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MEMORANDUM

To: Oregon Global Warming Commission

From: Maya Buchanan, Oregon Department of Energy, Senior Climate Policy Analyst
Catherine Macdonald, Oregon Global Warming Commission, Chair

Date: January 19, 2022

Re: Transformative Integrated GHG Emissions Reduction (TIGHGER) Project Briefing

Introduction

As discussed during our recent Commission meetings, the OGWC, with the assistance of ODOE, is developing a long-range plan for meeting the state's greenhouse gas (GHG) emissions reduction goals, known as the Roadmap. The Roadmap is being developed using dynamic energy system modeling and stakeholder engagement through the Transformational Integrated GHG Emissions Reduction (TIGHGER) project.

At the January 26 meeting, the OGWC will be briefed about how scenarios will be used to parameterize actions and will be presented a set of proposed scenarios. The OGWC will also be briefed on the process of developing a co-benefits analysis and will provide initial feedback on the co-benefits (and co-harms) associated with potential actions.

This memorandum outlines: (1) a reminder of where we are in the TIGHGER modeling process, (2) a summary of how scenarios will be used to parameterize actions to reduce GHG emissions or sequester carbon, (3) a primer on how a co-benefits analysis can be conducted to help prioritize actions, and (4) the next steps in the process to develop the Roadmap.

Background

The Oregon Global Warming Commission is working to develop a long range plan of the additional actions the state can take to supplement existing or planned state efforts (such as the Oregon Department of Environmental Quality's Climate Protection Program and 100% Clean Electricity Bill). Based on analysis and stakeholder input, the Roadmap will identify a suite of ambitious, transformative, and financially realistic economy-wide decarbonization actions and pathways for reaching Oregon's

climate goals, including the target of reducing GHG emissions by at least 45 percent below 1990 levels and increasing sequestration by at least 5 million metric tons of carbon dioxide equivalent (CO2e) by 2035. Please see additional details on the TIGHGER webpage.

Scope and Project Tasks

Overall, this project will: assess the GHG emissions reduction and sequestration potential and cost-effectiveness of individual and packages of actions, develop sector-based marginal abatement cost curves, and evaluate co-benefits that support an equitable economy wide transition to a clean energy and climate-smart natural and working lands future. The TIGHGER project includes the following core components:

1. With agency and stakeholder engagement, identify a comprehensive list of emissions reduction and sequestration actions to model.
2. Analyze the cost and GHG emissions reduction and increased sequestration potential of each action using a dynamic energy system model.
3. Develop sector-based and economy-wide marginal abatement cost curves (which show the unit cost/savings and scale of emissions reduction and increased sequestration actions).
4. Identify and analyze the co-benefits for each action.
5. Develop evaluation criteria and prioritize actions.
6. Create the Commission's Roadmap.

We are embarking on steps 3 and 4 of the project. Once step 4 has been completed, the Commission as the steering committee, with support from ODOE staff and additional public input, will establish evaluation criteria, score and rank the actions, and then create a roadmap to help Oregon meet its statewide GHG emissions reduction and sequestration goals. The roadmap will be submitted to the Legislature in late 2022.

Scenarios

What are Scenarios?

Scenarios are alternative descriptions of different possible futures that help decision makers consider implications of these future possibilities for planning and decision making today. Scenarios are not predictions. Rather, they are different versions of how the world will or may change by some future time.

Overall, scenarios should be:

- **Plausible.** The scenario must be believable.
- **Relevant to the key strategic issues and decisions at hand.** If the scenario would not cause a decision-maker to act differently compared to another scenario, there is little use in considering it.
- **Challenging to today's conventional wisdom.** It should make one think about different possibilities and options.
- **Divergent from each other.** Together, the scenarios should "stretch" the thinking about the future environment, so that the decisions take account of a wider range of issues.

- **Balanced.** It is useful to ensure that a group of scenarios strike a good balance between challenges and opportunities, and between risks and potential benefits.

Use of Scenarios to Characterize Actions

The set of scenarios will reflect different levels and pace of ambition (achieve vs. exceed Oregon's GHG emissions targets) and different pathways to achieve the level of ambition (e.g., large scale investments in electrification and fuel switching vs. investments in more nascent technologies).

While scenarios reflect different socio-economic future conditions, ***parameters*** are aspects of an action that determine the resulting quantity of GHG emission reductions resulting from a given action (e.g., adoption rates of technologies, extent of retrofits, carbon intensities of fuels, etc.).

The set of scenarios will largely determine the specific parameters needed to achieve a target under future conditions. For example, under a scenario where we speed up the pace of decarbonization, most GHG emissions reduction actions will require a high uptake rate to achieve such decarbonization. The modeling can then shed light on the amount of investments needed to implement a given GHG emissions reduction or sequestration action. Parameters must also be grounded in reality, based on literature, previous analyses, and Oregon's specific context.

