy recommendations will deliver maximum impact.

In general, the path to very low or zero emissions in the **electricity sector** is relatively clear, and there is good experience helping guide both the technologies and approaches that can deliver major reductions. Cleaning up the electricity system offers a double bonus: the faster states decarbonize their electricity sectors, the more that low-carbon electricity can be used to decarbonize transportation, buildings, and parts of industry. For **transportation**, electric vehicles (and the new infrastructure to support them) are very important, but it is also still crucial to focus on driving efficiency in gas and diesel burning vehicles, since many more will still be sold. The existing **building** stock can be upgraded to be much more efficient, and there are great opportunities to switch from burning oil or gas on-site at buildings to getting the same service from electricity. **Super-pollutants**, such as methane and hydrofluorocarbons (used primarily in cooling equipment), are another clear and important near-term opportunity to reduce climate impact.

The path to zero emissions is less clear in **industry** and **agriculture**. States have some options to address emissions from those sectors, but more work will be needed in those realms to drive to zero.

Carbon pricing can make all of these options more cost-effective and easier to achieve, but it is not a substitute for sector-specific policies.

ELECTRICITY

Adopt a 100% clean energy standard.

One of the most effective policies for reducing greenhouse gases in almost every state is a 100% clean energy standard for the electricity sector. The standard could include all sources of zero carbon electricity (solar, wind, biomass, hydro, geothermal, nuclear, carbon capture and storage, and any other source of zero-carbon electricity developed and deployed on schedule). Consider setting the 100% for the soonest reasonable year given the state's existing electricity mix. Interim clean energy requirements—say, every five years—are a crucial part of this strategy.

Set or expand energy efficiency resource standards (EERS); pay for performance and reward cost-effective electrification.

Set a requirement for utilities to achieve two percent annual efficiency savings. Empower the public utilities commission (PUC) and utilities to prioritize higher-value efficiency programs, taking into account not just the amount of energy saved, but the impact of those savings on customer cost. This can be achieved by embracing a "pay-for-performance" approach, which uses real-time consumption data to show which efficiency measures save energy at more valuable times, particularly during system peaks. This allows efficiency to become not just an energy saving measure, but also to actively displace fossil generation.[1]

Reform utility efficiency resource standards to accommodate fuel switching from gas or oil to electric space and water heating, especially where it is cost effective and more efficient use of fuel. Leverage the utility-customer relationship to administer incentive programs for building and water heat pumps.[2] Massachusetts provides a model for this.[3]

Set targets for specific technologies of interest.

In general, it makes great sense for policy to remain technology neutral, but some states have chosen to set targets for certain technologies they believe can help achieve the state's policy goals and that may have serious potential for cost reduction. Some electricity sector technologies to consider for targets include: high-efficiency heat pumps, offshore wind, storage, and demand response.

Establish or expand a program for zero-carbon flexible resources: storage and demand response.

Consider a complementary resource standard for flexible resources, to be set by the PUC. Empower the PUC to set utility performance standards and incentives to acquire and actively use storage and flexible demand response.

---

[1] See https://www.greentechmedia.com/articles/read/moving-efficiency-into-project-finance-by-paying-for-metered-performance

[2] See incentives discussion in Buildings section, below.

[3] https://fileservice.eea.comacloud.net/FileService.Api/file/FileRoom/10317061

Require utilities to consider demand response and storage in long-term planning and procurement, especially as replacements for gas-fired generation. This includes studying the potential contribution of each resource to future energy needs and studying potential benefits of state-wide smart meters.

Spur transmission: Smooth the way for new lines.

Transmission is the platform that allows our electricity system to function. As renewables provide increasing amounts of our electricity, we need to move the produced electricity from the places with the greatest sun and wind resources to the places where people and businesses need to use it. We can do that by getting more out of our existing system[4] and by adding some new lines.

