

# CONSTRUCTION DESTRUCTION

THE HIDDEN CARBON COSTS  
OF DIRTY STEEL



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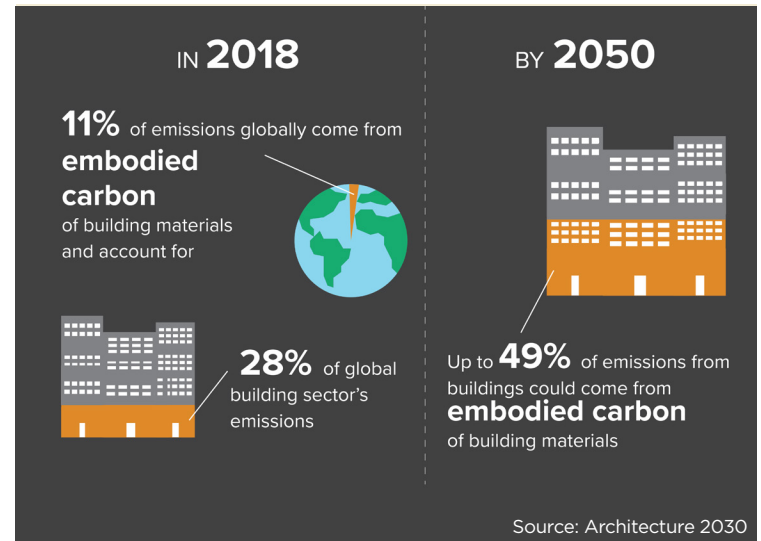
## THE HIDDEN CARBON IN OUR BUILT ENVIRONMENT

Steel is a fundamental facet of the built environment: it's in our buildings, bridges, pipelines, and wind turbines. In fact, more than half of the world's steel is used in construction, a category that includes buildings and infrastructure.<sup>1</sup>

While steel is a choice material for its strength and durability, it also presents a challenge: steel production is highly carbon-intensive. The global steel industry emits 2.3 gigatons of carbon dioxide each year – equivalent to the emissions from 569 coal plants.<sup>2,3</sup> Therefore, as the steel industry's largest customer segment, the construction industry is responsible for a massive amount of pollution before a project even breaks ground.

Over the past several decades, the construction industry has made tremendous advances in reducing climate pollution through enhanced design and operational efficiency, so attention is shifting toward embodied carbon – emissions resulting from the mining, manufacturing, and transportation of a product. Each year, the embodied carbon of all building materials accounts for 11 percent of global emissions and 28 percent of global building sector emissions.<sup>4</sup>

As buildings emit less day-to-day, their embodied carbon will take up an even greater proportion of their climate pollution, with one estimate making embodied carbon responsible for 49 percent of the carbon released from buildings constructed between 2020 and 2050.<sup>5</sup> Given the significant emissions coming from the construction industry, it is time for industry leaders like Skanska to tackle the problem with urgency and raise the bar on steel and other materials.



## THE REAL COSTS OF DIRTY STEEL

As far as building materials go, steel has lots going for it: it's recyclable, and it has the highest strength-to-weight ratio of any manufactured construction material.<sup>6</sup> In the United States, 68 percent of steel is made from scrap using electric arc furnaces (EAFs), a process that results in just one-fifth of the carbon dioxide emissions of the more traditional (and globally dominant) blast furnace/basic oxygen furnace production method.<sup>7,8</sup> In other words, most U.S. steel is recycled and much less carbon-intensive than steel produced in other countries. Within domestic infrastructure, the average recycled content of structural steel is more than 90 percent.<sup>9</sup>

However, despite advancements in the U.S. steel industry, there is still an urgent need for

further progress in emissions reductions, both domestically and abroad. According to the most recent IPCC report, improvements in process and energy efficiency within the steel industry are not enough to keep the world in line with a 1.5 degrees Celsius target.<sup>10</sup> There is therefore a need for the industry to slash its emissions through other means, including by shifting from fossil fuels to clean energy sources for its electricity.