Based on the modeling results, the parameters for actions can be adjusted and the scenarios rerun until the collection of actions in the scenario achieve the GHG emissions reduction targets.

Proposed Scenarios in the Roadmap

The Roadmap involves two reference scenarios, Business as Usual (BAU) and Business as Planned (BAP). The BAU scenario represents an extrapolation of current policies and technologies, while accounting for population increases and economic growth. The BAP scenario builds on top of the BAU by incorporating planned policies and actions (in development).

The Roadmap will also develop a small set of added decarbonization scenarios. The low-carbon scenarios (numbers 3-5 below) represent alternative pathways to achieve or exceed the 2035 target. Each of the low-carbon scenarios will include a mix of actions, but the table below describes the focus or emphasis of each scenario. For example, Scenario #4 emphasizes electrification but will also include certain levels of energy efficiency and alternative fuels. Actions related to natural and working lands and materials management will be incorporated into each low-carbon scenario.

Reference scenario	Reference scenario
1. Business as usual (BAU)	**2. Business as planned (BAP)**
- Continuation of current trends - Population increase	- Implementation of HB 2021 - Clean Car Standard - Advanced Clean Truck Rules - Clean Fuels Standard

Low carbon scenario

3. Maximum electrification

- Achieves the 2035 target
- Rapid electrification of heating with limited RNG deployment
- Deployment of decentralized solar PV and storage
- Rapid electrification of transportation
- Electrification of some industrial processes, clean hydrogen and RNG for the remainder

Low carbon scenario

4. Alternative fuels

- Achieves the 2035 target
- Slower pace of electrification
- Clean hydrogen and RNG in the natural gas grid
- Clean hydrogen used in a greater share of light duty and heavy-duty vehicles
- Industrial processes use clean hydrogen, RNG and other fuels

Low carbon scenario

5. Rapid transformation

- Achieves the US NDC (50-52% reduction) by 2030
- All actions accelerated (retrofits, electrification, decarbonization of the grid)
- Deep reductions in methane

Co-Benefits Analysis

An analysis of the co-benefits/co-harms associated with potential GHG emissions reduction and sequestration actions will be conducted to help inform the Commission's recommendations regarding the prioritization of actions. This information can also be used more broadly by the State and other entities to inform the development of equitable implementation of recommended actions. The meeting materials also include an example of how a co-benefits analysis can complement the type of energy system modeling being conducted here.

What are Co-Benefits and Co-Harms?

Co-benefits are positive ancillary effects on society resulting from a GHG emissions reduction or sequestration action, such as improved air quality resulting from reduced tailpipe emissions. The corollary, co-harms, are ancillary effects that have a negative effect on society, such as job losses.

Co-Benefits in the Roadmap

Co-benefits and co-harms will be quantified or assessed qualitatively for each of the low-carbon scenarios using indicators, which allows for the comparison of the performance of each scenario. A list of example indicators is provided in Table 1.

Table 1: Co-benefit categories and their respective indicators.

Category	Impact overview	Indicators
1. Health		
1.1 Air quality	Improvement in air quality.	Criteria air contaminants
1.2 Physical activity	Increased physical activity.	Walking miles traveled; cycling miles traveled by County
1.3 Noise	Decreased exposure to noise.	Decrease/increase in VMT by County; impact of electric vehicles on noise levels.
1.4 Accessibility	Destinations are more accessible.	Accessibility to destinations and workspaces by active modes or transit
1.5 Buildings	Indoor air quality is improved.	Number of homes/floor area of workplaces retrofit
2. Economic prosperity		
2.1 Employment	New employment opportunities are created. Existing employment opportunities are lost.	Jobs created/lost by sector and by county
2.2 Economic development	New economic sectors emerge. Existing sectors are phased out.	Capital expenditures by sector and by county
2.3 Innovation	Decarbonization policies will stimulate innovation.	Number of new sectors
2.4 Reputation	The reputation of the public and private sector is enhanced.	Value of “green” reputation
2.5 Social capital	Communities are more resilient.	Number of cooperatives or other non-profit organizations formed
2.6 Natural capital	Green spaces are preserved and enhanced.	Energy sprawl/land area required for energy infrastructure; Area of land preserved or restored
3. Social equity		

3.1 Poverty	Energy efficiency will reduce household building and transportation costs.	Household energy expenditures (“energy burden”)
3.2 Intergenerational equity and resilience	The burden on future generations is decreased. Stranded costs are avoided by acting quickly where possible.	Social cost of carbon

Next Steps

Following the meeting, the Commission will seek additional input on the co-benefits/co-harms associated with various actions, this will include hosting stakeholder meetings.