



STEP Tool: Economy-wide Clean Energy Planning Tool Used in 2-degree Scenario Analyses

June 10, 2020

Amlan Saha

Telephone: +1 (978) 369 5533

Email: asaha@mjbradley.com

STEP Tool: SState Emission Pathways Tool – Introduction

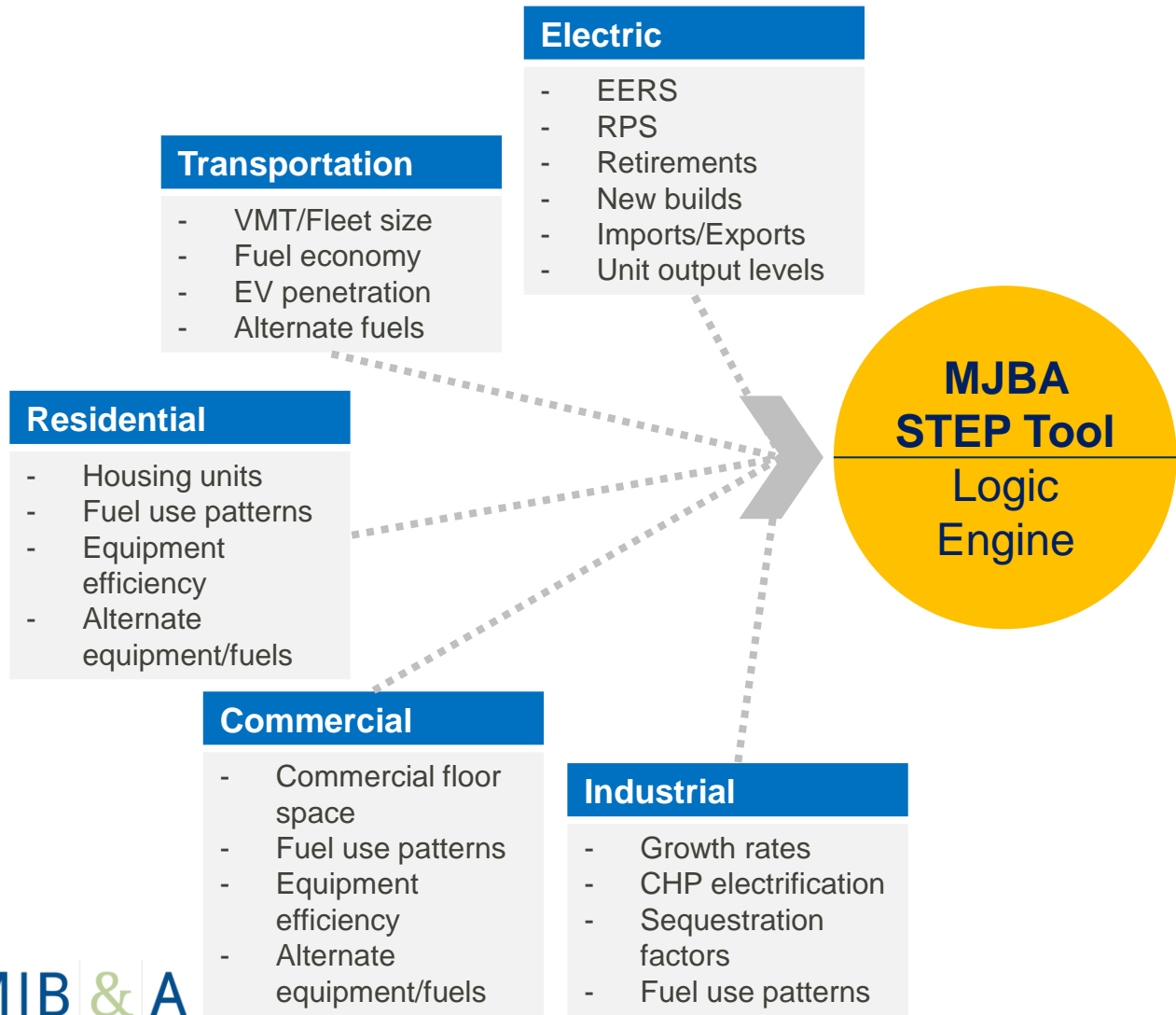
- Simplified, transparent, data-driven framework for asset owners, regulators, and stakeholders to engage in clean energy policy design
- Excel spreadsheet-based multi-sector model to analyze state/regional energy use and CO₂ emission trajectories under a range of policy scenarios
- Build detailed policy scenarios by selecting from various built-in policy options or provide custom inputs to model
- Track in real-time overall electricity generation, portfolio mix, total energy use by fuel type, total number of electric vehicles, vehicle miles traveled, CO₂ emissions, etc.