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# CLEANER STEEL STARTS WITH CLEAN ELECTRICITY

Unlike the traditional BF/BOF production method, which is primarily dependent on coal as its fuel source, EAFs mostly use electricity as fuel. Although EAFs are much less carbon-intensive than BF/BOF steelmaking, they rely on the grid, which, on average, only produces 7.6 percent of its electricity using solar and wind energy.<sup>11</sup>

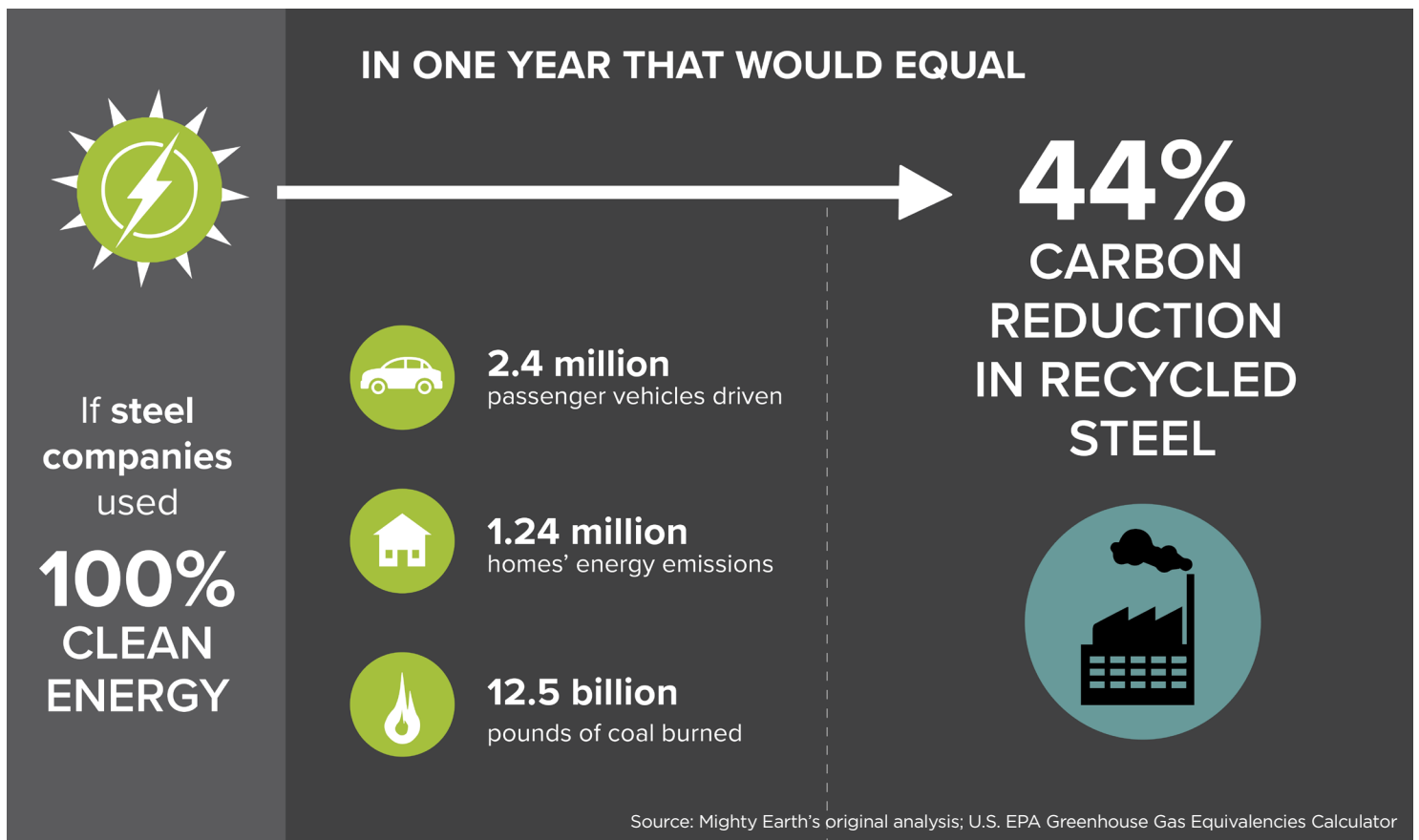
U.S. EAF facilities produced 55.488 million metric tons of crude steel in 2017.<sup>12</sup> This recycled steel produced 26.08 million metric tons of CO<sub>2</sub>-equivalent emissions, of which about 11.47 million metric tons (44 percent) were from the electricity consumed to produce this steel.<sup>13</sup> Therefore, if EAF facilities sourced 100 percent of their electricity from clean energy sources, recycled steel's carbon footprint would decrease by about 44 percent. Thus, a major strategy for reducing emissions from EAF steelmaking remains untapped.