States could undertake a mapping exercise to identify low-conflict corridors for siting transmission, and then facilitate siting processes there. Creation of renewable energy zones and pre-sited transmission corridors to access them would increase the likelihood that high-value transmission projects crucial to renewable energy development are built. [5] States and regional partners should consider building transmission to high value renewable energy zones (with rural community benefits), even without a renewable generation contract at the other end, as long as there are few siting conflicts, as was done successfully in Texas.[6]

New regional or improved governance structures and cost sharing agreements will be needed to build interstate lines, particularly in the West and Southeast which lack regional transmission operators. State executives should also facilitate engagement between developers and rural stakeholders, particularly landowners, to ensure rural communities benefit financially from and lend support to new lines.

Use performance-based regulation to make zero-carbon electricity the utility's most profitable course of action.

System flexibility and deep efficiency are not compatible with the conventional utility business model, which rewards increasing capital investment. Performance-based regulation is a key strategy to incent utilities to drive efficiency, demand response, storage, and distributed generation as flexible, clean resources that complement bulk-system renewables. States should require their public utility commissions to develop metrics of utility performance in key

---

[4] Dynamic line rating gets more out of the system than existing practices in much of the country (for more, see https://issues.nawindpower.com/article/using-grid-weve-got). Where needed, we can also beef up transmission capacity on existing rights of way.

[5] See Carl Zichella & Ryan Hledik, "Finding a Home for Renewable Energy and Transmission," America's Power Plan, 2013. https://americaspowerplan.com/wp-content/uploads/2013/09/APP-SITING-PAPER.pdf

[6] Texas provides a potential model – pre-approving and building out transmission to "Competitive Renewable Energy Zones," where clean energy resources are abundant. Market mechanisms can then be used to select the lowest-cost clean power in those zones.

categories of system efficiency, environmental performance, affordability, and resilience, and empower regulators to begin compensating and penalizing utilities for their performance.

In addition, public utility commissions should require utilities to treat distributed energy resources – demand response, energy efficiency, rooftop solar, and storage – on par with utility-owned resources. Utilities must be allowed to develop business models that allow these important low-carbon, cheap resources to scale.

Use low-cost financing to buy out stranded fossil units.

Much of the asset base of coal and natural gas infrastructure is on regulated public utility balance sheets, leaving customers on the hook for paying down billions in potential stranded assets. If plans for ambitious clean energy deployment and electrification are likely to leave significant infrastructure unused but not paid off, then state governments could consider enabling securitization of the undepreciated balance remaining in these plants[7], or could consider leveraging state governments' very low cost of capital to buy down these assets, saving customers billions.

TRANSPORTATION

Become a "177 State" by Following California's Fuel Economy Standards.

For those that have not already, join the dozen states that have adopted California's vehicle fuel economy standards as provided under Clean Air Act Section 177, and the nine states that have adopted California's zero emission vehicle (ZEV) mandate.[8]

Compliance with California's ZEV mandate requires annual ZEV sales to reach approximately 8 percent of annual sales annually by 2025, when banking and compliance multipliers are taken into account.

Set goals and incentives for Zero Emission Vehicles.

The ZEV mandate, while powerful, will not sufficiently impact transportation emissions, the most heavily emitting sector in the U.S. Furthermore, recent market trends indicate that 8 percent annual ZEV sales will soon be eclipsed; as such, a more ambitious target will be needed to avoid the worst impacts of climate change.

In addition to the ZEV mandate, states should set a numerical target for zero emission vehicles (defined as plug-in hybrids, battery electric vehicles, and hydrogen fuel cell vehicles) as a share

---

[7] For more information, see https://energyinnovation.org/wp-content/uploads/2018/12/Managing-The-Utility-Financial-Transition-From-Coal-To-Clean.pdf

[8] For more information, see https://www.transportpolicy.net/standard/us-section-177-states/

of total vehicle sales by 2025 and 2030. For example, California has set a state target of 1.5 million ZEVs by 2025, and 5 million by 2030. Meeting the 5 million ZEV target will require 50% annual ZEV sales in 2030.

Rather than binding manufacturers[9], this target can guide other state actions such as charging infrastructure build-out and financial incentives to reduce the upfront cost of ZEVs. To achieve these targets, states should supplement a federal tax rebate with state cash rebate incentives for electric vehicle purchases at the point of sale, for both light duty vehicles and medium duty trucks. States can also electrify government fleets and city buses, and partner with utilities to pilot new high-voltage fleet charging stations. States can consider "soft incentives" like free parking or charging at public buildings, and ensuring that electric vehicles can travel in high occupancy vehicle (HOV) lanes.

