# Stranded Asset Implications of the Paris Agreement in Latin America and the Caribbean

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## Supplementary Notes

### Supplementary Note 1: Additional Information on the Global Change Assessment Model

GCAM's energy system includes detailed representations of depletable primary resources (coal, oil, natural gas, uranium) and renewable sources (bioenergy, hydro, solar, and wind) at regional levels, the prices of which are calculated endogenously. The model also includes representations of the processes that transform these resources to final energy carriers, which are ultimately used to deliver goods and services demanded by end users in buildings, transportation, and industrial sectors. Each technology in the model has a lifetime, and investment is tracked by vintage. Once installed, technologies operate until the end of their lifetime unless they are no longer economic to operate (variable cost exceeds the market price). Technology deployment depends on relative costs and is implemented via an implicit probabilistic formulation, using a logit function, which reflects heterogeneity of investment behavior and prevents unrealistic winner-take-all outcomes [1-3].

The agriculture and land use module of GCAM determines the demands for and production of products originating on the land, the prices of these products, the allocation of land to competing uses, and the carbon stocks, flows, and emissions of other gases associated with land use. The energy system and agriculture and land-use systems are coupled through bioenergy and fertilizer. For the former, the energy system determines the demand for bioenergy and the agriculture and land-use system determines the supply. For the latter, the agriculture and land-use system determines the demand for fertilizer and the energy system determines the supply.

### Supplementary Note 2: Representation of capital stock turnover in GCAM

This section explains the representation of capital stock turnover in GCAM's electric power sector. GCAM tracks power plant capital by technology and vintage over the lifetime of the technology. The model represents two types of retirements of power plants – natural and profit-induced. Electricity generation by a technology $T$ and vintage $V$ ($V$ represents the year in which the capital investment was made) in time period $t$ ($>V$) in a state or region $s$ is calculated as follows:

$$G_{T,V,s}(t) = G_{T,V,s}(t-1) * (1 - y_{natural,T,s}(t)) * (1 - y_{profit,T,s}(t))$$

where $y_{natural,T,s}(t)$ is the fraction of natural retirements and $y_{profit,T,s}(t)$ is the fraction of profit-induced retirements in time period $t$ for technology $T$ in state or region $s$.

1. ***Natural retirements:*** Each power plant technology, $T$ has a lifetime (Table A1). The fraction of natural retirements in time period $t$, $y_{natural,T,s}(t)$ is calculated as follows: $1 - y_{natural,T,s}(t) = \frac{1}{1+e^{b(t-x)}}$ ; where $b$ is a steepness coefficient, $t$ is the elapsed time, and $x$ is the "mid-life" where 50% of the capital stock is retired. An example of the $1 - y_{natural,T,s}(t)$ function is shown in Supplementary Figure 12. The parameters $b$ and $x$ are assumed to be same for all technologies and uniform across the globe.

2. ***Profit-induced retirements:*** The model also includes a representation of power plants retiring when the variable cost of operation exceeds the market price of electricity. The fraction of profit-induced retirements in time period $t$, $y_{profit,T,s}(t)$ is calculated as follows: $y_{profit,T,s}(t) = 1 - \frac{(x+1)^b}{(x+1)^b + (mp_{T,s}(t)+1)^b}$ ; where $mp_{T,s}(t)$ is the profit rate, $b$ is a steepness coefficient and $x$ is the marginal profit when 50% of the stock will be retired. $mp_{T,s}(t)$ is calculated as: $mp_{T,s}(t) = \frac{mr_s(t) - (vc_{T,s}(t))}{mr_s(t)}$; where $mr_s(t)$ is the marginal revenue, $vc_{T,s}(t)$ is the variable cost that includes fuel costs, variable O&M costs and carbon taxes. An example of the $1 - y_{profit,T,s}(t)$ function is shown in Supplementary Figure 12. The parameters $b$ and $x$ are assumed to be same for all technologies and uniform across the globe.

**Supplementary Note 3: Implementation of the LAC Copenhagen pledges and NDCs in GCAM**

Country-level NDCs are aggregated to the GCAM region level in a manner consistent with previous studies [4]. Our representation of national mitigation pledges includes only quantifiable Copenhagen pledges that have not been formally rescinded and unconditional NDC targets; all such commitments are assumed to be achieved. Countries which have no quantifiable Copenhagen commitment are assumed to face no emissions constraint through 2020; countries which have not submitted NDCs or have no unconditional pledges in their NDCs are assumed to face no emissions constraint through 2030 (*NDCs-to-2°C* and *NDCs-to-1.5°C* scenarios). Supplementary Table 2 provides further detail on how each LAC country's NDC target is implemented in GCAM.

Several other key assumptions are made to represent the NDCs in GCAM. Emissions trajectories between 2020 and 2030 are assumed to be linear; if a target is only available for 2025 or 2030, a target for the missing period is linearly interpolated. At the country level, NDC targets are implemented as articulated by the country, with limitations on individual gasses modeled according to the NDC (which may or may not include non-$CO_2$ gases). However, for all regions, we assume that reductions in non-$CO_2$ emissions are obtained in an economically efficient manner with lowest cost mitigation undertaken before more expensive options and with equal marginal abatement costs across all economic sectors. Finally, $CO_2$

emissions from land-use change (LUC) are assumed to face a carbon price that is 1% of the price per ton of carbon on other gases, in order to avoid unrealistically rapid afforestation or land-use conversion for bioenergy production [5]. Since other assumptions about the price on land-use change emissions would affect the numerical results, we test the sensitivity of our results to this assumption.

**Supplementary Note 4: Latin America and Caribbean Emissions Pathways**

It is notable that Latin America and the Caribbean reaches net-negative energy and industry $CO_2$ emissions by 2050 in both of the 1.5°C scenarios, while global emissions in those scenarios remain positive through mid-century. This result is driven by the use of a uniform global carbon price to achieve the cumulative emissions budget. Under such a regime, emission-reduction efforts are directed toward lowest cost, irrespective of the source of emissions.

LAC's energy system is presently less carbon-intensive than the average for the rest of the world, which enables it to reach net-zero emissions more quickly than regions which have more carbon-intensive infrastructure already locked in place (assuming a uniform global carbon price). In addition, the share of bioenergy in primary energy consumption in LAC has historically been greater than the rest of the world. Since GCAM is calibrated to historical energy production, the model tends to deploy more bioenergy technologies, including bioenergy with carbon capture and sequestration (BECCS) in LAC compared to the rest of the world. The negative emissions from BECCS also contribute to LAC emissions dropping below zero before the rest of the world. However, it is important to note the deployment of BECCS is likely to be constrained by a range of social, political and technological factors [6, 7]; changes in the availability of BECCS will change the regional distribution of mitigation burdens.

**Supplementary Note 5: Bioenergy with Carbon Capture and Sequestration**

Carbon capture and sequestration (CCS) technologies remove carbon dioxide ($CO_2$) from hydrocarbon fuels (including fossil fuels and biofuels). Depending on the technology, $CO_2$ can be captured either before or after the fuels are combusted. CCS technologies capture most, but not all, of a fuel's $CO_2$ emissions, preventing them from being released into the atmosphere. This captured $CO_2$ is then stored (sequestered) in geologic reservoirs deep underground. These technologies have yet to be commercialized, and only a few industrial-scale installations currently exist worldwide. Most current CCS plants do not store $CO_2$ in geologic reservoirs, but re-use it in other industrial applications (enhanced oil recovery, for example). Bioenergy in combination with CCS (often abbreviated as BECCS) is a "negative emissions technology" in which $CO_2$ is removed from the atmosphere by plants during photosynthesis, then captured and stored when that plant matter (biomass) is transformed into useful energy. The net effect of energy from BECCS is thus $CO_2$ removal, or "negative emissions" [7]. However, the potential for large-scale BECCS deployment is highly uncertain for a variety of reasons, including technical (cost, geologic storage potential), social / political (public acceptance), and institutional (monitoring, verification, enforcement, liability structures) factors [8], as well as the potential to exacerbate other environmental issues [9]. Thus, we have explored the role of technology availability (including CCS) in our sensitivity analysis (Section 3.4).

**Supplementary Note 6: Implications of Lifetime Assumptions on Stranded Asset Values**

There are several plausible methodologies for quantifying the value of stranded assets in monetary terms. In this study, we calculated the foregone value of a prematurely retired power plant as the total overnight capital cost of the asset times the fraction of expected (physical) lifetime foregone due to premature retirement. This methodology is simple to explain and creates a metric that is easily comparable to the investment cost metric utilized in this study, which considers the undiscounted overnight capital investments that must be mobilized in each five-year model period to bring the requisite new generation capacity online. However, this methodology is potentially sensitive to assumed asset lifetimes.

Integrated assessment models (IAMs) utilize a range of lifetime assumptions; a recent inter-model comparison study by Krey et al. [10] suggests that GCAM lifetimes are higher than many other models. Additionally, it is likely that the book value of stranded power plants will have been fully depreciated before the end of their presumed physical lifetimes (GCAM assumes a 30-year financial lifetime in calculating fixed charge rates for power sector capital investments). However, it is also plausible that power plants which are fully depreciated but still able to operate and generate revenue have value; the premature retirement of these assets before the end of their useful lifetimes may still constitute a loss of value for their owners. This variation in how stranded assets are defined is reflected in a review by IRENA [11], which uses an International Energy Agency (IEA) definition of stranded asset based on an asset's "economic life (as assumed at the investment decision point)" alongside a definition from The Generation Foundation which emphasizes loss of value "ahead of [an asset's] anticipated useful life".

To assess the impact of different methods of quantifying stranded asset value on the key findings on our study, we present four alternative methods in Supplementary Figure 13. Supplementary Figure 13a presents stranded asset costs by scenario, period, and technology, with overnight capital costs for all technologies depreciated over a 30-year financial lifetime (rather than a technology's physical lifetime). This can be expressed as:

$$SV = OCC * ((FL - AL) / FL), \text{ where:}$$

*SV = stranded value,*
*OCC = overnight capital costs,*
*FL = financial lifetime, and*
*AL = actual lifetime*

Technologies which are retired before the end of their useful lifetime, but after their full 30-year financial lifetime, are assumed to have zero value and therefore do not contribute to stranding costs. Supplementary Figure 13b presents the same calculation but with a 20-year financial lifetime assumption. Supplementary Figure 13c presents stranded asset costs by scenario, period, and technology, calculated in manner identical to our core methodology but using physical lifetimes consistent with median values from Krey et al. [10] (specifically, 40 years for coal and 30 years for gas and oil-fired generators). Finally, Supplementary Figure 13d presents stranded asset costs by scenario, period, and technology, with overnight capital costs for all technologies depreciated over a 30-year financial lifetime (like Supplementary Figure 13a), but also including the financing costs for remaining payments on stranded assets. Since this metric includes financing costs, the stranded asset costs are discounted to present value using 5% discount rate. It should be noted that for each of these alternative methodologies, the original model simulations were utilized (reflecting the default technology lifetime assumptions). The only thing that changed is the post-simulation stranded cost calculation.

A few key insights emerge from this comparison. First, stranded asset costs are substantial across methodologies, with cumulative costs from 2021 to 2050 on the magnitude of tens to hundreds of billions of dollars. Second, alternative methodologies impact the estimated cost of asset stranding, with cumulative stranded asset costs (2021 to 2050) ranging from $10-71 billion for the *NDCs-to-2°C* scenario and $31-155 billion for the *NDCs-to-1.5°C* scenario ($50 billion and $90 billion, respectively, under our default methodology). Third, the key findings about stranded asset costs (namely that stranding costs are highest in the *NDCs-to-1.5°C* scenario; that the *Straight-to* scenarios incur higher stranding costs in the near-term, but lower cumulative stranding costs; and that the *NDCs-to* scenarios result in a spike in asset stranding post-2030 when global least-cost mitigation begins) are robust regardless of which methodology for quantifying stranding costs is employed. Finally, one important difference among these methodologies is that those which apply uniform financial lifetimes (Supplementary Figures 13a and 13b) result in a slightly lower share of stranding costs from coal power plants relative to other technologies. This is because coal power plants are assumed to have longer lifetimes (60 years) than gas and oil plants (45 years) in our central methodology; assuming a constant financial lifetime across technologies reduces the contribution of coal plants to stranded asset costs somewhat. However, coal power plants still contribute a disproportionately high amount to stranding costs (relative to their share of stranded capacity) because they are more capital intensive than gas and oil plants and, in Latin America and the Caribbean, tend to be newer.

## Supplementary Note 7: Strengths and Limitations of Integrated Assessment Models

GCAM is a global integrated assessment model which captures important interactions between the global economic, energy, agriculture, and land-use systems [12-15] (Supplementary Figure 1). Dynamic-recursive models of each system are linked through markets and paired with a reduced-form atmosphere-carbon-cycle-climate model called Hector [16]. GCAM, and integrated assessment models more broadly, are designed to analyze consequences of alternative socioeconomic, technological, or policy futures, and capture key interdependencies and tradeoffs among regions and sectors. These models are commonly used to evaluate the key characteristics of decarbonization pathways to over the course of several decades or longer by international scientific bodies such as the Intergovernmental Panel on Climate Change (IPCC) [17], national governments [18], and other entities.

Nevertheless, the structure of GCAM, and the nature of integrated assessment models (IAMs) more broadly, have important implications for interpreting the results of our study. The simplifications, limitations, and caveats associated with IAMs have been discussed extensively in the literature, for example Clarke, Jiang [17]. First and foremost, IAMs represent complex, co-evolving physical and social systems through a set of simplified numerical equations. Model results are heavily dependent on key input assumptions including population and economic growth, resource and technology availability and costs, and policy. GCAM and other IAMs are at their core, economic models and generally operate with a goal of cost minimization (in the case of models based on optimization approaches) or economic efficiency (in the case of models based on market equilibrium or general equilibrium approaches). Equity and other concerns are generally not prominent in these tools' decision models. Operating at a global, multi-system scale requires simplifications of many important system dynamics. For example, these economic-centric models "typically assume fully functioning markets and competitive market behavior" [17] as well as perfect policy implementation, ignoring market distortions such as information asymmetries, transaction costs, oversupply or unmet demand, macro-economic cycles, etc.

In the past decade or so, the IAM community has begun to explore approaches for better representing market distortions in its modeling tools. Examples of such studies include work focused on imperfect international cooperation [19, 20], heterogeneous investment risks across regions [21], and behavioral realism [22]. Despite this recent work, most IAM tools are still subject to the simplifications and limitations discussed above. Nevertheless, these models have been consistently used to draw high-level insights about transformation pathways and the effects of policy on various system and sectors, consistent with the approach in this study.