In Mighty Earth's first report on the steel industry, [\*Cold Steel, Hot Climate: America's Biggest Untapped Clean Energy Opportunity\*](#), we identified

Nucor Corporation as the steel company best-positioned to switch to 100 percent clean energy for its electricity. Nucor is America's largest steelmaker and brands itself as the country's largest recycler, since it relies on EAFs to produce recycled steel.<sup>14</sup>

We also identified the important role that Skanska should play in leading the steel industry toward a low-carbon spade future given the company's pledge to achieve carbon neutrality by 2050. However, Nucor has not committed to sourcing 100 percent clean energy, despite the significant decrease in embodied carbon that such a move would provide. The company is ignoring an opportunity to achieve greater alignment with the demands and values of the green building industry, one its major customers.

**We are calling on Skanska and its industry competitors to start requiring Nucor to begin transitioning to clean energy.**



# THE LAGGING TRANSPARENCY AND ACCOUNTABILITY OF STEEL PRODUCERS

Environmental Product Declarations (EPDs) document the environmental impacts of a product from “cradle to gate” — from the extraction and provision of raw materials to manufacturing. They include multiple indicators, such as global warming potential (i.e., metric tons of carbon dioxide equivalent emitted per ton of product), ozone depletion potential, and eutrophication potential (i.e., metric tons of nitrogen equivalent per ton of product). Architects and engineers use EPDs to assess the environmental impacts of building materials, and, ideally, select the least harmful products. EPDs are also used to satisfy Leadership in Energy and Environmental Design (LEED) project requirements.

There are EPDs for the manufacture of raw steel as well as for the fabrication of finished products, the latter of which the construction industry sources directly. However, while EPDs cover multiple types of steel products used in buildings, for the most part, these EPDs reflect industry averages. For example, the American Institute of Steel Construction (AISC) has developed industry average EPDs for fabricated hot-rolled structural sections and fabricated steel plate.<sup>15</sup> These EPDs apply to the more than 250 fabricators that are members of the AISC, meaning that the most polluting fabricators can claim the industry average as their own environmental impact.

Furthermore, based on the pilot version of the Embodied Carbon Calculator for Construction (see more on page 6), Gerdau Long Steel North America is the only company that has distinct EPDs for each of its plants.<sup>16</sup> Meanwhile, Nucor Corporation, the number one steel producer in the United States, has only published one EPD, which applies to rebar and merchant bar products manufactured by Nucor Steel Seattle.<sup>17</sup> In its 2017 Sustainability Report, Nucor states that the company plans to produce EPDs for “any downstream product that could end up on a job site,” but additional EPDs are not available yet.<sup>18</sup>

Individual manufacturers and fabricators need to be held accountable for the carbon emissions from their products, and they must take steps to lower their emissions beyond the savings that energy

efficiency provides. The first action that the steel industry must take is to publish facility-specific EPDs because, as the saying goes, you can’t manage what you don’t measure. Until EPDs become facility-specific, efforts to reduce the embodied carbon of steel products can only go so far.



Photo Yermolov / Shutterstock.com

## WHY EPDS ARE NOT ENOUGH

Despite the advantages that facility-specific EPDs provide, their publication will not automatically lead to emissions reductions. In addition to working toward greater industry transparency, steel companies need to commit to decreasing their emissions, and construction companies need to explicitly demand this decarbonization. Each steel company should set a target for an average maximum global warming potential across its products, then work to decrease this emissions intensity over time. The only way for the steel industry as a whole to limit its climate pollution is for each company to take steps to reduce its own carbon footprint.