Join the ZEV alliance and the multistate ZEV action plan to support state policy development.

Establish a transportation infrastructure program for public transit, non-motorized transport, and electric vehicle charging infrastructure.

American cities and rural areas need improved public transit options and support for a new wave of electric vehicles. A statewide infrastructure and transportation program could provide funds for electric vehicle charging infrastructure, electric bus purchases and electrified light rail investments, as well as incentives for expanded pedestrian and bike lanes. The International Council on Clean Transportation has quantified the charging infrastructure gap for the 100 largest metropolitan areas in the U.S.

Funds for fast-charging along highways would help address range anxiety concerns that discourage vehicle buyers from going electric. Incentives for home and business charging would further reduce barriers to EV purchasing. For planning along interstate highways, joint regional planning groups can help coordinate across state lines, which is already taking place in the Mountain West, Northeast, and Pacific states.

BUILDINGS

Set quantitative targets for building sector decarbonization.

Because building decarbonization will result from a suite of policies, a statewide target to measure success can guide implementing agency policy and provide a guiding goal for all types of stakeholders throughout the state. In addition to a long-term emission reduction target, interim targets allow for better measurement of progress towards goals and help to notify

[9] More stringent rules than the California ZEV mandate binding manufacturers would be preempted by the federal Clean Air Act standards.

policymakers when policies are not creating their intended effects. Interim targets should be every three- to five-years, with regular updates to the legislature on progress. The level of ambition of these targets can be adjusted based on the cost of compliance, and the importance of this target depends on the level of gas use in buildings. Some example metrics:

- Emissions-focused: 80% building sector direct[10] greenhouse gas reductions by 2040, with an interim target of at least 40% by 2030. Focusing on carbon emissions allows efficiency to play a role in meeting the targets.
- Building-focused: Specify the number of fully electrified buildings by [year X]. This metric could be subdivided by building use, square footage, or gas use. Incorporate building stock turnover and all-electric new buildings by [year Y] into any policy target.

A state target for annual building retrofits (defined as a percentage of buildings using fuel onsite by building type) to improve the building efficiency and electrify end-uses in buildings would complement statewide building emissions reduction targets. Such a metric and target would provide insight into whether efficiency and electrification program managers are on pace to decarbonize the building stock, investing public funds equitably, and appropriately scaling the work needed to meet long-term decarbonization targets.

Update state and local building codes to require high-efficiency, all-electric new construction.

All states should create a building energy code to address energy efficiency and electrification, as well as technology readiness, such as solar-ready[11] and electric vehicle (EV)-ready.[12]

Building codes should be automatically reviewed and revised regularly, at least every three years. Additionally, the code should allow local jurisdictions to adopt a more stringent code; it is recommended that states make this option available to local officials who want to go above the baseline to meet the needs and wants of their communities. Alternatively, states can adopt the latest International Code Council's International Energy Conservation Code.[13]

While the cost of switching existing buildings from natural gas to electric heat can be greater today, it is already cost-effective for new buildings to be all-electric, even in cold climates. Making new buildings all-electric avoids costly and long-lived natural gas infrastructure, capping the growth in gas use in buildings while saving customers money, especially if appliance

---

[10] Direct building emissions are those associated with burning fuel onsite. Indirect emissions are associated with electricity consumption, the emissions intensity of which historically building owners likely do not control. There are increasingly more opportunities for building owners to control emissions intensity of their electricity, through self-generation, green tariffs, and PPAs, for example.

[11] https://www.energy.ca.gov/2015publications/CEC-400-2015-033/chapters/chapter_09_solar_ready.pdf

[12] https://arb.ca.gov/cc/greenbuildings/pdf/tcac2018.pdf

[13] See https://www.iccsafe.org/about-icc/government-relations/international-energy-conservation-code-resource-page/

standards, favorable financing, and consumer choice drive use of high-efficiency heat pumps and induction stoves.

Electrify and deeply retrofit existing buildings.