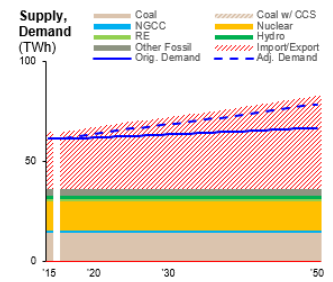
STEP Tool: Framework – Key Inputs and Outputs

KEY INPUTS

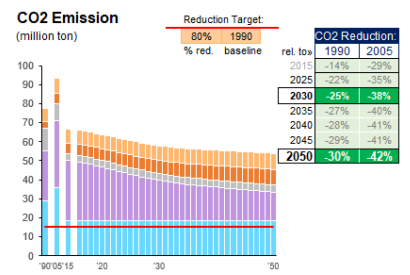
SAMPLE OUTPUTS



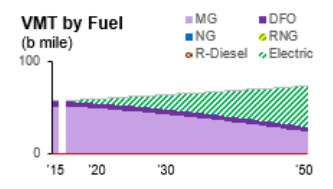
Electricity/Energy Demand and Supply Mix



CO₂ Emissions by Sector and Fuel



No. of EVs and Electric VMT



Detailed Output Tables

Data Tables

Category	1990	2005	2015	2025	2030	2040	2050
Coal	4,172	2,915	4,218	4,712	4,828		
Natural Gas	215.05	216.28	217.52	218.75			
Renewable Natural Gas	0.00	0.00	0.00	0.00			
Other Fossil	0.00	0.00	0.00	0.00			
Nuclear	4,000.04	3,951.17	3,801.50	3,751.07			
Hydro	2,255.44	2,262.57	2,269.69	2,276.81			
Other	812.18	812.17	812.17	812.17			
Total	13,255	13,757	13,757	13,757			

Sector-specific Results

Category	1990	2005	2015	2025	2030	2040	2050
Coal	14.16	14.17	14.17	14.17			
Coal w/ CCS	0.00	0.00	0.00	0.00			
NGCC	1.30	1.30	1.30	1.30			
Other Fossil	0.00	0.00	0.00	0.00			
Nuclear	14.24	14.24	14.24	14.24			
Hydro	1.62	1.62	1.62	1.62			
Renewables	1.30	1.30	1.30	1.30			
Total	32.62	32.62	32.62	32.62			

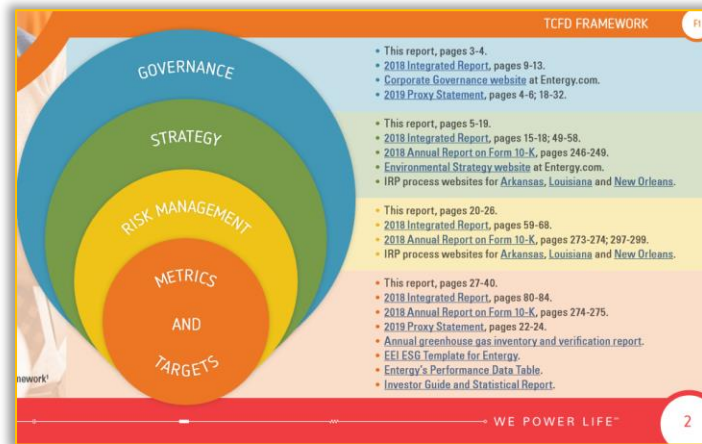
STEP Tool: Illustrative Policy Questions STEP Tool Can Help Answer

- Estimate the **impact on a state's electricity supply-demand** balance of...
 - retiring nuclear units
 - conversion of heating-related delivered fuel use to electricity (heat pumps, etc.)
 - electrification of vehicles
- **Translate 2-degree scenario** related emission reduction implications and operational constraints to states' economic sectors
- **Evaluate high-level sectoral or economy-wide policy packages** to achieve states' GHG emission reduction targets
- Compare impact on emissions and energy use of **large scale electrification versus alternate fuel use** (e.g.: RNG, renewable diesel, power to methane, etc.)
- **Inform and augment additional offline analyses** using data from detailed output tables

STEP Tool + TCFD Engagements



- Supported report development and scenario analysis
- Advised Entergy scenarios and used STEP Tool to assess IEA SDS for Entergy region



- Supported report development and conducted scenario analysis
- Applied IEA 2DS to FE region using STEP Tool

TWO-DEGREE SCENARIO IMPLICATIONS – RISKS AND OPPORTUNITIES

Our regulated utility business strategy is aligned with current market and technology trends and provides a strong foundation for our company's growth. At the same time, FirstEnergy's business strategy is consistent with efforts to transition to a lower-carbon energy future and the degree of change described by the IEA 2DS. More specifically, the regulated utility industry, including our regulated utility business, is uniquely positioned to enable electrification in the transportation, buildings and industrial sectors, and support associated multi-sector CO₂ emission reductions. The potential risks and opportunities our regulated utility business might face in such a scenario is discussed in the analysis below.

RISKS

As described in the scenario analysis section, dramatic changes are anticipated in the IEA 2DS. The scale and pace of those changes present risks to our transmission and distribution system and generation fleet, as well as financial risks to our customers and our company. In the following discussion, we discuss risks that are integrated into FirstEnergy's risk planning process that could present themselves in the hypothetical IEA 2DS in the states where we operate.