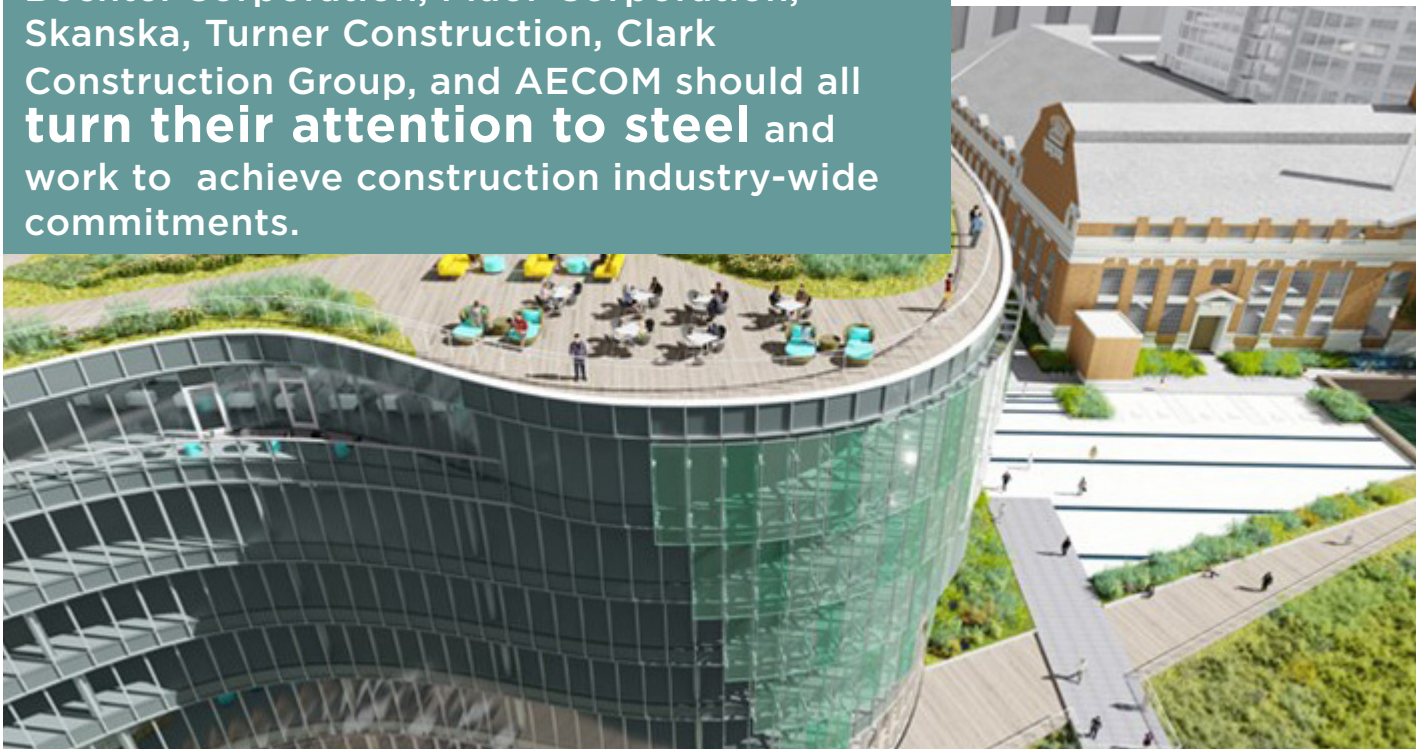
## THE GREEN BUILDING INDUSTRY NEEDS TO GET EVEN GREENER

The top three green building contractors — Turner Construction, Clark Construction Group, and AECOM — collectively have a green design revenue of \$13.36 billion, and they have built hundreds of LEED certified projects, totaling more than 240 million square feet.<sup>19,20,21,22</sup> As the most influential players within the green building industry, these companies have already started to drive attention toward reducing embodied carbon within the built environment. For example, Turner Construction’s former Chief Sustainability Officer was chair of the Embodied Carbon Network’s Construction Task Force, and AECOM has developed a “Total Carbon Metric methodology” that assesses the carbon impacts of a building across multiple emissions sources, including embodied carbon.<sup>23</sup> In addition, Skanska, ranked as number six on Engineering News-Record’s Top 100 Green Building Contractors list, has made embodied carbon one of the company’s focus areas and an essential priority for achieving its carbon neutral goal. The company is moving in the right direction by sponsoring a new tool, the Embodied Carbon Calculator for Construction, that aggregates EPDs for building materials into one database, and the company helped fund University of Washington’s Embodied Carbon Benchmark Study, which resulted

in the largest known open-source database of building embodied carbon.<sup>24</sup>