Because the majority of US buildings standing today will still be here in 2050[14], states must find ways to incent decarbonization of existing buildings, and cannot rely on building codes for new buildings alone. Retrofits and fuel switching from fuel to electricity should be paired together; more efficient building envelopes can improve the effectiveness of new all-electric heat sources, while also offsetting much of the increase in electricity use from new demand. Where valuable and cost-effective, such projects should also include on-site clean power generation (e.g. rooftop solar).

Current retrofitting programs vary in their effectiveness but generally reach only a fraction of one percent of eligible customers each year.[15]A state program to target a package of decarbonization retrofits in two percent of homes per year would likely be necessary to meet ambitious building decarbonization targets. Here we identify two key policies to reach this untapped and difficult market segment: building codes and financial incentives.

Require electrification and efficiency retrofits for major construction

Building codes today don't typically impact existing buildings. By including major building retrofits, building codes can expand their reach, increase the rate of building decarbonization, and reduce the all-in cost of building decarbonization. For example, if a building is being gutted or an electrical room is being updated, building codes should require building owners to make use of that opportunity of getting the whole building or part of the building (in the case of the electrical room, for added capacity) up to code.

Retrofitting policy works in tandem with state incentives for efficient all-electric equipment and retrofits. Retrofits are very expensive, as are major equipment replacements – they will require low-cost financing and upfront incentives to effectively drive down carbon emissions. Part of this building code challenge will be ensuring that customers take advantage of the incentives and financing available to them, further improving the economics of greater efficiency and fuel switching. Other financing tools will also need to be developed and strengthened.

Provide financial incentives for building retrofits and efficient all-electric appliances

[14] https://architecture2030.org/buildings_problem_why/

[15] See https://link.springer.com/article/10.1007/s12053-018-9661-5.

A program with financial incentives including low-interest loans,[16] on-bill financing,[17] property tax financing,[18] and cash rebates[19] at the point of equipment sale for building decarbonization retrofitting could significantly improve the economics of retrofitting. Programs should also encourage pay-for-performance, increasing the incentive for efficiency measures that reduce grid costs.[20] Incentives should cover electrification of the four big end-uses – building heat, [21] water heat, clothes drying, and cooking,[22] while implementing appliance standards that ensure maximum efficiency and customer savings.

As these retrofit and appliance rebate programs expand to include building electrification and decarbonization, utility efficiency resource standards must accommodate fuel switching from gas, propane, or oil to electric space and water heating, especially where it is cost-effective. On the flipside, states should stop offering incentives for more efficient gas appliances. Investing public funds in gas appliances will be inadequate to reach significant carbon reduction goals as they also lock in gas consumption for the 15-20 year life of the appliance, result in minimal savings, and create upstream methane leakage.

Promote regulatory reform for electric utilities to encourage grid-beneficial electrification.

Under current monopoly utility regulation, utilities make more when they spend more, meaning encouraging customers to charge in grid-beneficial ways undermines their business model. Electric utilities should be allies encouraging customers to switch fuels and providing customers with access to incentive programs, but electric utilities can also influence how customers consume electricity once they electrify. An optimal electrification program, though prices, incentives, and information, should encourage customers to shift their usage to hours when energy is cheaper and cleaner.[23]

Performance-based regulation is a promising option to align utility incentives with climate and customer goals.[24] Under performance-based regulation, utilities can receive financial incentives when they meet targets for building electrification while keeping peak demand increases and

---

[16] https://www.energy.gov/savings/low-interest-energy-loan-programs

[17] https://aceee.org/blog/2019/04/bill-financing-gains-ground-faces

[18] https://www.energy.gov/eere/slsc/property-assessed-clean-energy-programs

[19] https://www.smud.org/en/Rebates-and-Savings-Tips/Improve-Home-Efficiency

[20] https://www.brookings.edu/research/advancing-inclusion-through-clean-energy-jobs/

[21] It would be important to only offer these incentives for heat pumps that use working fluids with very low global warming potential – otherwise, some of the chemicals in heat pumps can be dangerous for climate change.

[22] Of these, water heating and building heating are by far the largest gas users. However, failure to focus on the remaining end-uses promotes the continued use of legacy gas distribution infrastructure, the cost of which must be ultimately borne by consumers.