# Supplementary Tables

## Supplementary Table 1

### Supplementary Table 1: Latin America and Caribbean countries in GCAM

| GCAM Region | Country |
|---|---|
| Argentina | Argentina |
| Brazil | Brazil |
| Central America and Caribbean | Anguilla; Antigua & Barbuda; Aruba; Bahamas; Barbados; Belize; Bermuda; Cayman Islands; Costa Rica; Cuba; Dominica; Dominican Republic; El Salvador; Grenada; Guadeloupe; Guatemala; Haiti; Honduras; Jamaica; Martinique; Montserrat; Netherlands Antilles; Nicaragua; Panama; Saint Kitts and Nevis; Saint Lucia; Saint Vincent and the Grenadines; Trinidad and Tobago |
| Colombia | Colombia |
| Mexico | Mexico |
| Northern South America | French Guiana; Guyana; Suriname; Venezuela |
| Southern South America | Bolivia; Chile; Ecuador; Paraguay; Peru; Uruguay |

## Supplementary Table 2

# Supplementary Table 2: LAC NDC Commitments as Implemented in GCAM

| GCAM Region | Country | Representation of Copenhagen Commitments | Representation of INDCs | | Source for History/BAU emissions | Notes | Links |
|---|---|---|---|---|---|---|---|
| | | 2020 | 2025 | 2030 | | | |
| Argentina | Argentina | | Linear interpolation between 2020 BAU and 2030 emissions constraint | 15% reduction in all GHG (including LUC) below BAU | BAU based on INDC submission | | http://www4.unfccc.int/submissions/indc/Submission%20Pages/submissions.aspx |
| Brazil | Brazil | 37.5% (average of 36.1-38.9% ) reduction in all GHG (including LUC) below BAU | 37% reduction in all GHG (including LUC) below 2005 | 43% reduction in all GHG (including LUC) below 2005 | Historical emissions and 2020 BAU based on INDC submission | The Copenhagen target is non-binding | http://www4.unfccc.int/submissions/indc/Submission%20Pages/submissions.aspx |
| Central America and Caribbean | Grenada | | 30% reduction in all GHG (including LUC) below 2010 | | Historical emissions based on INDC submission | | http://www4.unfccc.int/submissions/indc/Submission%20Pages/submissions.aspx |
| | Trinidad and Tobago | | | 30% reduction in CO2 from fossil fuels and industry below BAU | BAU based on INDC submission | | http://www4.unfccc.int/submissions/indc/Submission%20Pages/submissions.aspx |
| Colombia | Colombia | | Linear interpolation between 2020 BAU and 2030 emissions constraint | 20% reduction in all GHG (including LUC) below BAU | BAU based on INDC submission | | http://www4.unfccc.int/submissions/INDC/Published%20Documents/Colombia/1/Colombia%20iNDC%20Unofficial%20translation%20Eng.pdf |
| Mexico | Mexico | 30% reduction in all GHG (including LUC) below BAU | Linear interpolation between 2020 and 2030 emissions constraints | 22% reduction in all GHG (including LUC) below BAU | BAU based on INDC submission | | http://www4.unfccc.int/submissions/indc/Submission%20Pages/submissions.aspx |
| South America_Northern | Peru | | Linear interpolation between 2020 BAU and 2030 emissions constraint | 20% reduction in all GHG (including LUC) below BAU | BAU based on INDC submission | | http://www4.unfccc.int/submissions/indc/Submission%20Pages/submissions.aspx |
| | Uruguay | | | Reduction of 1.4 MtCO2 in all GHG (including LUC) below BAU | Emissions reductions from BAU based on INDC submission | | |
| | Paraguay | | | 10% reduction in all GHG (including LUC) below BAU | BAU based on INDC submission | | |
| South America_Southern | | | | | | | |

**Supplementary Table 3**

**Supplementary Table 3: Capital cost assumptions for the electric power sector (2010 USD / kW)[a]**

| Electricity Generation Technology | Overnight Capital Costs (2010 USD / kW) | | |
|---|---|---|---|
| | 2020 | 2030 | 2050 |
| Biomass (conv) | $ 3,951 | $ 3,818 | $ 3,702 |
| Biomass (IGCC) | $ 5,745 | $ 5,180 | $ 4,819 |
| Biomass (conv CCS) | $ 7,317 | $ 6,568 | $ 6,168 |
| Biomass (IGCC CCS) | $ 8,337 | $ 7,298 | $ 6,720 |
| Coal (conv pul) | $ 2,337 | $ 2,242 | $ 2,196 |
| Coal (IGCC) | $ 3,060 | $ 2,854 | $ 2,769 |
| Coal (conv pul CCS) | $ 5,503 | $ 4,925 | $ 4,619 |
| Coal (IGCC CCS) | $ 4,020 | $ 3,607 | $ 3,448 |
| Gas (CC) | $ 859 | $ 824 | $ 807 |
| Gas (steam/CT) | $ 911 | $ 875 | $ 857 |
| Gas (CC CCS) | $ 1,864 | $ 1,677 | $ 1,605 |
| Refined liquids (steam/CT) | $ 742 | $ 717 | $ 694 |
| Refined liquids (CC) | $ 1,036 | $ 1,004 | $ 972 |
| Refined liquids (CC CCS) | $ 2,356 | $ 2,079 | $ 1,937 |
| Gen II LWR (Nuclear) | $ 5,500 | $ 5,500 | $ 5,500 |
| Gen III (Nuclear) | $ 4,400 | $ 4,044 | $ 3,901 |
| CSP | $ 3,415 | $ 3,077 | $ 2,946 |
| CSP with storage | $ 7,430 | $ 6,329 | $ 5,771 |
| PV | $ 1,856 | $ 1,534 | $ 1,514 |
| PV with storage | $ 4,212 | $ 3,799 | $ 3,534 |
| Wind | $ 1,662 | $ 1,526 | $ 1,481 |
| Wind with storage | $ 5,555 | $ 5,006 | $ 4,661 |
| Rooftop PV | $ 4,499 | $ 4,057 | $ 3,776 |
| Geothermal | $ 4,348 | $ 4,199 | $ 4,073 |

[a] This table presents only the overnight capital costs. A fixed charge rate of 13% is assumed to amortize capital costs over the capital lifetime of a power plant.

## Supplementary Table 4

**Supplementary Table 4: Physical lifetime assumptions for technologies in the electric power sector**

| **Technology** | **Lifetime (years)** |
|---|---|
| Biomass (conv) | 60 |
| Biomass (IGCC) | 60 |
| Biomass (conv CCS) | 60 |
| Biomass (IGCC CCS) | 60 |
| Coal (conv pul) | 60 |
| Coal (IGCC) | 60 |
| Coal (conv pul CCS) | 60 |
| Coal (IGCC CCS) | 60 |
| Gas (steam/CT) | 45 |
| Gas (CC) | 45 |
| Gas (CC CCS) | 45 |
| Refined liquids (steam/CT) | 45 |
| Refined liquids (CC) | 45 |
| Refined liquids (CC CCS) | 45 |
| Gen_II_LWR (nuclear) | 60 |
| Gen_III (nuclear) | 60 |
| Wind | 30 |
| Wind_storage | 30 |
| PV | 30 |
| PV_storage | 30 |
| CSP | 30 |
| CSP_storage | 30 |
| Geothermal | 30 |

## Supplementary Table 5

### Supplementary Table 5A: LAC Power Sector New Installations and Premature Retirements by Technology for the Straight-to-2°C scenario. Numbers represent cumulative additions / retirements, in GW, over a five-year model period.

**New Installations**

| Region | Scenario | Power Sector Technology | 2016-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 | Units |
|---|---|---|---|---|---|---|---|---|---|---|
| LAC | Straight-to-2°C | Oil w/o CCS | 6.5 | 0.1 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | GW |
| LAC | Straight-to-2°C | Oil w/ CCS | 0.0 | 8.7 | 16.4 | 16.3 | 16.2 | 13.3 | 9.0 | GW |
| LAC | Straight-to-2°C | Gas w/o CCS | 12.4 | 3.5 | 6.1 | 3.5 | 0.7 | 0.0 | 0.0 | GW |
| LAC | Straight-to-2°C | Gas w/ CCS | 0.0 | 8.1 | 20.4 | 30.0 | 37.9 | 42.1 | 42.9 | GW |
| LAC | Straight-to-2°C | Coal w/o CCS | 3.6 | 0.3 | 0.2 | 0.1 | 0.0 | 0.0 | 0.0 | GW |
| LAC | Straight-to-2°C | Coal w/ CCS | 0.0 | 0.4 | 1.6 | 2.8 | 3.9 | 4.4 | 4.5 | GW |
| LAC | Straight-to-2°C | Biomass w/o CCS | 1.6 | 0.8 | 1.2 | 0.3 | 0.0 | 0.0 | 0.0 | GW |
| LAC | Straight-to-2°C | Biomass w/ CCS | 0.0 | 0.9 | 5.3 | 10.3 | 13.6 | 15.0 | 16.8 | GW |
| LAC | Straight-to-2°C | Nuclear | 0.4 | 0.7 | 1.8 | 2.7 | 5.5 | 8.2 | 10.2 | GW |
| LAC | Straight-to-2°C | Hydro | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | GW |
| LAC | Straight-to-2°C | Wind | 4.5 | 10.6 | 23.2 | 33.8 | 41.2 | 48.9 | 53.8 | GW |
| LAC | Straight-to-2°C | Solar | 2.9 | 8.4 | 12.7 | 18.7 | 23.8 | 29.8 | 33.7 | GW |
| LAC | Straight-to-2°C | Geothermal | 1.3 | 2.2 | 4.3 | 5.0 | 5.1 | 4.6 | 4.4 | GW |
| LAC | Straight-to-2°C | TOTAL | 33.3 | 44.6 | 93.3 | 123.4 | 147.8 | 166.3 | 175.3 | GW |

**Premature Retirements**

| Region | Scenario | Power Sector Technology | 2016-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 | Units |
|---|---|---|---|---|---|---|---|---|---|---|
| LAC | Straight-to-2°C | Oil w/o CCS | 0.5 | 4.0 | 2.4 | 4.0 | 3.6 | 3.5 | 2.8 | GW |
| LAC | Straight-to-2°C | Oil w/ CCS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | GW |
| LAC | Straight-to-2°C | Gas w/o CCS | 1.5 | 2.1 | 1.8 | 3.1 | 3.3 | 5.8 | 10.9 | GW |
| LAC | Straight-to-2°C | Gas w/ CCS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | GW |
| LAC | Straight-to-2°C | Coal w/o CCS | 2.0 | 0.6 | 1.0 | 2.9 | 3.8 | 2.8 | 1.4 | GW |
| LAC | Straight-to-2°C | Coal w/ CCS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | GW |
| LAC | Straight-to-2°C | TOTAL | 4.1 | 6.7 | 5.2 | 10.0 | 10.7 | 12.1 | 15.1 | GW |

**Supplementary Table 5B: LAC Power Sector New Installations and Premature Retirements by Technology for the NDCs-to-2°C scenario. Numbers represent cumulative additions / retirements, in GW, over a five-year model period.**

**New Installations**

| Region | Scenario | Power Sector Technology | 2016-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 | Units |
|---|---|---|---|---|---|---|---|---|---|---|
| LAC | NDCs-to-2°C | Oil w/o CCS | 6.5 | 1.4 | 2.3 | 0.0 | 0.0 | 0.0 | 0.0 | GW |
| LAC | NDCs-to-2°C | Oil w/ CCS | 0.0 | 8.8 | 5.7 | 28.4 | 15.3 | 13.1 | 9.1 | GW |
| LAC | NDCs-to-2°C | Gas w/o CCS | 12.4 | 8.0 | 8.4 | 2.9 | 0.2 | 0.0 | 0.0 | GW |
| LAC | NDCs-to-2°C | Gas w/ CCS | 0.0 | 6.4 | 8.6 | 40.5 | 41.0 | 43.4 | 44.1 | GW |
| LAC | NDCs-to-2°C | Coal w/o CCS | 3.6 | 1.7 | 1.5 | 0.0 | 0.0 | 0.0 | 0.0 | GW |
| LAC | NDCs-to-2°C | Coal w/ CCS | 0.0 | 0.4 | 0.5 | 3.6 | 4.1 | 4.4 | 4.5 | GW |
| LAC | NDCs-to-2°C | Biomass w/o CCS | 1.6 | 1.6 | 1.8 | 0.3 | 0.0 | 0.0 | 0.0 | GW |
| LAC | NDCs-to-2°C | Biomass w/ CCS | 0.0 | 1.2 | 0.9 | 13.2 | 14.7 | 15.5 | 16.8 | GW |
| LAC | NDCs-to-2°C | Nuclear | 0.4 | 0.9 | 0.9 | 3.4 | 5.8 | 8.4 | 10.6 | GW |
| LAC | NDCs-to-2°C | Hydro | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | GW |
| LAC | NDCs-to-2°C | Wind | 4.5 | 9.1 | 13.3 | 45.5 | 43.6 | 50.1 | 55.3 | GW |
| LAC | NDCs-to-2°C | Solar | 2.9 | 6.5 | 9.2 | 25.2 | 25.4 | 30.5 | 34.3 | GW |
| LAC | NDCs-to-2°C | Geothermal | 1.3 | 2.0 | 2.6 | 6.6 | 5.5 | 4.7 | 4.5 | GW |
| LAC | NDCs-to-2°C | TOTAL | 33.3 | 48.0 | 55.8 | 169.7 | 155.6 | 170.2 | 179.2 | GW |

**Premature Retirements**

| Region | Scenario | Power Sector Technology | 2016-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 | Units |
|---|---|---|---|---|---|---|---|---|---|---|
| LAC | NDCs-to-2°C | Oil w/o CCS | 0.5 | 1.5 | 0.4 | 12.4 | 4.6 | 4.0 | 3.1 | GW |
| LAC | NDCs-to-2°C | Oil w/ CCS | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | GW |
| LAC | NDCs-to-2°C | Gas w/o CCS | 1.5 | 0.1 | 0.2 | 9.5 | 4.1 | 7.8 | 13.0 | GW |
| LAC | NDCs-to-2°C | Gas w/ CCS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | GW |
| LAC | NDCs-to-2°C | Coal w/o CCS | 2.0 | 0.0 | 0.2 | 6.6 | 4.6 | 3.2 | 1.4 | GW |
| LAC | NDCs-to-2°C | Coal w/ CCS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | GW |
| LAC | NDCs-to-1.5°C | TOTAL | 4.1 | 1.5 | 0.9 | 28.4 | 13.3 | 15.0 | 17.5 | GW |

**Supplementary Table 5C: LAC Power Sector New Installations and Premature Retirements by Technology for the Straight-to-1.5°C scenario. Numbers represent cumulative additions / retirements, in GW, over a five-year model period.**

**New Installations**

| Region | Scenario | Power Sector Technology | 2016-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 | Units |
|---|---|---|---|---|---|---|---|---|---|---|
| LAC | Straight-to-1.5°C | Oil w/o CCS | 6.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | GW |
| LAC | Straight-to-1.5°C | Oil w/ CCS | 0.0 | 21.1 | 20.3 | 17.2 | 12.8 | 6.7 | 2.6 | GW |
| LAC | Straight-to-1.5°C | Gas w/o CCS | 12.4 | 2.3 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | GW |
| LAC | Straight-to-1.5°C | Gas w/ CCS | 0.0 | 23.5 | 35.5 | 42.1 | 46.2 | 42.7 | 38.4 | GW |
| LAC | Straight-to-1.5°C | Coal w/o CCS | 3.6 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | GW |
| LAC | Straight-to-1.5°C | Coal w/ CCS | 0.0 | 1.7 | 3.1 | 3.7 | 4.1 | 3.8 | 3.4 | GW |
| LAC | Straight-to-1.5°C | Biomass w/o CCS | 1.6 | 0.2 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | GW |
| LAC | Straight-to-1.5°C | Biomass w/ CCS | 0.0 | 7.9 | 18.4 | 20.8 | 19.1 | 16.1 | 15.0 | GW |
| LAC | Straight-to-1.5°C | Nuclear | 0.4 | 1.6 | 2.8 | 3.6 | 6.6 | 8.9 | 10.6 | GW |
| LAC | Straight-to-1.5°C | Hydro | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | GW |
| LAC | Straight-to-1.5°C | Wind | 4.5 | 22.0 | 33.2 | 39.8 | 47.3 | 52.2 | 55.3 | GW |
| LAC | Straight-to-1.5°C | Solar | 2.9 | 15.4 | 18.3 | 22.5 | 28.3 | 32.7 | 33.4 | GW |
| LAC | Straight-to-1.5°C | Geothermal | 1.3 | 4.4 | 5.5 | 4.4 | 5.0 | 4.4 | 4.0 | GW |
| LAC | Straight-to-1.5°C | TOTAL | 33.3 | 100.3 | 137.9 | 154.2 | 169.3 | 167.4 | 162.7 | GW |

**Premature Retirements**

| Region | Scenario | Power Sector Technology | 2016-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 | Units |
|---|---|---|---|---|---|---|---|---|---|---|
| LAC | Straight-to-1.5°C | Oil w/o CCS | 0.5 | 11.2 | 5.9 | 4.2 | 2.8 | 1.5 | 0.8 | GW |
| LAC | Straight-to-1.5°C | Oil w/ CCS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | GW |
| LAC | Straight-to-1.5°C | Gas w/o CCS | 1.5 | 8.0 | 5.3 | 6.3 | 8.9 | 10.1 | 7.8 | GW |
| LAC | Straight-to-1.5°C | Gas w/ CCS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | GW |
| LAC | Straight-to-1.5°C | Coal w/o CCS | 2.0 | 4.4 | 4.4 | 2.4 | 0.9 | 0.3 | 0.1 | GW |
| LAC | Straight-to-1.5°C | Coal w/ CCS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | GW |
| LAC | Straight-to-1.5°C | TOTAL | 4.1 | 23.6 | 15.6 | 12.9 | 12.6 | 11.9 | 9.1 | GW |