STRATEGIC RISKS

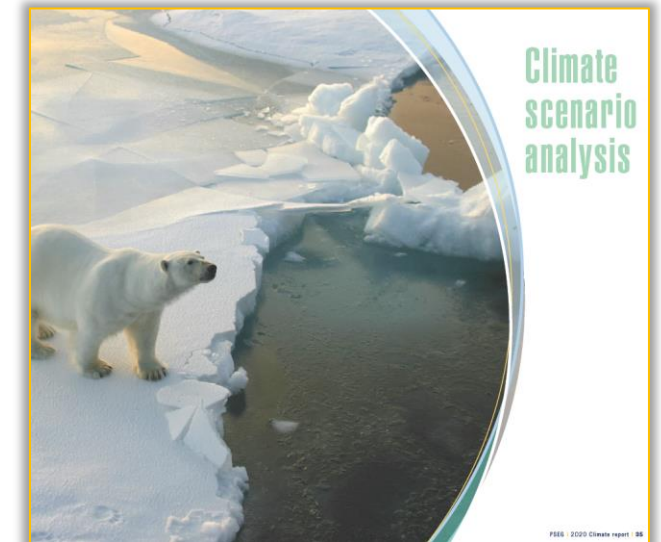
As a fully regulated utility, the implications to FirstEnergy of the changes outlined in the IEA 2DS present strategic risks since the ability to implement the required changes

pace to ensure regulated utilities have enough resources to provide safe, reliable and affordable service that is responsive to customer preferences.

We actively engage with federal and state legislators, regulators, customers and other stakeholders to facilitate an open and constructive dialogue on changing market conditions and appropriate measures required to maintain high-quality service for our customers. In addition, we work with state and federal policymakers to educate and advance FirstEnergy's position on legislative and regulatory proposals that shape FirstEnergy's future. Policymakers who understand our vision, mission and strategies can help support our efforts toward a brighter



- Facilitated full process for analysis and report development
- Applied IEA 2DS to regional power markets and New Jersey using STEP Tool



Recent Reports Based on STEP Tool Modeling

The Role of Renewable Biofuels in a Low Carbon Economy

Complementary Strategies to Reduce GHG in the Northeast & Mid-Atlantic States



MJB & A

February 2020

Colorado's Climate Action Plan Emission Targets: Illustrative Strategies and GHG Abatement Potentials
February 2020

MJB & A

February 28, 2020

Colorado's Climate Action Plan Emission Targets: Illustrative Strategies and GHG Abatement Potentials

On May 30, 2019, Colorado Governor Jared Polis signed House Bill 19-1261, the Climate Action Plan. This legislation amends Colorado's Air Pollution Prevention and Control Act and commits the state to wide greenhouse gas (GHG) emission reduction goals of 26 percent below 2005 levels by 2025, 50 percent by 2030, and 90 percent by 2050.² The Act also requires the Colorado Air Quality Control Commission (CAQCC) to develop implementing regulations consistent with these targets.³ Further revisions through Senate Bill 19-1261 require the CAQCC to, by July 1, 2020 "propose rules to implement measures that would cost-effectively allow the state to meet its greenhouse gas emission reduction goals."

Meeting these goals will require significant emission reductions across Colorado's economy including electric, transportation, residential, commercial, and industrial sectors. This analysis reviews the status of emission reduction goals in the context of Colorado's historic and projected emissions through 2030 under a business-as-usual (BAU) scenario. It then evaluates potential emission reductions from a range of illustrative sector-specific strategies to inform discussions on the potential scale of GHG emission reductions that are expected depending on the breadth and ambition of each illustrative strategy.⁶

In addition to using MJB&A's proprietary STEP Tool,⁷ this analysis also draws from previous analyses and projections of Colorado's economy-wide GHG emissions by Evolved Energy Research⁸ and the Rhodium Group.⁹ It is important to note that the abatement strategies considered in this paper are neither exhaustive, prescriptive, nor exclusive in nature. Rather, they constitute a set of illustrative strategies that may be deployed to achieve emission reductions across different sectors of the state's economy. Some abatement strategies could be implemented through regulatory change resulting in enforceable emission reductions; other strategies could require several policy changes.

This analysis aims to illustrate the relative scales of potential reductions from pursuing various abatement strategies under the stated assumptions and scopes of applicability for each. Magnitudes of emission reductions are presented in the following sections.

¹ State of Colorado, Seventy-Second General Assembly, "Concerning the Reduction of Greenhouse Gas Pollution, and in Connection Therewith, Establishing Statewide Greenhouse Gas Pollution Reduction Goals and Making an Appropriation." (May 13, 2019). available at: [http://leg.colorado.gov/bills/19/1261](#)

Decarbonizing Transportation

The Benefits and Costs of a Clean Transportation System in the Northeast and Mid-Atlantic Region



MJB & A

October 2018



Concord, MA

[Headquarters](#)

47 Junction Square Drive
Concord, MA 01742
USA

T: +1 978 369 5533
F: +1 978 369 7712

Washington, DC

1225 Eye Street, NW, Suite 200
Washington, DC 20005
USA

T: +1 202 525 5770
F: +1 202 315 3402

For more information, visit www.mjbradley.com

Amlan Saha

Telephone: +1 (978) 369 5533

Email: asaha@mjbradley.com