[23] https://www.raponline.org/knowledge-center/beneficial-electrification-ensuring-electrification-public-interest/

[24] https://www.raponline.org/knowledge-center/next-generation-performance-based-regulation-emphasizing-utility-performance-unleash-power-sector-innovation/

overall system costs low. Failure to realign these incentives could result in more costly electricity service, undermining the economics of the transition to all-electric buildings.

Electrification will increase electricity usage in buildings and regulators may need to modify consumer electricity rates to improve economics for all-electric building owners, rewarding customers that fully electrify buildings. For example, inclining block rates (rates that increase with the total amount of energy consumed), a common pricing scheme to reward greater efficiency, would dissuade electrification of both buildings and vehicles. Instead, time-varying rates and real-time pricing can encourage building owners to shift electricity use to low-cost hours, reducing costs for all customers.

Create a plan for winding down the gas utility business.

As policymakers pursue building electrification, the gas utility business must also change. Infrastructure owned by gas utilities has a useful life of 50-80 years. Taking into account we need to reach near-zero emissions economy-wide by 2050, and we are still investing in new and existing pipelines today, we will have to radically restructure the revenue model for natural gas utilities to ensure a smooth transition to all-electric buildings.

Under current regulation, many of these assets still need to be paid off, but if we successfully electrify a large portion of gas customers, fewer and fewer customers will be left holding the bag for remaining gas infrastructure, which still needs to be maintained for safety. We need to ensure that these final customers, who are likely disproportionately poor customers, are not stuck paying ever-increasing bills for natural gas. Therefore, policymakers need to begin a hard conversation now about the future of the natural gas business, and address head-on the reality of needing to wind-down natural gas utilities.

Top policymakers: Public utility commissions, legislators, utility stakeholders, natural gas utility

INDUSTRY

Create a "Buy Clean" program.

This program would set standards for cement, iron, steel, and other products used to build state government-funded infrastructure, based on the emissions intensity of those inputs. A model policy is in place in California (Assembly Bill 262), which includes suppliers' emission intensities for a few important government procurement decisions—such as concrete or steel for highways.[25] Ensure the program considers material substitution opportunities (e.g., using timber instead of steel for buildings less than 20 stories).[26]

[25] See https://buyclean.org/2017/10/16/gov-jerry-brown-signs-buy-clean-law/.

[26] See http://www.energy-transitions.org/sites/default/files/ETC_MissionPossible_FullReport.pdf.

Provide incentives for industrial cogeneration and waste heat recovery.

New incentives for industry facilities to cogenerate electricity and heat, and to use waste heat, would improve the efficiency of factories, if there are many factories in-state. Incentives for cogeneration should not be offered for coal-fired industrial equipment.

Create R&D program with leading in-state companies to explore and refine high-efficiency and low-carbon industrial processes.

Public-private partnerships could help to develop low-carbon industrial equipment and processes that could later be exported to other markets, thereby growing the local economy and impacting emissions at the same time. High-interest technologies include hydrogen production for industrial applications and perhaps for energy storage, low-carbon cement or steel manufacturing techniques, or carbon capture and sequestration.

SUPER-POLLUTANTS

Adopt State-Level Regulations to Transition Away from F-gases

Minimizing leaks from refrigeration systems and collecting and destroying used F-gases (mainly hydrofluorocarbons) are huge levers for reducing emissions. States could set a policy to ensure that any new appliance sold in-state would need to use a refrigerant with a low global warming potential (not HFCs). Programs could also be established to collect and destroy used refrigerants at the end of equipment lifetimes. By addressing all these sources of HFC emissions, states could reduce emissions from this sector by as much as 40-50 percent by 2030. The US Climate Alliance compiled a detailed set of recommendations and best practices to phase out F-gases.

States can also call on the federal government to ratify the Kigali Amendment to the Montreal Protocol. There is widespread, bipartisan support for this, including from the business community.

Set a steadily declining requirement for methane emissions from oil and gas activity, including extraction and distribution; create new monitoring and reporting requirements.