**Supplementary Table 5D: LAC Power Sector New Installations and Premature Retirements by Technology for the NDCs-to-1.5°C scenario. Numbers represent cumulative additions / retirements, in GW, over a five-year model period.**

**New Installations**

| Region | Scenario | Power Sector Technology | 2016-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 | Units |
|---|---|---|---|---|---|---|---|---|---|---|
| LAC | NDCs-to-1.5°C | Oil w/o CCS | 6.5 | 1.4 | 2.3 | 0.0 | 0.0 | 0.0 | 0.0 | GW |
| LAC | NDCs-to-1.5°C | Oil w/ CCS | 0.0 | 8.8 | 5.7 | 68.4 | 2.8 | 2.7 | 0.1 | GW |
| LAC | NDCs-to-1.5°C | Gas w/o CCS | 12.4 | 8.0 | 8.4 | 0.0 | 0.0 | 0.0 | 0.0 | GW |
| LAC | NDCs-to-1.5°C | Gas w/ CCS | 0.0 | 6.4 | 8.6 | 82.7 | 52.1 | 43.2 | 36.8 | GW |
| LAC | NDCs-to-1.5°C | Coal w/o CCS | 3.6 | 1.7 | 1.5 | 0.0 | 0.0 | 0.0 | 0.0 | GW |
| LAC | NDCs-to-1.5°C | Coal w/ CCS | 0.0 | 0.4 | 0.5 | 6.7 | 4.3 | 3.5 | 2.9 | GW |
| LAC | NDCs-to-1.5°C | Biomass w/o CCS | 1.6 | 1.6 | 1.8 | 0.0 | 0.0 | 0.0 | 0.0 | GW |
| LAC | NDCs-to-1.5°C | Biomass w/ CCS | 0.0 | 1.2 | 0.9 | 49.1 | 22.4 | 15.6 | 14.1 | GW |
| LAC | NDCs-to-1.5°C | Nuclear | 0.4 | 0.9 | 0.9 | 7.1 | 7.8 | 9.8 | 11.3 | GW |
| LAC | NDCs-to-1.5°C | Hydro | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | GW |
| LAC | NDCs-to-1.5°C | Wind | 4.5 | 9.1 | 13.3 | 82.3 | 54.5 | 55.6 | 57.3 | GW |
| LAC | NDCs-to-1.5°C | Solar | 2.9 | 6.5 | 9.2 | 46.5 | 33.2 | 33.8 | 32.8 | GW |
| LAC | NDCs-to-1.5°C | Geothermal | 1.3 | 2.0 | 2.6 | 10.1 | 5.4 | 4.5 | 3.9 | GW |
| LAC | NDCs-to-1.5°C | TOTAL | 33.3 | 48.0 | 55.8 | 353.0 | 182.5 | 168.8 | 159.2 | GW |

**Premature Retirements**

| Region | Scenario | Power Sector Technology | 2016-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 | Units |
|---|---|---|---|---|---|---|---|---|---|---|
| LAC | NDCs-to-1.5°C | Oil w/o CCS | 0.5 | 1.5 | 0.4 | 26.5 | 3.0 | 1.3 | 0.6 | GW |
| LAC | NDCs-to-1.5°C | Oil w/ CCS | 0.0 | 0.0 | 0.1 | 0.0 | 3.4 | 2.1 | 2.4 | GW |
| LAC | NDCs-to-1.5°C | Gas w/o CCS | 1.5 | 0.1 | 0.2 | 37.8 | 12.9 | 11.0 | 6.9 | GW |
| LAC | NDCs-to-1.5°C | Gas w/ CCS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | GW |
| LAC | NDCs-to-1.5°C | Coal w/o CCS | 2.0 | 0.0 | 0.2 | 17.3 | 0.5 | 0.2 | 0.0 | GW |
| LAC | NDCs-to-1.5°C | Coal w/ CCS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | GW |
| LAC | NDCs-to-1.5°C | TOTAL | 4.1 | 1.5 | 0.9 | 81.6 | 19.9 | 14.6 | 9.9 | GW |

## Supplementary Table 6

### Supplementary Table 6A: LAC Power Sector Capital Investments and Stranded Asset Costs by Technology for the Straight-to-2°C scenario. Numbers represent cumulative costs, in billion 2010 USD, over a five-year model period.

**New Installations**

| Region | Scenario | Power Sector Technology | 2016-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|
| LAC | Straight-to-2°C | Oil w/o CCS | 5.8 | 0.1 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 |
| LAC | Straight-to-2°C | Oil w/ CCS | 0.0 | 19.6 | 35.3 | 33.8 | 32.8 | 26.2 | 17.5 |
| LAC | Straight-to-2°C | Gas w/o CCS | 12.0 | 3.6 | 6.1 | 3.5 | 0.7 | 0.0 | 0.0 |
| LAC | Straight-to-2°C | Gas w/ CCS | 0.0 | 15.5 | 37.4 | 53.5 | 65.9 | 71.6 | 71.8 |
| LAC | Straight-to-2°C | Coal w/o CCS | 10.4 | 1.1 | 0.9 | 0.3 | 0.0 | 0.0 | 0.0 |
| LAC | Straight-to-2°C | Coal w/ CCS | 0.0 | 1.9 | 8.3 | 14.3 | 19.1 | 21.0 | 21.2 |
| LAC | Straight-to-2°C | Biomass w/o CCS | 6.4 | 3.4 | 5.3 | 1.8 | 0.0 | 0.0 | 0.0 |
| LAC | Straight-to-2°C | Biomass w/ CCS | 0.0 | 6.6 | 36.7 | 68.9 | 89.2 | 96.5 | 105.4 |
| LAC | Straight-to-2°C | Nuclear | 2.4 | 3.6 | 9.4 | 14.1 | 28.4 | 42.0 | 52.1 |
| LAC | Straight-to-2°C | Hydro | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| LAC | Straight-to-2°C | Wind | 8.7 | 19.8 | 41.7 | 59.0 | 70.2 | 81.5 | 87.9 |
| LAC | Straight-to-2°C | Solar | 5.3 | 15.6 | 26.2 | 41.7 | 55.2 | 71.5 | 82.3 |
| LAC | Straight-to-2°C | Geothermal | 5.7 | 9.3 | 18.3 | 20.9 | 21.2 | 19.1 | 17.8 |
| LAC | Straight-to-2°C | TOTAL | 56.7 | 99.9 | 225.9 | 311.8 | 382.6 | 429.4 | 456.0 |

**Premature Retirements**

| Region | Scenario | Power Sector Technology | 2016-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|
| LAC | Straight-to-2°C | Oil w/o CCS | 0.2 | 2.5 | 0.9 | 1.6 | 1.5 | 1.4 | 1.0 |
| LAC | Straight-to-2°C | Oil w/ CCS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| LAC | Straight-to-2°C | Gas w/o CCS | 0.5 | 0.8 | 0.6 | 1.0 | 1.0 | 2.0 | 3.9 |
| LAC | Straight-to-2°C | Gas w/ CCS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| LAC | Straight-to-2°C | Coal w/o CCS | 2.9 | 0.7 | 1.1 | 4.2 | 6.0 | 4.6 | 2.0 |
| LAC | Straight-to-2°C | Coal w/ CCS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| LAC | Straight-to-2°C | TOTAL | 3.6 | 4.0 | 2.6 | 6.7 | 8.5 | 8.0 | 6.9 |

**Supplementary Table 6B: LAC Power Sector Capital Investments and Stranded Asset Costs by Technology for the NDCs-to-2°C scenario. Numbers represent cumulative costs, in billion 2010 USD, over a five-year model period.**

**New Installations**

| Region | Scenario | Power Sector Technology | 2016-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|
| LAC | NDCs-to-2°C | Oil w/o CCS | 5.8 | 1.3 | 2.3 | 0.0 | 0.0 | 0.0 | 0.0 |
| LAC | NDCs-to-2°C | Oil w/ CCS | 0.0 | 19.7 | 12.3 | 59.0 | 31.0 | 25.9 | 17.7 |
| LAC | NDCs-to-2°C | Gas w/o CCS | 12.0 | 8.0 | 8.3 | 2.9 | 0.2 | 0.0 | 0.0 |
| LAC | NDCs-to-2°C | Gas w/ CCS | 0.0 | 12.2 | 15.9 | 72.1 | 71.3 | 73.8 | 73.7 |
| LAC | NDCs-to-2°C | Coal w/o CCS | 10.4 | 5.0 | 4.6 | 0.1 | 0.0 | 0.0 | 0.0 |
| LAC | NDCs-to-2°C | Coal w/ CCS | 0.0 | 2.3 | 2.6 | 18.2 | 20.5 | 21.3 | 21.4 |
| LAC | NDCs-to-2°C | Biomass w/o CCS | 6.4 | 7.0 | 7.6 | 1.6 | 0.0 | 0.0 | 0.0 |
| LAC | NDCs-to-2°C | Biomass w/ CCS | 0.0 | 8.8 | 6.3 | 88.7 | 96.3 | 99.7 | 106.1 |
| LAC | NDCs-to-2°C | Nuclear | 2.4 | 4.7 | 4.9 | 17.8 | 30.2 | 43.3 | 53.8 |
| LAC | NDCs-to-2°C | Hydro | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| LAC | NDCs-to-2°C | Wind | 8.7 | 16.9 | 23.9 | 79.5 | 74.3 | 83.5 | 90.4 |
| LAC | NDCs-to-2°C | Solar | 5.3 | 12.1 | 17.7 | 56.6 | 58.7 | 73.6 | 84.4 |
| LAC | NDCs-to-2°C | Geothermal | 5.7 | 8.6 | 11.1 | 27.8 | 22.7 | 19.4 | 18.2 |
| LAC | NDCs-to-2°C | TOTAL | 56.7 | 106.7 | 117.7 | 424.2 | 405.2 | 440.4 | 465.7 |

**Premature Retirements**

| Region | Scenario | Power Sector Technology | 2016-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|
| LAC | NDCs-to-2°C | Oil w/o CCS | 0.2 | 0.9 | 0.1 | 5.7 | 2.1 | 1.7 | 1.2 |
| LAC | NDCs-to-2°C | Oil w/ CCS | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| LAC | NDCs-to-2°C | Gas w/o CCS | 0.5 | 0.0 | 0.1 | 3.1 | 1.5 | 3.0 | 4.9 |
| LAC | NDCs-to-2°C | Gas w/ CCS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| LAC | NDCs-to-2°C | Coal w/o CCS | 2.9 | 0.0 | 0.2 | 9.8 | 8.0 | 5.5 | 2.2 |
| LAC | NDCs-to-2°C | Coal w/ CCS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| LAC | NDCs-to-1.5°C | TOTAL | 3.6 | 0.9 | 0.6 | 18.7 | 11.6 | 10.1 | 8.2 |

**Supplementary Table 6C: LAC Power Sector Capital Investments and Stranded Asset Costs by Technology for the Straight-to-1.5°C scenario. Numbers represent cumulative costs, in billion 2010 USD, over a five-year model period.**

**New Installations**

| Region | Scenario | Power Sector Technology | 2016-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|
| LAC | Straight-to-1.5°C | Oil w/o CCS | 5.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| LAC | Straight-to-1.5°C | Oil w/ CCS | 0.0 | 47.4 | 43.7 | 35.8 | 25.8 | 13.2 | 5.0 |
| LAC | Straight-to-1.5°C | Gas w/o CCS | 12.0 | 2.4 | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 |
| LAC | Straight-to-1.5°C | Gas w/ CCS | 0.0 | 44.9 | 65.2 | 75.0 | 80.4 | 72.6 | 64.2 |
| LAC | Straight-to-1.5°C | Coal w/o CCS | 10.4 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| LAC | Straight-to-1.5°C | Coal w/ CCS | 0.0 | 9.1 | 16.4 | 19.0 | 20.3 | 18.2 | 15.9 |
| LAC | Straight-to-1.5°C | Biomass w/o CCS | 6.4 | 1.2 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 |
| LAC | Straight-to-1.5°C | Biomass w/ CCS | 0.0 | 56.5 | 126.7 | 139.3 | 124.8 | 103.2 | 94.9 |
| LAC | Straight-to-1.5°C | Nuclear | 2.4 | 8.5 | 14.8 | 19.0 | 34.0 | 45.9 | 54.1 |
| LAC | Straight-to-1.5°C | Hydro | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| LAC | Straight-to-1.5°C | Wind | 8.7 | 40.9 | 59.7 | 69.6 | 80.8 | 87.0 | 90.5 |
| LAC | Straight-to-1.5°C | Solar | 5.3 | 29.1 | 38.6 | 51.2 | 67.5 | 79.8 | 85.0 |
| LAC | Straight-to-1.5°C | Geothermal | 5.7 | 19.0 | 23.3 | 18.3 | 20.6 | 18.0 | 16.2 |
| LAC | Straight-to-1.5°C | TOTAL | 56.7 | 259.4 | 389.7 | 427.2 | 454.4 | 437.9 | 425.9 |

**Premature Retirements**

| Region | Scenario | Power Sector Technology | 2016-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|
| LAC | Straight-to-1.5°C | Oil w/o CCS | 0.2 | 6.3 | 2.7 | 1.9 | 1.2 | 0.6 | 0.2 |
| LAC | Straight-to-1.5°C | Oil w/ CCS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 |
| LAC | Straight-to-1.5°C | Gas w/o CCS | 0.5 | 3.1 | 1.9 | 2.6 | 4.1 | 4.2 | 2.7 |
| LAC | Straight-to-1.5°C | Gas w/ CCS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| LAC | Straight-to-1.5°C | Coal w/o CCS | 2.9 | 7.6 | 7.8 | 4.7 | 1.7 | 0.4 | 0.1 |
| LAC | Straight-to-1.5°C | Coal w/ CCS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| LAC | Straight-to-1.5°C | TOTAL | 3.6 | 16.9 | 12.4 | 9.1 | 6.9 | 5.2 | 3.5 |

**Supplementary Table 6D: LAC Power Sector Capital Investments and Stranded Asset Costs by Technology for the NDCs-to-1.5°C scenario. Numbers represent cumulative costs, in billion 2010 USD, over a five-year model period.**

**New Installations**

| Region | Scenario | Power Sector Technology | 2016-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|
| LAC | NDCs-to-1.5°C | Oil w/o CCS | 5.8 | 1.3 | 2.3 | 0.0 | 0.0 | 0.0 | 0.0 |
| LAC | NDCs-to-1.5°C | Oil w/ CCS | 0.0 | 19.7 | 12.3 | 142.1 | 5.6 | 5.4 | 0.2 |
| LAC | NDCs-to-1.5°C | Gas w/o CCS | 12.0 | 8.0 | 8.3 | 0.0 | 0.0 | 0.0 | 0.0 |
| LAC | NDCs-to-1.5°C | Gas w/ CCS | 0.0 | 12.2 | 15.9 | 147.4 | 90.7 | 73.5 | 61.5 |
| LAC | NDCs-to-1.5°C | Coal w/o CCS | 10.4 | 5.0 | 4.6 | 0.0 | 0.0 | 0.0 | 0.0 |
| LAC | NDCs-to-1.5°C | Coal w/ CCS | 0.0 | 2.3 | 2.6 | 34.0 | 21.4 | 17.1 | 13.9 |
| LAC | NDCs-to-1.5°C | Biomass w/o CCS | 6.4 | 7.0 | 7.6 | 0.0 | 0.0 | 0.0 | 0.0 |
| LAC | NDCs-to-1.5°C | Biomass w/ CCS | 0.0 | 8.8 | 6.3 | 327.5 | 146.5 | 100.4 | 89.0 |
| LAC | NDCs-to-1.5°C | Nuclear | 2.4 | 4.7 | 4.9 | 37.4 | 40.6 | 50.3 | 57.5 |
| LAC | NDCs-to-1.5°C | Hydro | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| LAC | NDCs-to-1.5°C | Wind | 8.7 | 16.9 | 23.9 | 144.0 | 93.1 | 92.7 | 93.8 |
| LAC | NDCs-to-1.5°C | Solar | 5.3 | 12.1 | 17.7 | 107.1 | 79.0 | 84.5 | 87.3 |
| LAC | NDCs-to-1.5°C | Geothermal | 5.7 | 8.6 | 11.1 | 42.4 | 22.5 | 18.6 | 15.8 |
| LAC | NDCs-to-1.5°C | TOTAL | 56.7 | 106.7 | 117.7 | 981.9 | 499.3 | 442.6 | 419.0 |