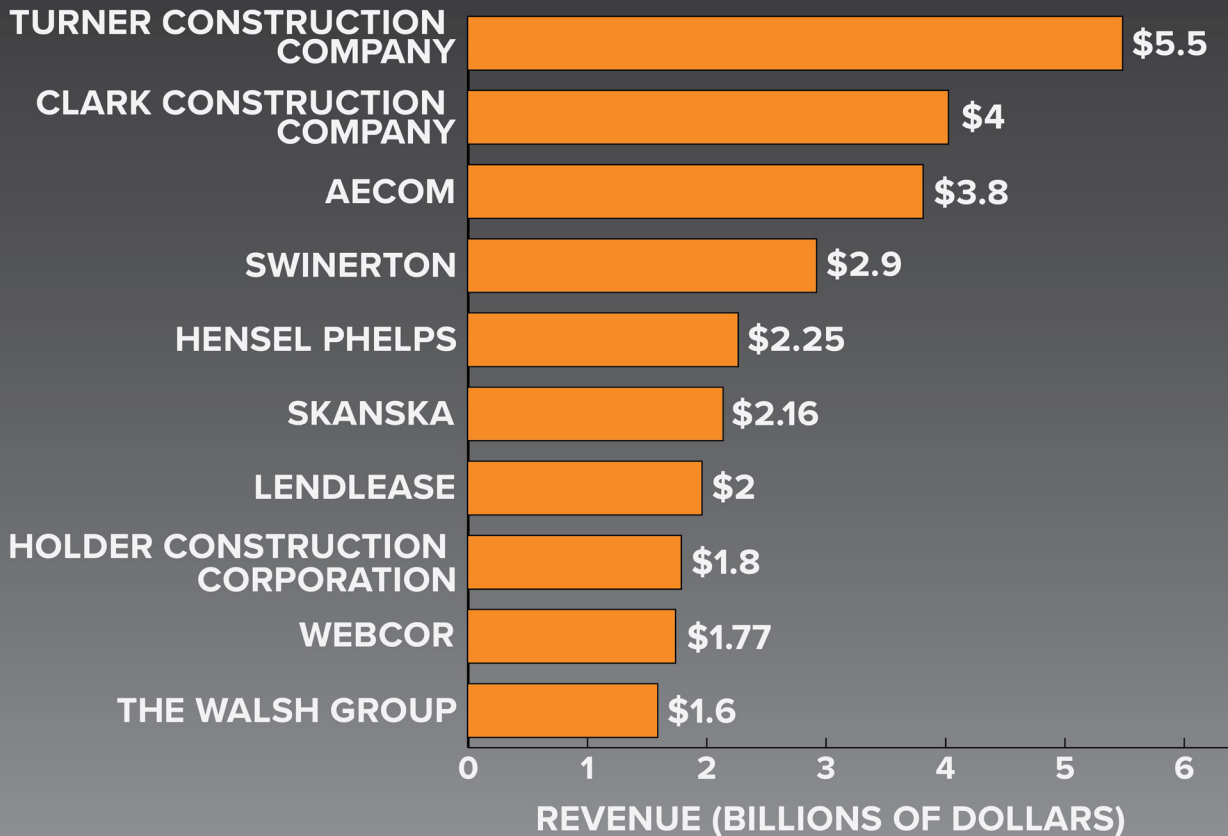
Despite substantial movement toward reducing embodied carbon, none of these green building contractors have committed to only buying materials with the lowest possible global warming potentials. In addition, Bechtel Corporation and Fluor Corporation — the two largest construction companies in the United States — have not made any public efforts to address their projects’ embodied carbon.<sup>25,26</sup> These companies, along with top green builders Skanska, Turner Construction, Clark Construction Group, and AECOM, should all turn their attention to steel and work to achieve construction industry-wide commitments. These include requiring all steel manufacturers and fabricators to publish facility-specific EPDs, as described in the previous section; setting a maximum global warming potential for all steel that they source and decreasing that value over time; and requiring steel facilities to switch to clean energy for all grid-sourced electricity. It’s up to Skanska and its competitors to take the immediate action needed for the green building industry to support the achievement of global climate targets.

Bechtel Corporation, Fluor Corporation, Skanska, Turner Construction, Clark Construction Group, and AECOM should all **turn their attention to steel** and work to achieve construction industry-wide commitments.