Adopt new or strengthen existing standards for methane leakage, methane leak detection, and mitigation systems, to push methane leakage rates toward zero. A 2050 target of zero leakage throughout the system, along with strong interim targets, will encourage the natural gas industry to invest in the necessary system upgrades and monitoring equipment to significantly cut emissions. Colorado is one good example of state standards, while New York and California have adopted comprehensive methane reduction plans. Canada's policy may provide a model of early action, as it aims to reduce methane emissions from the oil and gas sector 40-45% from 2012 levels by 2025.

Dedicate resources to measuring methane leakage, and include leakage estimates into greenhouse gas inventories.

CARBON PRICING

Consider implementing a hybrid cap-and-trade / carbon pricing system; link with other states.

Carbon pricing would create an additional incentive to decarbonize the economy, particularly the electricity and industry sectors. Consider establishing a hybrid cap-and-trade system with cap levels reflecting scientifically-based targets, a price floor and ceiling to manage price variability, and significant investment of revenue in reductions not directly responsive to carbon pricing (such as transportation, buildings, and agriculture). Another option is a hybrid carbon tax, whereby the tax level varies based on progress reducing emissions.

Consider linking with the Western Climate Initiative, which uses this type of system, to save on implementation costs and create a more efficient market.

An important caveat: existing policies should be not discarded in favor of carbon pricing. Rather, carbon pricing should be thought of as complementary policy that can help achieve additional emissions reductions. It is not a substitute for solid sector-specific policies.

AGRICULTURE

Increase incentives for agricultural practices that reduce greenhouse gases.

Increased incentives can expand low-GHG agricultural practices, such as low-till methods, cover crops, and water conservation. Conversion to these practices may have high upfront or ongoing costs as well as some loss of revenue, so government incentives can encourage farmers to adopt these practices. States could fund pilot programs to explore whether farmers could be paid directly for increasing the carbon content of their soil.

Increase technical assistance for precision agriculture deployment.

Increase technical assistance for deployment (e.g. farmer-to-farmer workshops) of precision fertilizer, soil supplements, and other practices aimed at reducing costs, chemical input, fertilizer, and soil erosion. Government assistance in the form of incentives and formation of cooperatives can also help increase deployment of precision agriculture.

RURAL AMERICA AND THE ENERGY TRANSITION

Ensure rural communities benefit from renewable energy and transmission development.

Empower a state-level ombudsman to convene transmission developers, renewable energy developers, rural community leaders, and rural land-owners and support negotiations and agreements around siting and benefit sharing. A public fund to help compensate rural

communities where new energy infrastructure might be placed could help increase public support for these projects.

Create a fund for transition support for coal miners and power plant workers.

The clean energy transition will result in fewer Americans working in coal mines and coal power plants. The total number of Americans working in these industries is already relatively small – in total, roughly 50,000 Americans are employed in the coal mining industry[27] – so a state fund may not need to be very big to assist communities and individuals through this transition. Tonawanda (New York) can provide a model for community transition support – the state decided to replace a share of foregone tax revenue for several years after a major coal plant shut down there.[28] Another model is the Colorado Clean Energy Plan, where large a large coal retirement in Pueblo County was replaced by utility-scale wind and solar development in the same communities.[29]

State-supported environmental reclamation for coal mines and other areas can help both with jobs transitions and with repair of scarred lands.

Create investment incentives for clean energy in coal and fracking communities.

Incentives for clean energy manufacturers and developers to invest in communities that have historically hosted fossil fuel infrastructure can help those frontline communities during this transition. New investment can help create jobs and reinvigorate local economies and support local services affected by the transition.

Support health care for coal miners.

If there is in-state coal mining, the state could provide additional support for health care for coal miners, to help those most adversely affected by coal work. These workers deserve support for helping America achieve the economic prosperity we enjoy today.

[27] See https://data.bls.gov/timeseries/CES1021210001

[28] See https://www.forbes.com/sites/energyinnovation/2018/08/23/billions-at-stake-should-we-invest-in-struggling-power-plants-or-communities-facing-closures/#5a3b093b1f68

[29] See, https://westernresourceadvocates.org/blog/colorado-energy-plan-explained/