**Premature Retirements**

| Region | Scenario | Power Sector Technology | 2016-2020 | 2021-2025 | 2026-2030 | 2031-2035 | 2036-2040 | 2041-2045 | 2046-2050 |
|---|---|---|---|---|---|---|---|---|---|
| LAC | NDCs-to-1.5°C | Oil w/o CCS | 0.2 | 0.9 | 0.1 | 12.4 | 1.5 | 0.5 | 0.2 |
| LAC | NDCs-to-1.5°C | Oil w/ CCS | 0.0 | 0.0 | 0.1 | 0.0 | 5.7 | 3.0 | 2.8 |
| LAC | NDCs-to-1.5°C | Gas w/o CCS | 0.5 | 0.0 | 0.1 | 16.5 | 6.9 | 5.2 | 2.6 |
| LAC | NDCs-to-1.5°C | Gas w/ CCS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| LAC | NDCs-to-1.5°C | Coal w/o CCS | 2.9 | 0.0 | 0.2 | 30.0 | 1.1 | 0.3 | 0.1 |
| LAC | NDCs-to-1.5°C | Coal w/ CCS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| LAC | NDCs-to-1.5°C | TOTAL | 3.6 | 0.9 | 0.6 | 59.0 | 15.1 | 8.9 | 5.6 |

**Supplementary Table 7**

**Supplementary Table 7: Sensitivity analysis parameters**

| Sensitivity Variable | GCAM parameter | Low | Mid *(Central Assumption)* | High |
|---|---|---|---|---|
| **Political willingness to avoid stranded assets** | median shutdown point with respect to profit margin | - | -0.1 | -0.5* |
| **Role of land-use in mitigation** | % of carbon price faced by land sector | 1% | 10% | 50% |

* A case which did not allow any stranding in the power sector failed to solve.

**Supplementary Table 8**

**Supplementary Table 8: CO2 Prices for All Scenarios in 2050**

| Temperature Target | Stranding Avoidance | Technology availability | Role of land-use in mitigation | CO2 price (2050) (2010$ / tCO2) |
|---|---|---|---|---|
| Straight-to-2°C | Mid Avoidance | Full Tech | Mid LUC | $237 |
| Straight-to-1.5°C | Mid Avoidance | Full Tech | Mid LUC | $418 |
| NDCs-to-2°C | Mid Avoidance | Full Tech | Mid LUC | $251 |
| NDCs-to-2°C | Mid Avoidance | Full Tech | Low LUC | $251 |
| NDCs-to-2°C | Mid Avoidance | Full Tech | High LUC | $279 |
| NDCs-to-2°C | Mid Avoidance | No CCS | Mid LUC | $558 |
| NDCs-to-2°C | Mid Avoidance | No CCS | Low LUC | $614 |
| NDCs-to-2°C | Mid Avoidance | No CCS | High LUC | $558 |
| NDCs-to-2°C | Mid Avoidance | No CCS and No New Nuclear | Mid LUC | $558 |
| NDCs-to-2°C | Mid Avoidance | No CCS and No New Nuclear | Low LUC | $614 |
| NDCs-to-2°C | Mid Avoidance | No CCS and No New Nuclear | High LUC | $558 |
| NDCs-to-2°C | High Avoidance | Full Tech | Mid LUC | $293 |
| NDCs-to-2°C | High Avoidance | Full Tech | Low LUC | $293 |
| NDCs-to-2°C | High Avoidance | Full Tech | High LUC | $335 |
| NDCs-to-2°C | High Avoidance | No CCS | Mid LUC | $641 |
| NDCs-to-2°C | High Avoidance | No CCS | Low LUC | $683 |
| NDCs-to-2°C | High Avoidance | No CCS | High LUC | $628 |
| NDCs-to-2°C | High Avoidance | No CCS and No New Nuclear | Mid LUC | $641 |
| NDCs-to-2°C | High Avoidance | No CCS and No New Nuclear | Low LUC | $697 |
| NDCs-to-2°C | High Avoidance | No CCS and No New Nuclear | High LUC | $628 |
| NDCs-to-1.5°C | Mid Avoidance | Full Tech | Mid LUC | $516 |
| NDCs-to-1.5°C | Mid Avoidance | Full Tech | Low LUC | $516 |
| NDCs-to-1.5°C | Mid Avoidance | Full Tech | High LUC | $586 |
| NDCs-to-1.5°C | High Avoidance | Full Tech | Mid LUC | $586 |
| NDCs-to-1.5°C | High Avoidance | Full Tech | Low LUC | $614 |
| NDCs-to-1.5°C | High Avoidance | Full Tech | High LUC | $655 |

**Supplementary Table 9**

**Supplementary Table 9: Food Prices for Selected NDCs-to-2°C Scenarios in 2050**

| **Temperature Target** | **Stranding Avoidance** | **Technology availability** | **Role of land-use in mitigation** | **Aggregate Food Price* (2050) (2010$ / Mcal)** |
|---|---|---|---|---|
| NDCs-to-2°C | Mid Avoidance | Full Tech | Mid LUC | $1.53 |
| NDCs-to-2°C | Mid Avoidance | No CCS | Mid LUC | $2.21 |
| NDCs-to-2°C | Mid Avoidance | No CCS and No New Nuclear | Mid LUC | $2.21 |
| NDCs-to-2°C | High Avoidance | Full Tech | Mid LUC | $1.67 |
| NDCs-to-2°C | High Avoidance | No CCS | Mid LUC | $2.41 |
| NDCs-to-2°C | High Avoidance | No CCS and No New Nuclear | Mid LUC | $2.41 |

* Consumption-weighted average food price (crops & meat) for Latin America and the Caribbean in 2050. Average prices calculated by multiplying prices and consumption for each food good / GCAM region, summing to get total food expenditures across LAC, and dividing by total food consumption in LAC to get an average price per Mcal consumed.

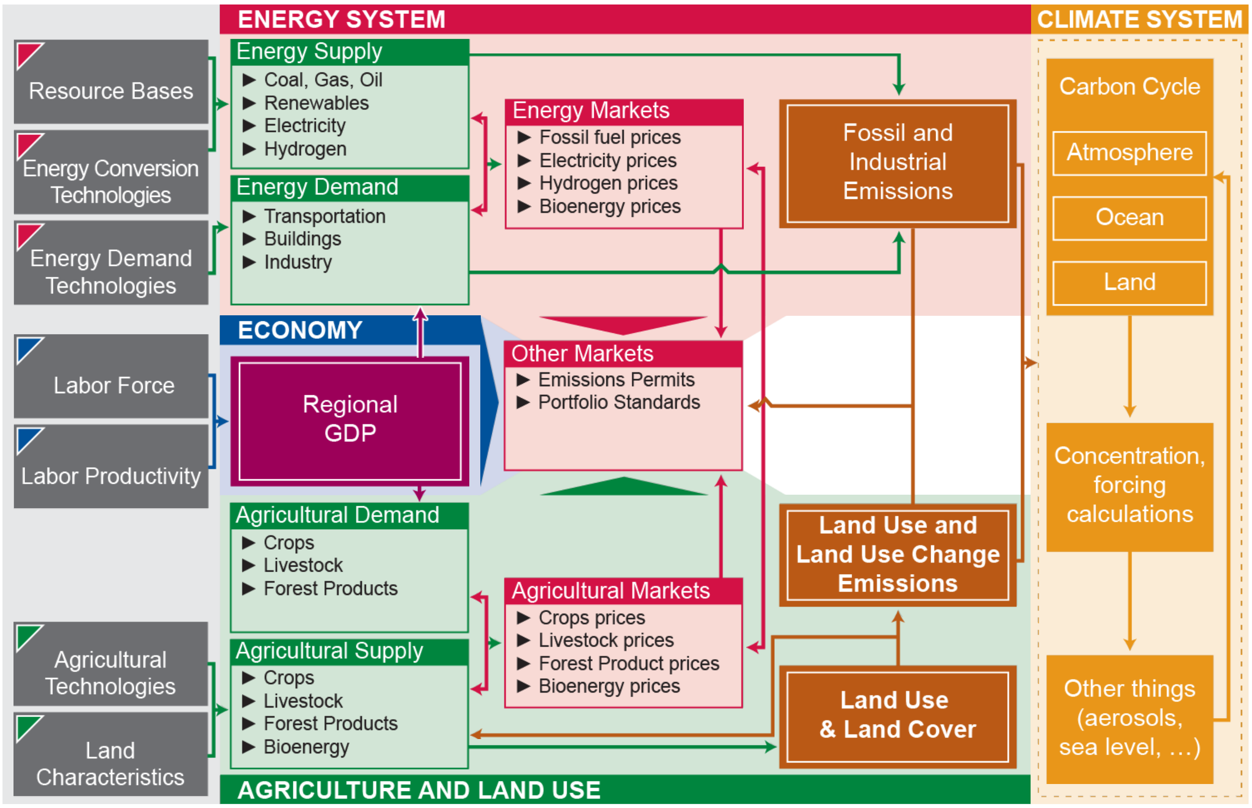
**Supplementary Table 10**

**Supplementary Table 10: Passenger Transportation Service for All Scenarios in 2050**

| Temperature Target | Stranding Avoidance | Technology availability | Role of land-use in mitigation | Passenger Transportation (million passenger km) |
|---|---|---|---|---|
| NDCs-to-2°C | Mid Avoidance | Full Tech | Mid LUC | 725,874 |
| NDCs-to-2°C | Mid Avoidance | Full Tech | Low LUC | 729,213 |
| NDCs-to-2°C | Mid Avoidance | Full Tech | High LUC | 719,352 |
| NDCs-to-2°C | Mid Avoidance | No CCS | Mid LUC | 672,816 |
| NDCs-to-2°C | Mid Avoidance | No CCS | Low LUC | 670,120 |
| NDCs-to-2°C | Mid Avoidance | No CCS | High LUC | 672,218 |
| NDCs-to-2°C | Mid Avoidance | No CCS and No New Nuclear | Mid LUC | 671,559 |
| NDCs-to-2°C | Mid Avoidance | No CCS and No New Nuclear | Low LUC | 668,842 |
| NDCs-to-2°C | Mid Avoidance | No CCS and No New Nuclear | High LUC | 670,954 |
| NDCs-to-2°C | High Avoidance | Full Tech | Mid LUC | 717,154 |
| NDCs-to-2°C | High Avoidance | Full Tech | Low LUC | 719,301 |
| NDCs-to-2°C | High Avoidance | Full Tech | High LUC | 708,349 |
| NDCs-to-2°C | High Avoidance | No CCS | Mid LUC | 663,570 |
| NDCs-to-2°C | High Avoidance | No CCS | Low LUC | 662,440 |
| NDCs-to-2°C | High Avoidance | No CCS | High LUC | 664,508 |
| NDCs-to-2°C | High Avoidance | No CCS and No New Nuclear | Mid LUC | 662,423 |
| NDCs-to-2°C | High Avoidance | No CCS and No New Nuclear | Low LUC | 659,892 |
| NDCs-to-2°C | High Avoidance | No CCS and No New Nuclear | High LUC | 663,368 |
| NDCs-to-1.5°C | Mid Avoidance | Full Tech | Mid LUC | 680,352 |
| NDCs-to-1.5°C | Mid Avoidance | Full Tech | Low LUC | 680,080 |
| NDCs-to-1.5°C | Mid Avoidance | Full Tech | High LUC | 670,707 |
| NDCs-to-1.5°C | High Avoidance | Full Tech | Mid LUC | 671,267 |
| NDCs-to-1.5°C | High Avoidance | Full Tech | Low LUC | 668,308 |
| NDCs-to-1.5°C | High Avoidance | Full Tech | High LUC | 662,713 |