D.C. Water and Sewer Authority, New Headquarters Building | Photo rendering Skanska.com

# TOP U.S. GREEN BUILDERS



**Turner**

**CLARK**  
CONSTRUCTION

**AECOM**

**SKANSKA**

Source: Engineering News-Record



In the U.S. and around the world, construction companies must ask their steel suppliers to commit to clean electricity and take other steps to dramatically reduce their emissions. For more details on how the steel industry can shrink its carbon footprint, see Mighty Earth's report, [Cold Steel, Hot Climate](#).



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## THE NEW ZERO: THE RACE TOWARD THE LOWEST CARBON BUILDING MATERIALS IS ALREADY UNDERWAY

There is growing momentum to address the embodied carbon of building materials. Here are a few examples:

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### LEED V4

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The newest LEED certification criteria, LEED v4, includes an enhanced Materials and Resources section that awards more points to projects that use more sustainable materials. LEED v4 also rewards teams for using a whole building life cycle assessment to optimize material usage and selection.

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### Architecture 2030, the Carbon Leadership Forum, and the Embodied Carbon Network

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Architecture 2030 is a nonprofit that aims to dramatically reduce greenhouse gas emissions from the global built environment. The Carbon Leadership Forum is an industry-academic collaboration hosted at the University of Washington that focuses on reducing embodied carbon in building materials. Together, they founded the Embodied Carbon Network, which aims to achieve a carbon neutral built environment by 2050. In addition, Architecture 2030 created the Carbon Smart Materials Palette, which provides guidance on choosing materials with reduced levels of embodied carbon.

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### Embodied Carbon Calculator for Construction (EC3)

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Skanska and Microsoft are founding sponsors of the Embodied Carbon Calculator for construction (EC3) a tool that is being developed by the Carbon Leadership Forum. EC3 serves as a database for Environmental Product Declarations (EPDs) of building materials, and its search engine highlights the global warming potential of each product, categorized by manufacturer. The calculator is in pilot stages now but will be available as an open source tool in 2019.

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### Buy Clean Legislation

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California's Buy Clean California Act, signed into law last year, requires the state government to establish maximum acceptable global warming potentials for building materials used in state-funded infrastructure projects.<sup>27</sup> The Washington state legislature was considering a similar legislation earlier this year, but the bill remains in committee. Buy Clean legislation incentivizes the use of building materials produced at the most efficient and least carbon intensive facilities.

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### Breakthrough Energy

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The Breakthrough Energy Coalition is a group of private investors, companies, and financial institutions. Their goal is to provide capital to technologies, including the development of low-carbon building materials and clean energy, that will decrease carbon emissions and mitigate climate change. In October 2018, the coalition launched a Memorandum of Understanding with the European Commission to establish Breakthrough Energy Europe, a 100 million joint investment fund.

# TOP 5 ACTIONS THE CONSTRUCTION & STEEL INDUSTRIES NEED TO TAKE NOW

Although the built environment remains a major emitter, there is room for hope. As buildings have become increasingly efficient and decreased their operational emissions, momentum has grown to decrease the embodied carbon of steel and other building materials. Some of the largest green building companies

in the country have already started to work on reducing the embodied carbon of their projects, and multiple initiatives are working to address embodied carbon through innovation, new tools, and coalitions. However, bolder actions and commitments are still needed to prevent the worst consequences of climate change.

## **Skanska, Turner Construction, Clark Construction Group, AECOM, Bechtel and Fluor should leverage their collective buying power to:**

- Require all steel manufacturers and fabricators to publish facility-specific Environmental Product Declarations.
- Set a maximum acceptable global warming potential for all steel that they source and decrease the value over time. Maximum acceptable values should be set for every steel supplier so that each company is required to decrease the embodied emissions of their products over time, regardless of whether the steel is primary or secondary.
- Require steel facilities to switch to clean energy for all grid-sourced electricity — a move that would ultimately reduce the embodied carbon of recycled steel by 44 percent.
- Require architects, engineers, and other professionals to include the global warming potential of steel and other building materials in design specifications.
- Work together to form a construction industry-wide commitment to reduce the embodied carbon of building materials, starting with steel and its electricity use.



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