Modeling Methodology for Sequoia India Investment Memo

Energy Innovation modeled Sequioa Climate Foundation’s (SCF) India investments using an in-development version 3.1.3 of the Energy Policy Simulator (EPS), an open-source systems dynamics model that simulates the impact of energy and climate policies on greenhouse gas emissions, energy use, and other economic and social indicators.[[1]](#footnote-1) Compared with a business-as-usual (BAU) scenario, Energy Innovation’s modeled EPS policy scenario estimates 583 MMT CO2e avoided in 2030, and a cumulative 10.7 GT CO2e avoided between now and 2050. The largest savings are in the electricity sector followed by the industry sector and buildings.

The following table summarizes the policies or intended policy impacts of SCF’s India investment portfolio. The sections following the table provide more detail on the key assumptions and methodology for modeling each sector’s policies.

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| --- | --- |
| **Electricity Sector Policy** | **Description** |
| Increase in non-fossil fuel capacity | Between 2024 and 2026, India adds 90 GW of non-fossil fuel capacity resulting in 30% non-fossil fuel electricity generation. By 2030 there is 500 GW of non-fossil fuel capacity. |
| Replace coal capacity with flexible demand | Starting in 2024, India achieves 5 GW of flexible resources by 2026 and 10 GW by 2030. |
| **Cross-Sectoral Policy** | **Description** |
| Phase down HFCs | India ratifies and meets the Kigali Amendment. |
| Reduce electricity demand relative to BAU | Every year between 2026 and 2030, there is an additional 2-3% reduction in total economy-wide electricity demand compared to BAU electricity demand in that year. This overall demand reduction comes from industry, buildings, and agriculture. |

## Electricity Sector

### Increase in non-fossil fuel capacity

In the EPS, the clean electricity standard policy lever is set to 52% of electricity generation from clean sources by 2030. This setting stimulates the targeted non-fossil fuel capacity additions (for a cumulative total of 500 GW by 2030) and additional renewable electricity generation. While one of the objectives is to achieve 30% of electricity generation from non-fossil fuels, note that the share of generation from non-fossil fuel sources (renewables plus nuclear) in the EPS BAU is already 37%, and the share of generation from renewables (hydropower, solar, wind, biomass, and geothermal) is already 32%. Our policy scenario further increases these shares to 40% and 35%, respectively.

### Replace coal capacity with flexible demand

In the EPS, we use the demand response policy lever to achieve 8% of demand response potential in 2026 and 11% of the potential in 2030. These settings correspond to 5 GW of demand response and 10 GW in 2026 and 2030, respectively. In our policy scenario, we assume that each unit of demand response corresponds with an equivalent reduction in coal power generation capacity.[[2]](#footnote-2) To meet 5 GW of coal capacity reductions in 2026 in our policy scenario compared with the BAU, we also layered on the early retirement policy lever in the EPS to retire 2 GW of coal in 2026.

While our policy scenario as a whole results in 5 GW and 10 GW less of coal generation capacity in 2026 and 2030, respectively, the EPS attributes this impact almost entirely to the clean electricity standard and in small part to the forced coal retirements policy. At this time, the EPS is unable to show a direct causal relationship between flexible resource capacity and reduced demand for coal generation capacity.

## Cross-Sectoral

### Phase down HFCs

We referenced Velders et al. (2022)[[3]](#footnote-3) to estimate the impact of the Kigali Amendment on India’s emissions. We calculated the average emissions reductions in Velders et al.’s KA-2022 scenario and turned on the various F-gas reduction policy levers in the EPS to meet these targeted reductions.

### Reduce electricity demand relative to BAU

The targeted improvement in energy efficiency in every year between 2026 and 2030 is 2-3%, with the average targeted improvement being 2.5%. We use the average to calculate the schedule of targeted cumulative percentage improvement in total economy-wide electricity demand with respect to the BAU in each year.

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| --- | --- | --- | --- | --- | --- |
| **Cumulative % electricity demand reduction vs BAU** | **2026** | **2027** | **2028** | **2029** | **2030** |
| Low | 2% | 4% | 6% | 8% | 10% |
| High | 3% | 6% | 9% | 12% | 15% |
| Average | 2.5% | 5.0% | 7.5% | 10.0% | 12.5% |

We used policy levers across industry, buildings, and agriculture to meet the schedule of targeted improvements. The industry energy efficiency standards policy lever in the EPS is turned on for electricity across the cement, iron and steel, chemicals, waste management, agriculture, and “other industries” subsectors. The building energy efficiency standards policy lever in the EPS is turned on for the cooling and ventilation, lighting, appliances, and “other components” categories across all building types (urban residential, rural residential, commercial).

## Additional Information

### Macroeconomic impacts

Our modeled policy scenario does not include any policies to make up for lost government revenue from fossil fuels. From 2024 to 2050, the projected cumulative total loss in government revenue resulting from the policy scenario amounts to $55 billion 2012 US dollars.

### Supporting information

Additional supporting information including workbooks with calculations are available in the “Calculations and Notes” subfolder of the of the SCF\_India\_Analysis branch of Energy Innovation's eps-india GitHub repository.

1. <https://india.energypolicy.solutions/> [↑](#footnote-ref-1)
2. Based on the 2017 LBNL study that Sequoia shared with Energy Innovation. See supporting information. [↑](#footnote-ref-2)
3. See supporting information. [↑](#footnote-ref-3)