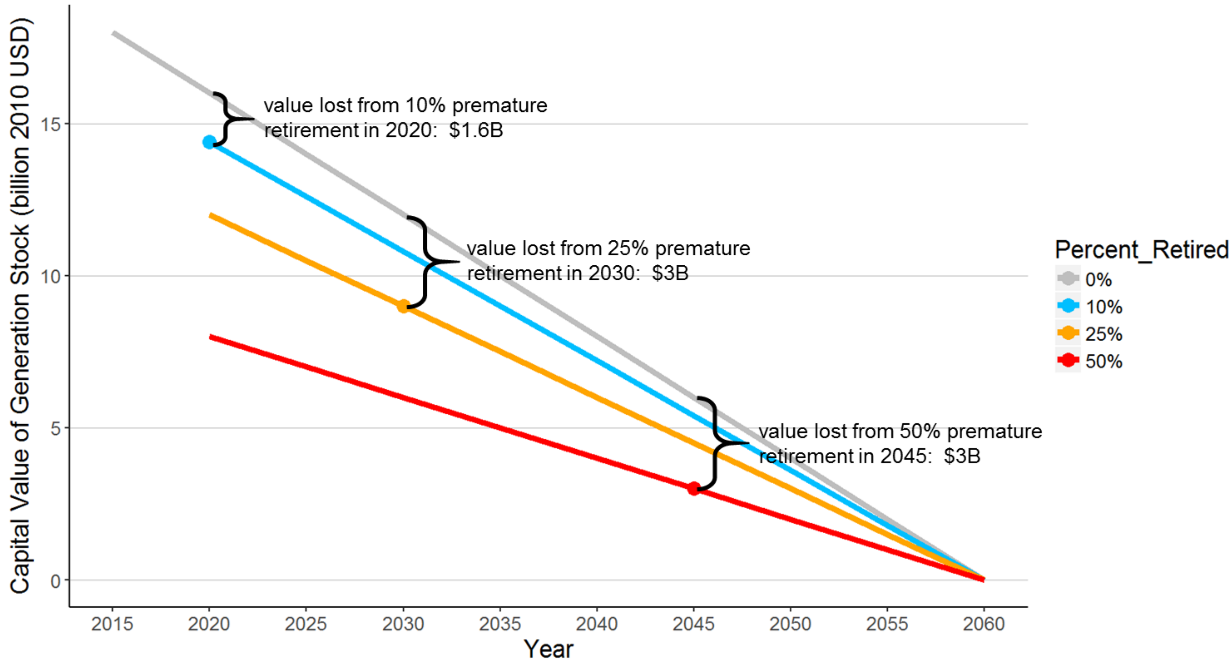
## Supplementary Figures

### Supplementary Figure 1



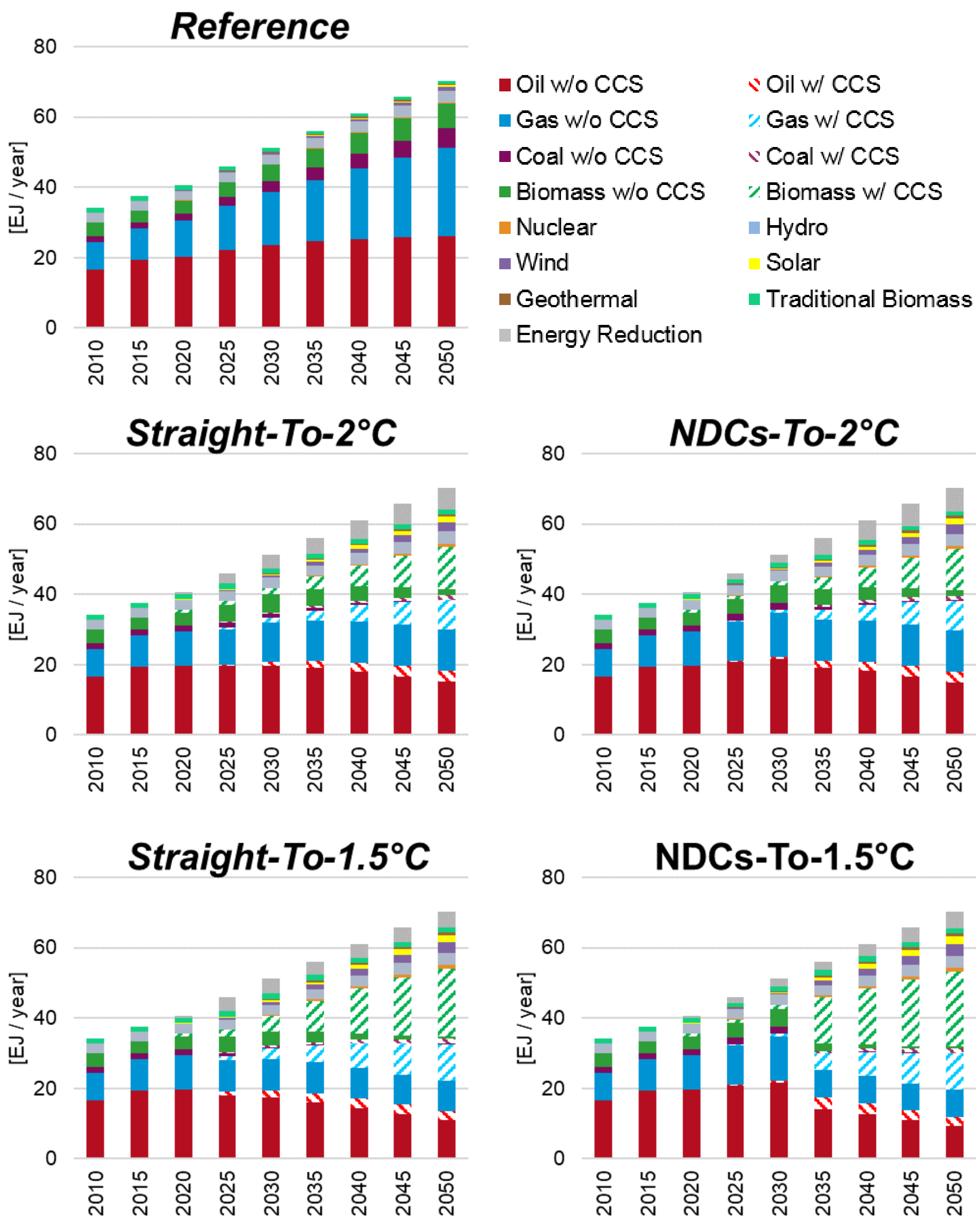

*Supplementary Figure 1: Structure of the Global Change Assessment Model*

**Supplementary Figure 2**



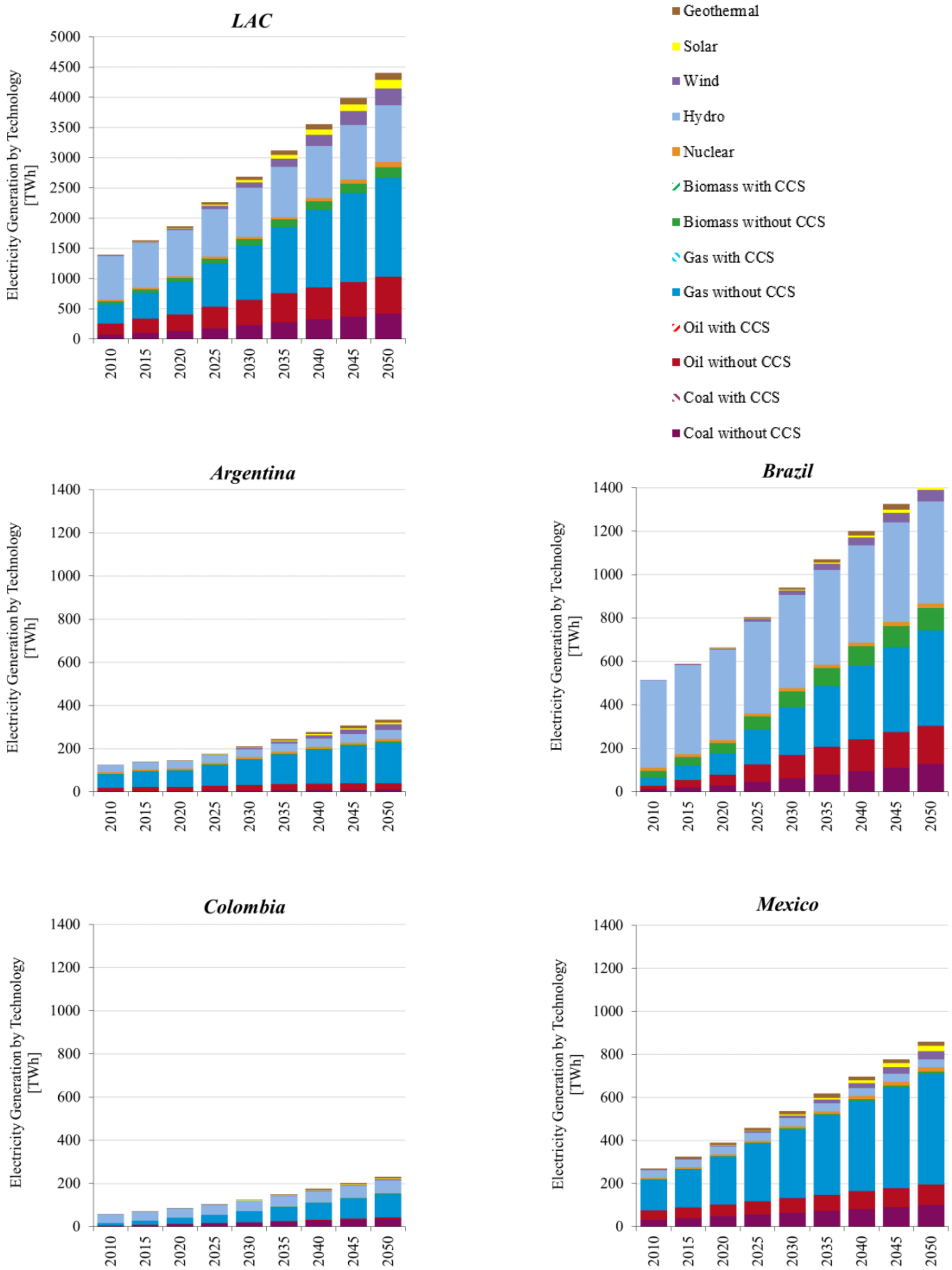

***Supplementary Figure 2: Calculation of the foregone value due to premature retirement of hypothetical electric power capital stock. For this example, the vintage is assumed to be 2015 with a capital asset value of $18B 2010 USD, and expected technical lifetime of 45 years. The lines represent value across time for different magnitudes of premature retirement. The gray (0% retired) line reflects a simple linear devaluation of the capital stock. The blue (10% retired), yellow (25% retired), and red (50% retired) lines represent the remaining value of the vintage across time if the specified percent were to be retired in a given year. (A vintage is always fully utilized during its initial operating period; the earliest this hypothetical vintage could be prematurely retired is 2020). The distance between the gray and blue / yellow / red lines represents the loss of value associated with that respective level of premature retirement.***

**Supplementary Figure 3**

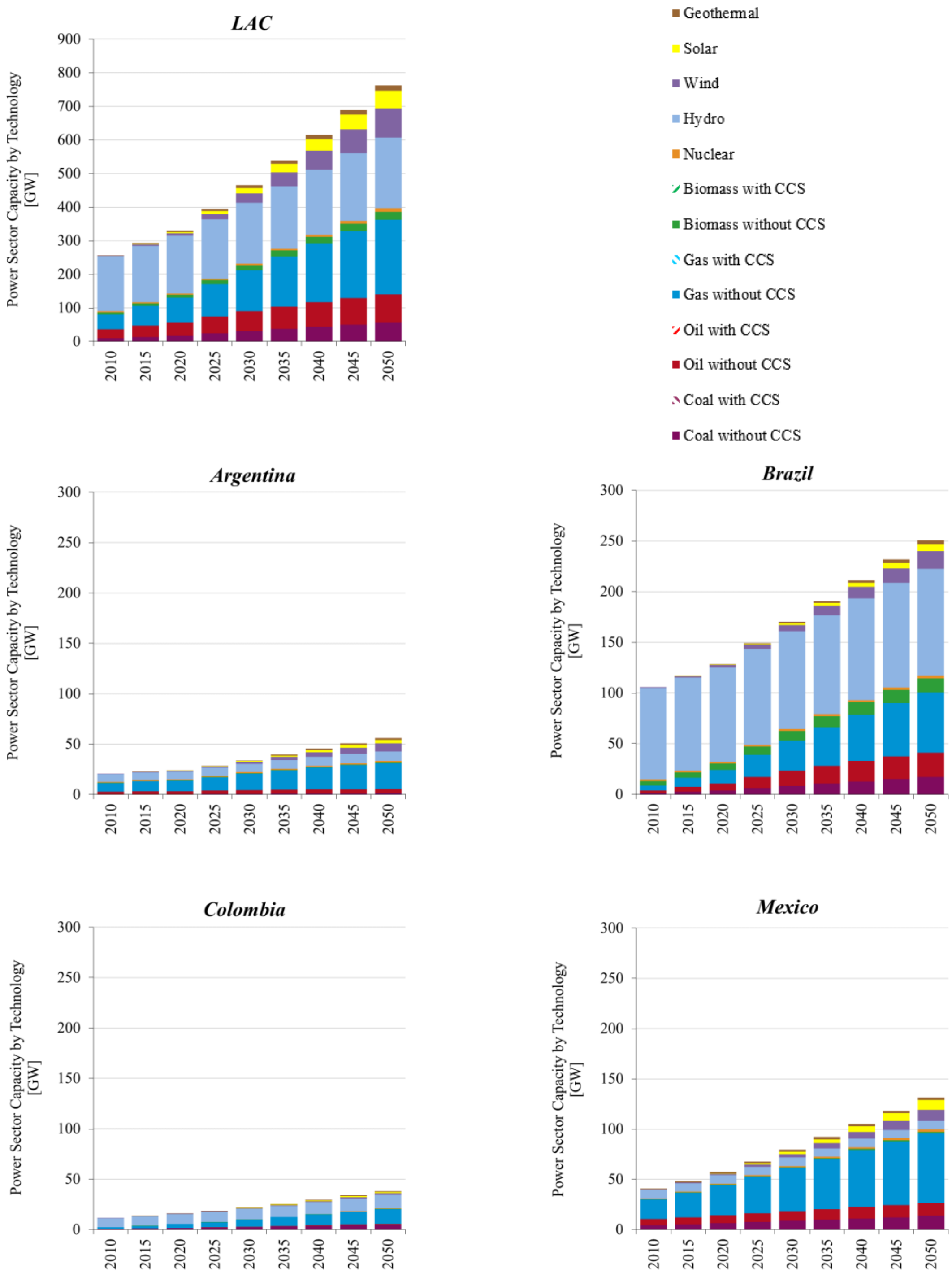



***Supplementary Figure 3: Primary energy consumption (direct equivalent) by fuel in Latin America and Caribbean for each model scenario. "Energy Reduction" (gray) for each mitigation scenario is relative to Reference.***

## Supplementary Figure 4

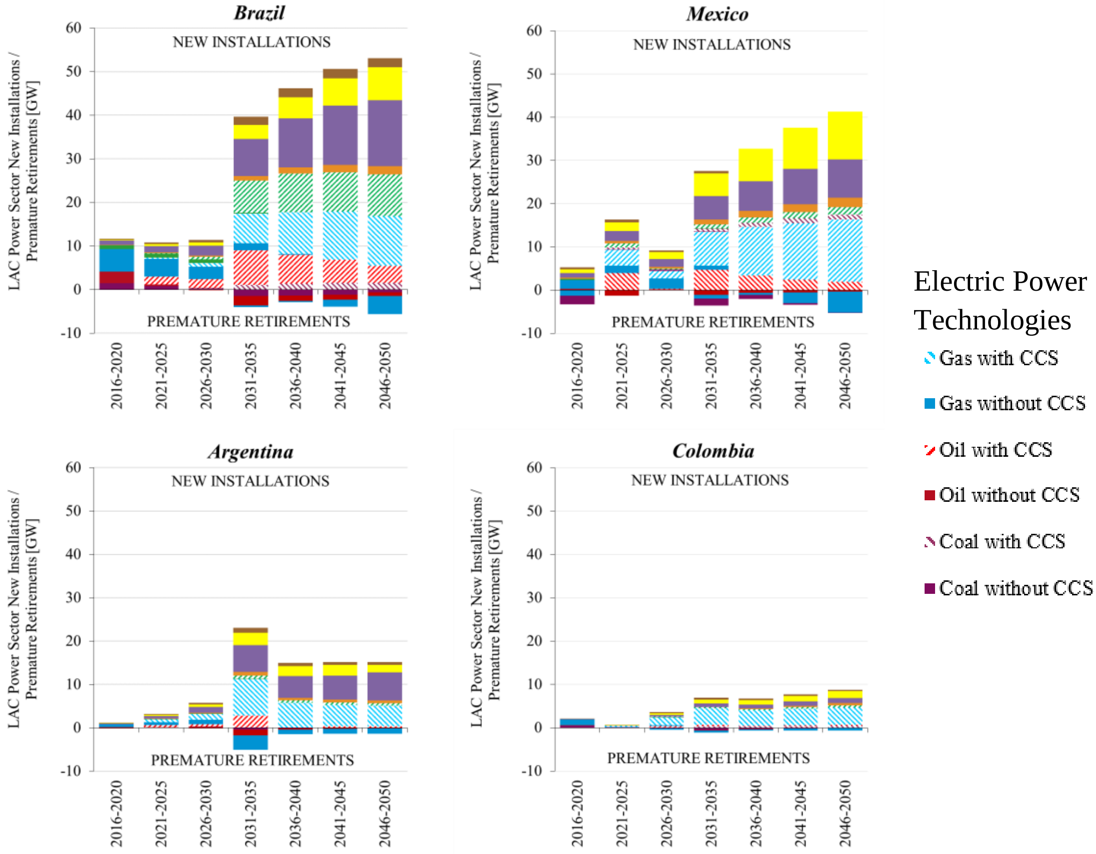



***Supplementary Figure 4A: Electricity Generation by Technology in Reference Scenario, for Latin America and the Caribbean (LAC) and the region's four largest economies.***

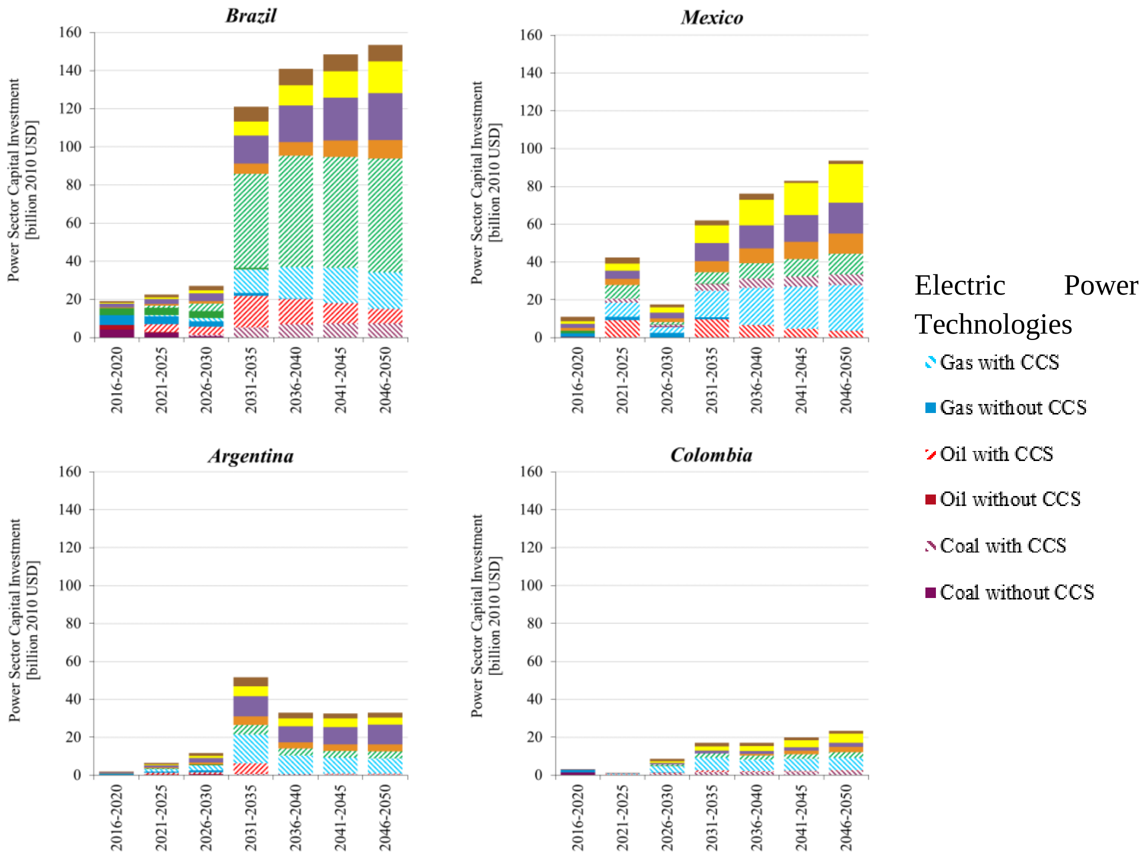



***Supplementary Figure 4B: Power Sector Capacity by Technology in Reference Scenario, for Latin America and the Caribbean (LAC) and the region's four largest economies.***

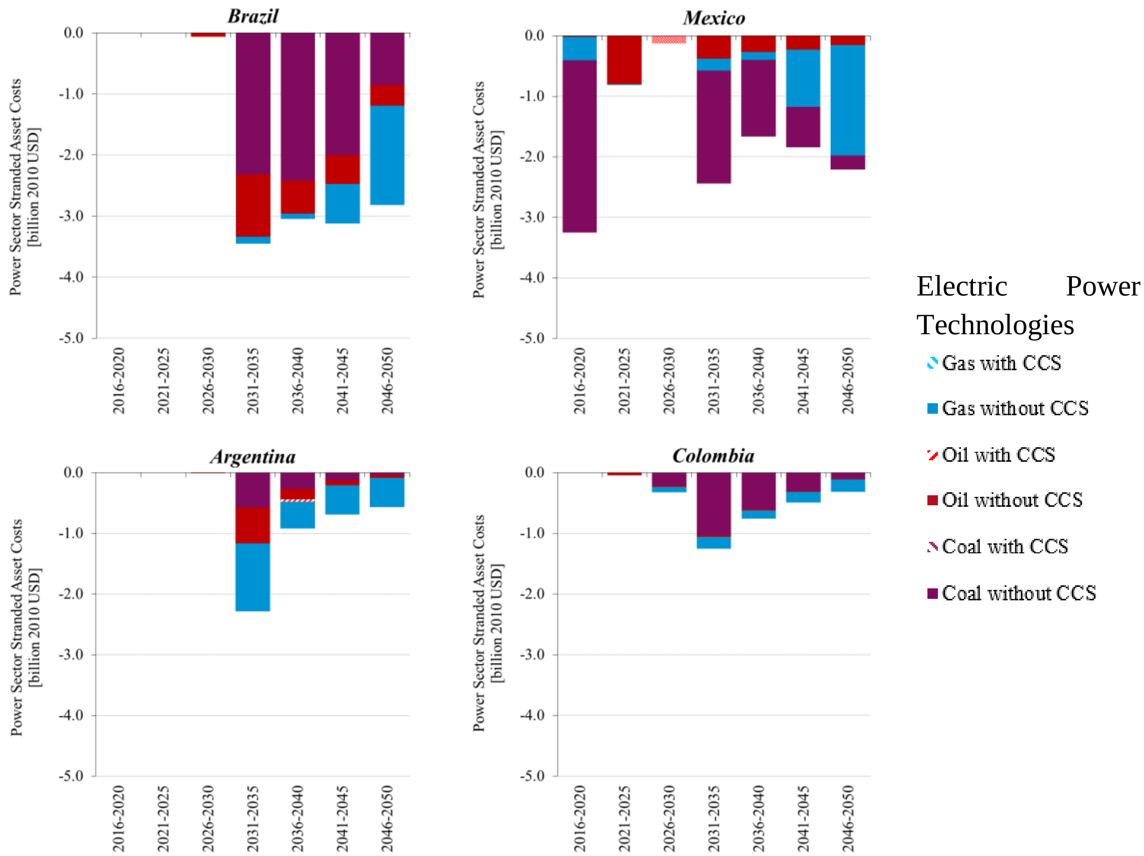
**Supplementary Figure 5**




***Supplementary Figure 5A: Country-Level Power Sector New Installations and Premature Retirements (negative values) by Period and Technology (NDCs-to-2°C scenario). Bars represent cumulative additions / retirements over a five-year model period.***

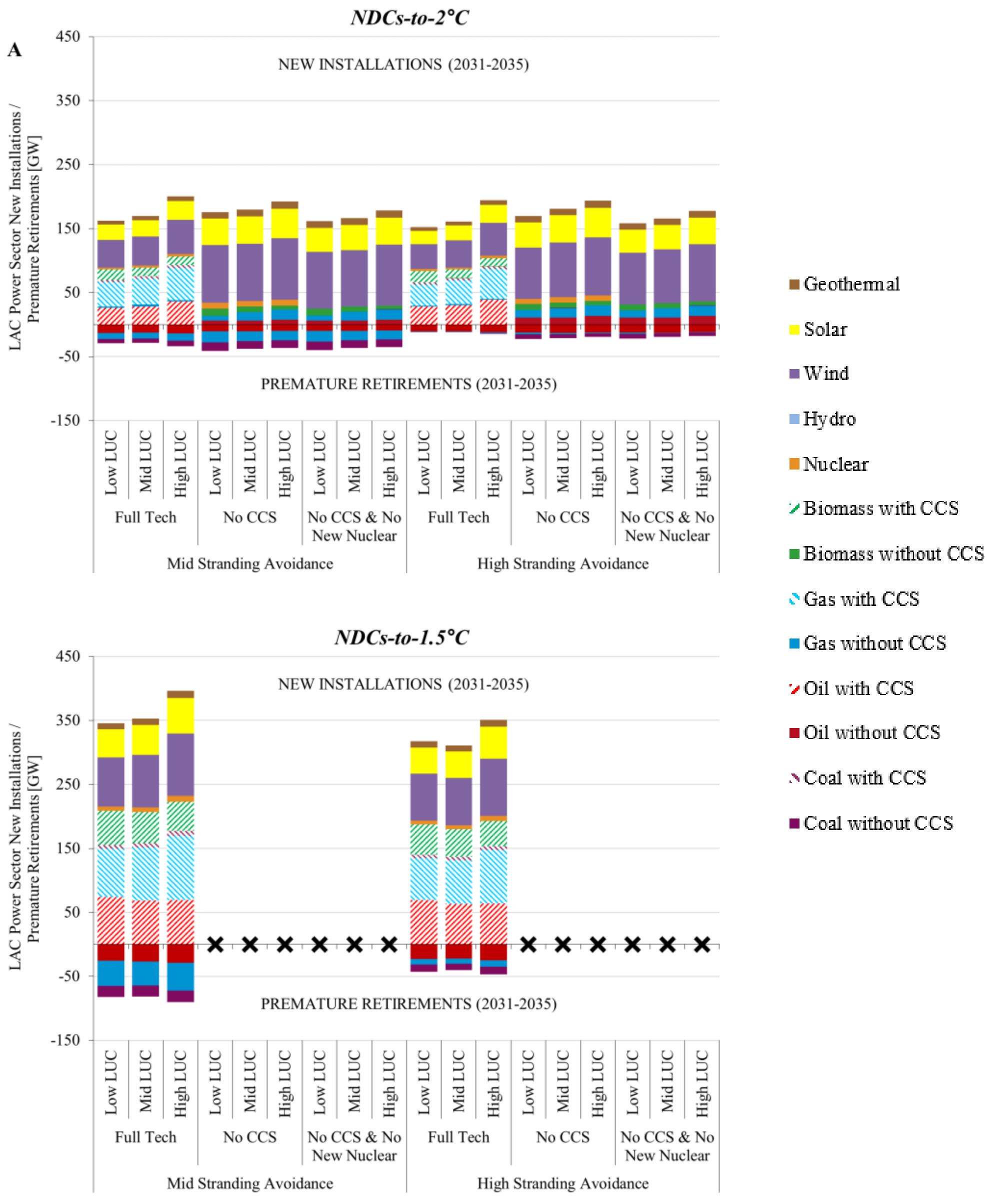



***Supplementary Figure 5B: Country-Level Power Sector Capital Investment by Period and Technology (NDCs-to-2°C scenario). Bars represent cumulative costs over a five-year model period.***

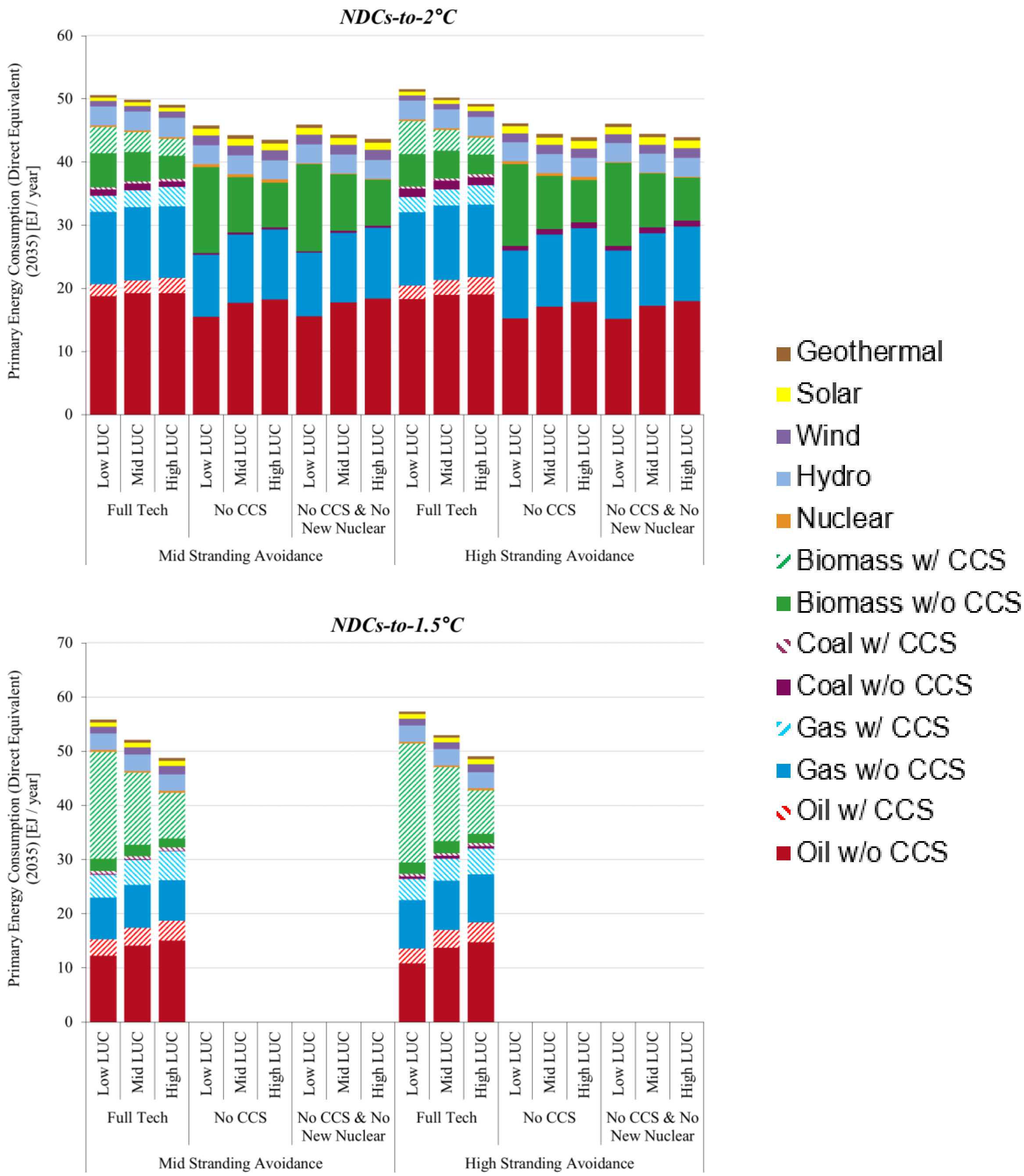



***Supplementary Figure 3C: Country-Level Power Sector Stranded Asset Costs by Period and Technology (NDCs-to-2°C scenario). Bars represent cumulative costs over a five-year model period.***

**Supplementary Figure 6**

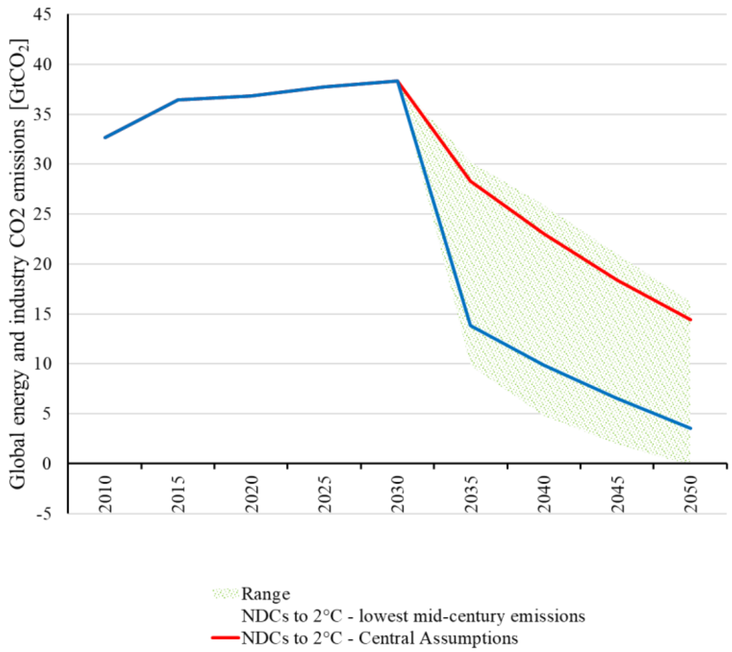



***Supplementary Figure 6A: New Installations and Premature Retirements (negative investment values) by Scenario and Technology in the LAC Power Sector (2031-2035) across sensitivity cases. Bars represent cumulative additions / retirements over the five-year model period.***

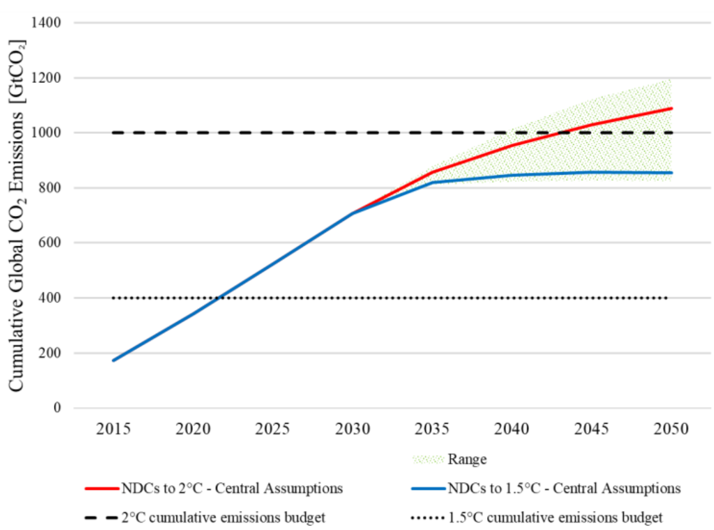



***Supplementary Figure 6B: Latin America and Caribbean Primary Energy Consumption (2035) by Scenario and Technology***

**Supplementary Figure 7**

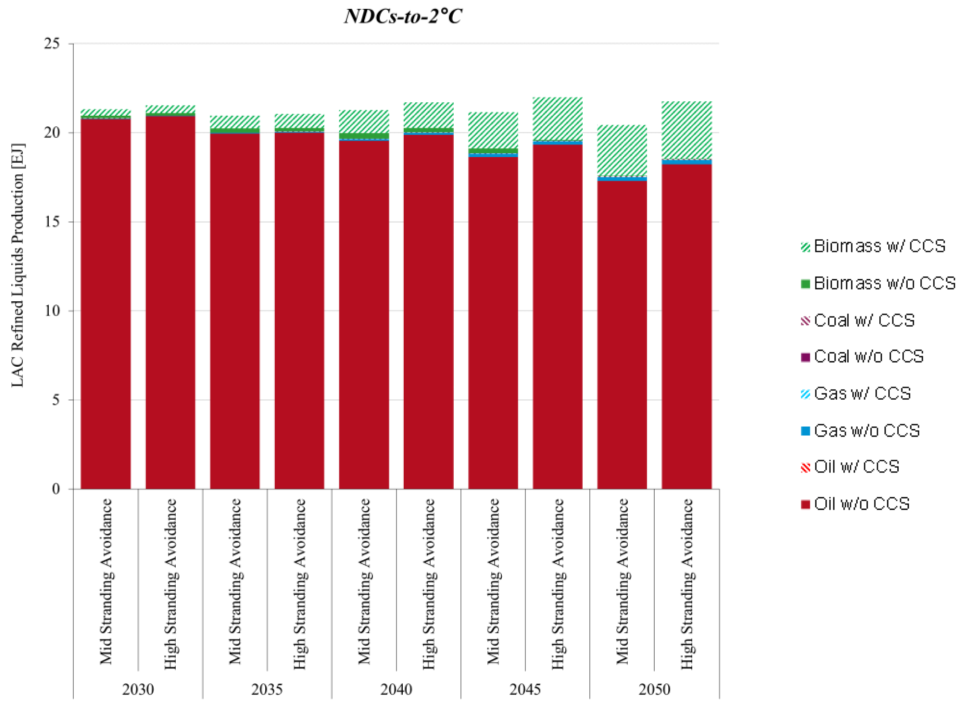



***Supplementary Figure 7A: Global energy and industry CO2 emissions. Solid lines represent cumulative emissions from the NDCs-to-2°C scenario and NDCs-to-1.5°C scenario with central assumptions. Shaded area represents the range of cumulative emissions across sensitivity cases.***



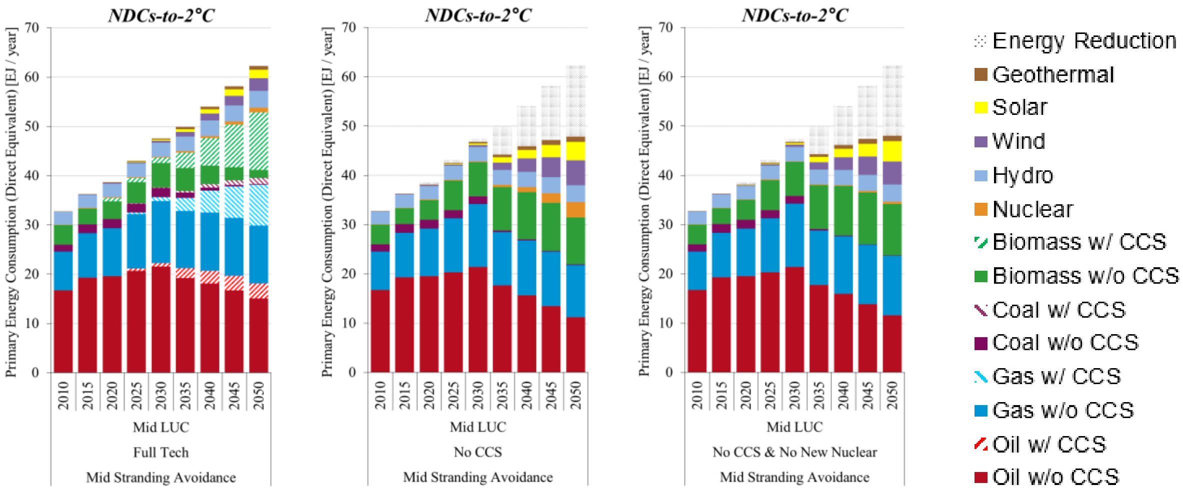

***Supplementary Figure 7B: Cumulative global $CO_2$ emissions (beginning 2011) by scenario. Solid lines represent cumulative emissions from the NDCs-to-2°C scenario and NDCs-to-1.5°C scenario with central assumptions. Dashed lines represent 2°C and 1.5°C cumulative emissions budgets (2011-2100). Shaded area represents the range of cumulative emissions across sensitivity cases.***

**Supplementary Figure 8**

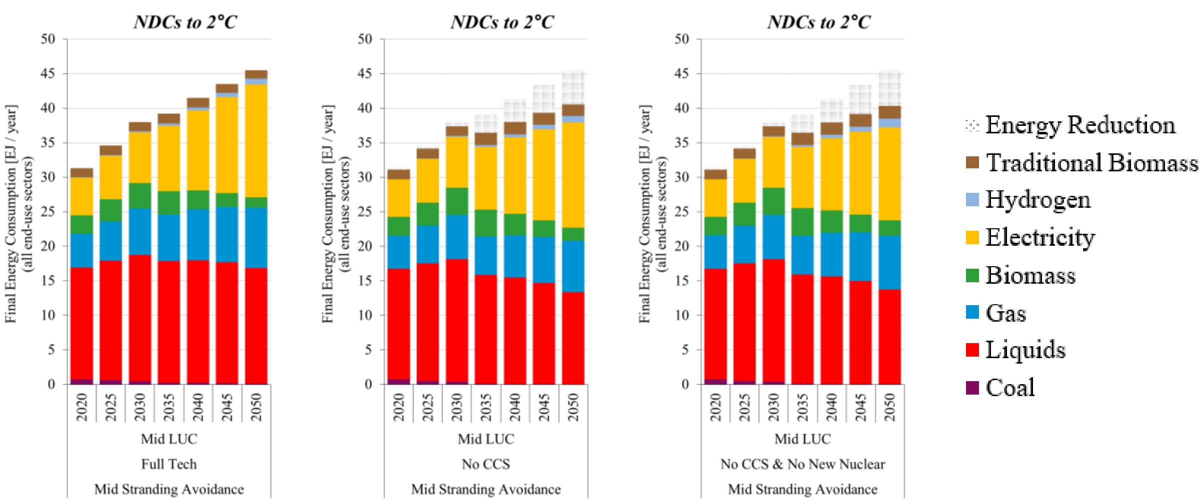



***Supplementary Figure 8: Refined liquids production by scenario, period, and technology in LAC for NDCs-to-2°C scenarios with Mid / High Stranding Avoidance and central technology / land-use mitigation assumptions.***

**Supplementary Figure 9**

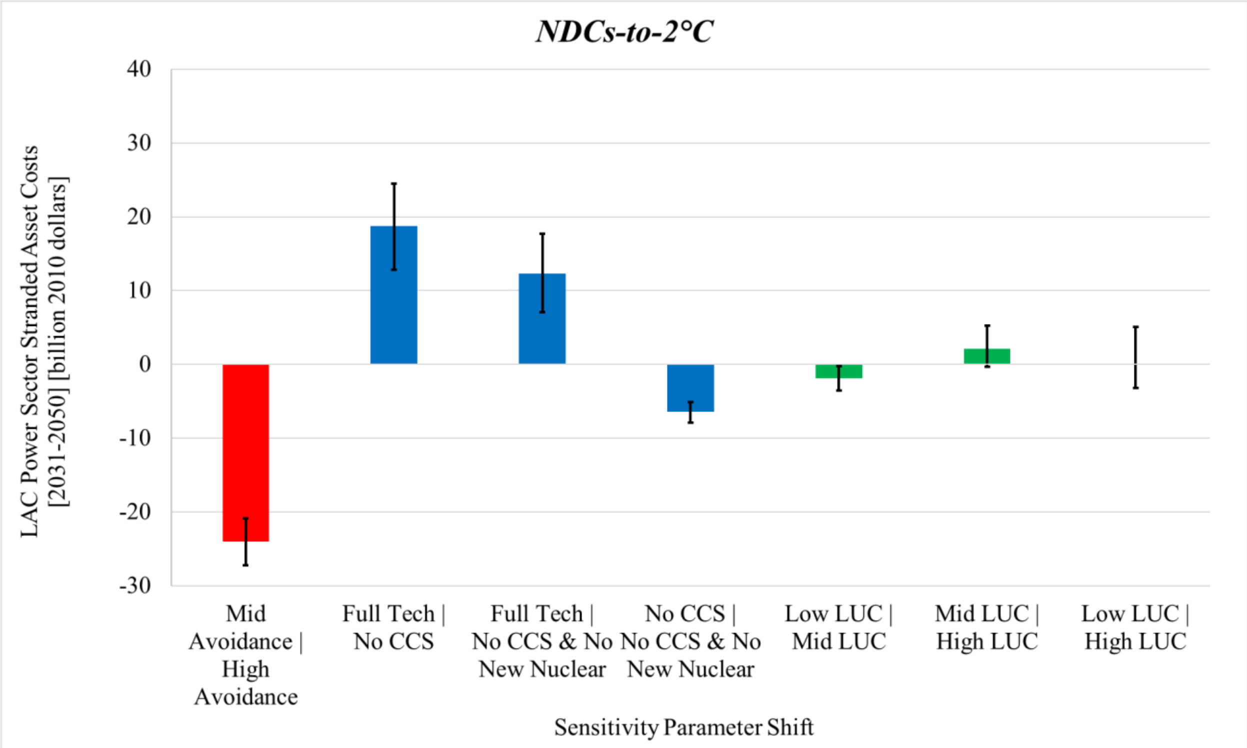



***Supplementary Figure 9A: Primary Energy Consumption by Scenario, Period, and Technology in LAC for NDCs-to-2°C scenarios with Full Tech / No CCS / No CCS and No New Nuclear technology assumptions and central stranding avoidance / land-use mitigation assumptions.***



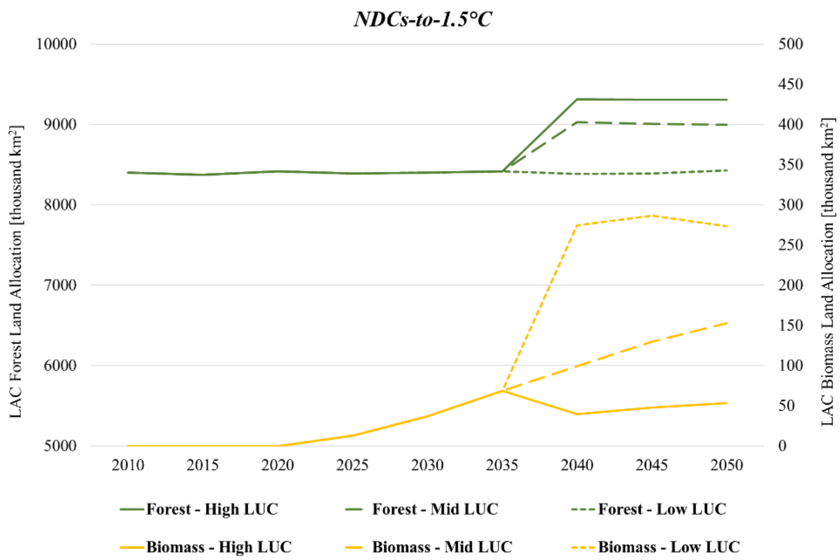

***Supplementary Figure 9B: Final Energy Consumption by Scenario, Period, and Fuel in LAC for NDCs-to-2°C scenarios with Full Tech / No CCS / No CCS and No New Nuclear technology assumptions and central stranding avoidance / land-use mitigation assumptions.***

**Supplementary Figure 10**

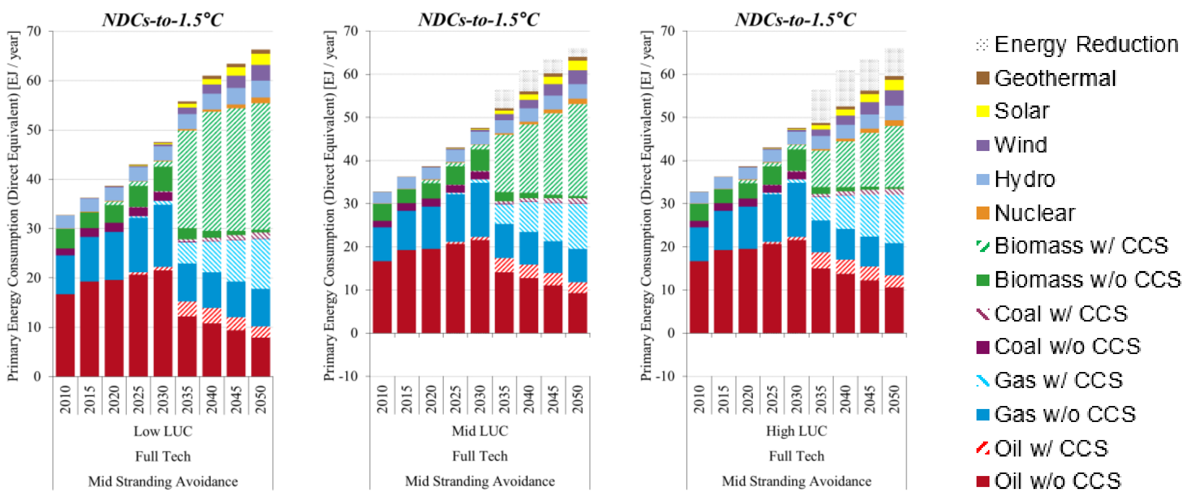



***Supplementary Figure 10: Sensitivity of LAC power sector stranded asset costs to changes in sensitivity parameters. Bars represent average additional cumulative stranded asset costs over the twenty-year period from 2031-2050 associated with switching from parameter value 1 to parameter value 2 (where value 1 is before " | " and value 2 is after " | "). Error bars represent the range of average additional cumulative stranded asset costs over the same period. Additional cumulative stranded asset costs are calculated by identifying paired cases where all sensitivity parameters besides the one being perturbed are identical, and calculating the difference in stranding associated with moving from the first parameter value to the second. "Stranding Avoidance" has 9 sets of paired cases; "Technology Availability" and "Role of Land-Use in Mitigation" each have 6 sets of paired cases.***

**Supplementary Figure 11**

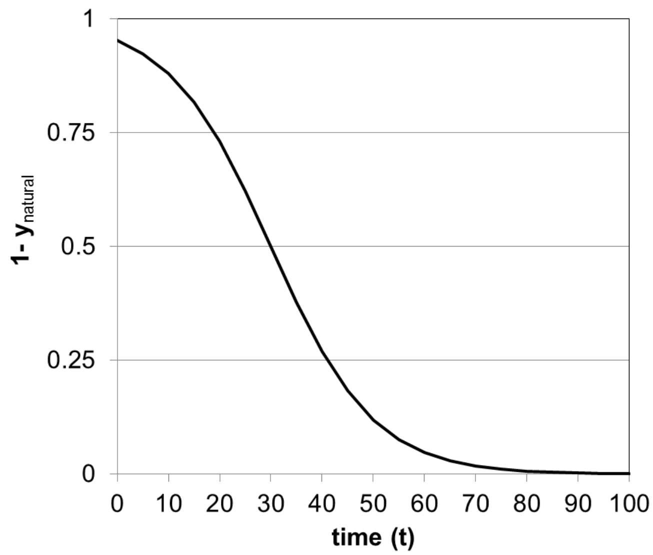



***Supplementary Figure 11A: Land Allocation for Forest and Biomass in LAC for NDCs-to-1.5°C scenarios with Low / Mid / High land-use mitigation assumptions and central stranding avoidance / technology assumptions.***

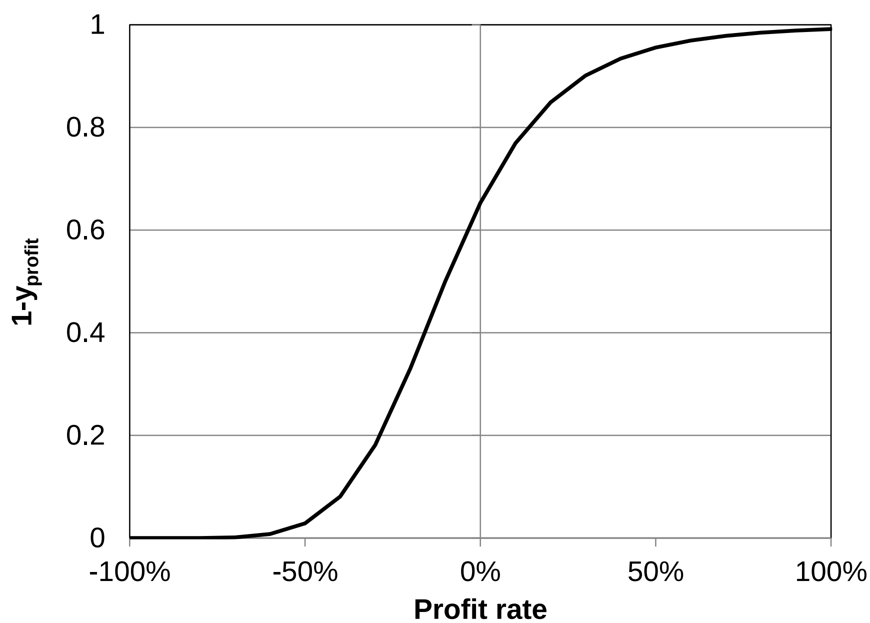



***Supplementary Figure 11B: Primary Energy Consumption by Scenario, Period, and Technology in LAC for NDCs-to-1.5°C scenarios with Low / Mid / High land-use mitigation assumptions and central stranding avoidance / technology assumptions.***

**Supplementary Figure 12**




*Supplementary Figure 12A:* $\mathbf{1-}\ y_{natural}(\boldsymbol{t})$ *for a steepness coefficient (b) of 0.1 and mid-life (x) of 30 years*




*Supplementary Figure 12B:* $\mathbf{1-}\ y_{profit}$ *for a steepness coefficient (b) of 6 and x = -10%*

**Supplementary Figure 13**

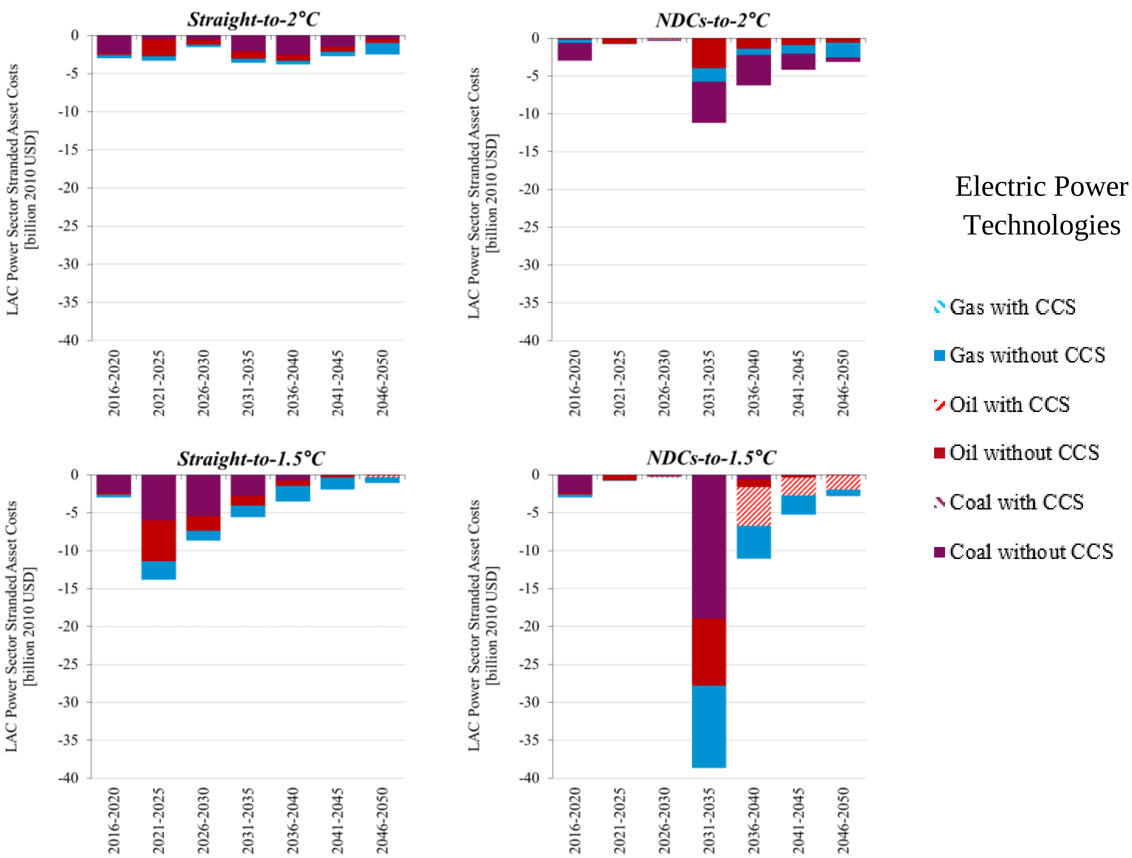



***Figure 13a: LAC Power Sector Stranded Asset Costs by Scenario, Period, and Technology, assuming a 30-year financial lifetime for all technologies. Bars represent cumulative costs over a five-year model period.***

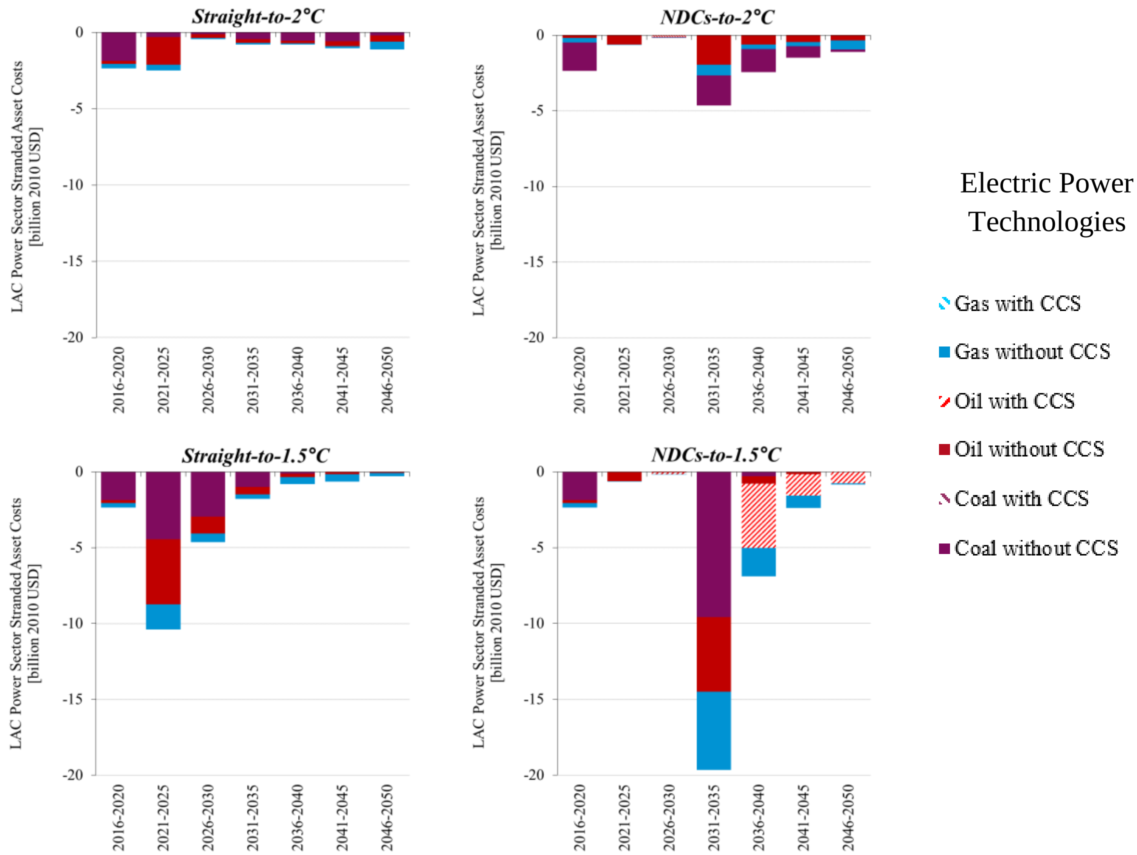



***Figure 13b: LAC Power Sector Stranded Asset Costs by Scenario, Period, and Technology, assuming a 20-year financial lifetime for all technologies. Bars represent cumulative costs over a five-year model period.***

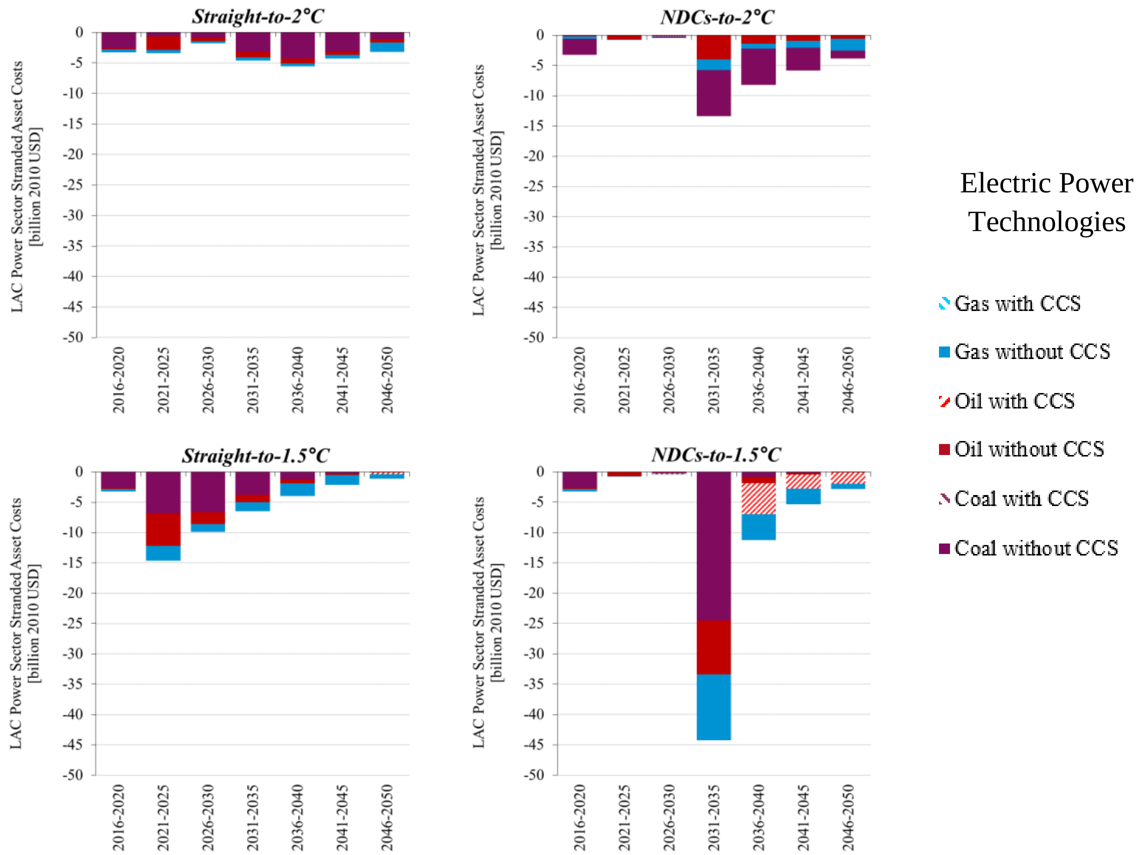



***Figure 13c: LAC Power Sector Stranded Asset Costs by Scenario, Period, and Technology, assuming physical lifetimes consistent with Krey et al. (2019). Bars represent cumulative costs over a five-year model period.***

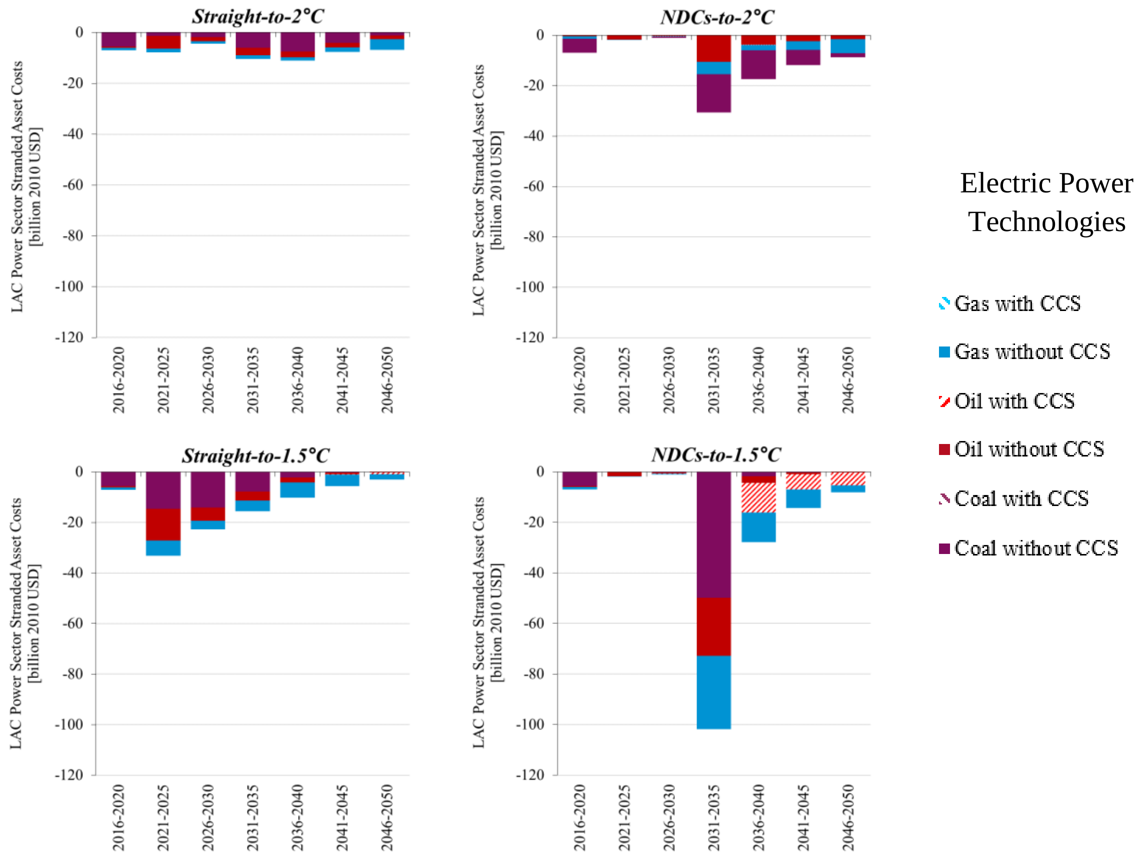



***Figure 13d: LAC Power Sector Stranded Asset Costs by Scenario, Period, and Technology, assuming a 30-year financial lifetime for all technologies and inclusive of financing costs, with costs discounted to net present value using a 5% discount rate. Bars represent cumulative costs over a five-year model period.***

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