Environmental, Social and Governance Risks in the Engineering and Construction Sector[1]

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Introduction

ESG stands for **Environmental, Social, and Governance**. It is an approach for evaluating the extent to which a corporation works on behalf of environmental and broader social goals. This focus is in addition to its role to maximize profits on behalf of its shareholders.

Increased ESG focus by:

- ***Securities agencies/ investors***
- ***Debt providers***
- ***Auditors***
- ***Clients***
- ***Stakeholders***
- ***Staff***

Investors are increasingly applying these non-financial factors to identify material risks and growth opportunities. As such **ESG risks are a key component of any Enterprise Risk Management (ERM)[i] program**. Companies are increasingly making disclosures in their annual report or in a standalone sustainability report and these disclosures and reports are of increasing interest to clients, regulators, and staff.

Throughout this paper we look at these risks both as they are encountered in engineering and construction projects but also in turn by the enterprises that undertake them. The project nature of the engineering & construction industry makes this class of risks both important at the project and enterprise levels. These risks permeate the entire project value chain.

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Definition of Environmental, Social, Governance (ESG)

Prior to defining ESG it is useful to consider some other terms such as sustainability and the triple bottom line which have been around for several years.

"In the broadest sense, sustainability refers to **the ability to maintain or support a process continuously over time**. In business and policy contexts, sustainability seeks to prevent the depletion of natural or physical resources, so that they will remain available for the long term."[ii] Sustainability is made up of three pillars: **the economy, society, and the environment**. These principles are also informally used as profit, people, and planet. Sustainability stresses intergenerational equity.

The Triple Bottom Line is a concept that closely relates to sustainability, and seeks to measure performance against profit, people, and planet. The result is three bottom lines. "The concept behind the triple bottom line is that companies should focus as much on social and environmental issues as they do on profits."[iii]

In contrast, ESG focuses on environmental, social and governance factors, risks, and performance. It differs from sustainability and the Triple Bottom Line concepts in two important ways. The first, profit, is not explicitly considered in ESG as contrasted with sustainability. As such an assessment of ESG performance and risks is not a complete picture of corporate performance. Arguably, the Triple Bottom Line approach, appropriately measured, provides a clearer and more complete assessment of corporate performance and risks. By extension, any Enterprise Management System must include both financial and non-financial risks with the latter being generally subsumed into ESG risks. The second difference between ESG and sustainability is in the bi-furcation and broadening of the people dimension embedded in sustainability. In ESG this dimension is segregated into Social and Governance dimensions with major portions of the Governance dimension going beyond what was typically considered as part of People.

So, as we look at ESG through the balance of this paper we will remember that Profit is not explicitly within ESG scope and that the three factors comprising ESG are:

- **ENVIRONMENTAL**
  - Climate change and carbon emissions
    - Focus is sharpest on greenhouse gases
  - Water and resource extraction
  - Air and water pollution
  - Biodiversity
  - Deforestation
  - Energy efficiency
  - Waste management[iv]
  - Water scarcity

- **SOCIAL**
  - Health, Safety and Environmental (HSE)[v] [vi]
  - Customer satisfaction
  - Data protection and privacy
  - Diversity, Equity, Inclusion (DEI)[vii] sometimes referred to as JEDI (Justice, Equity, Diversity, Inclusion)
  - Employee engagement
  - Community relations
  - Human rights
  - Labor standards

- **GOVERNANCE**
  - Shareholder engagement
  - Stakeholder engagement which is extremely important in the engineering & construction industry project model[viii]
  - Code of conduct
  - Board composition
  - Audit committee structure
  - Bribery and Corruption[ix] [x] [xi], which remains a significant risk in the engineering & construction industry
  - Executive compensation
  - Lobbying
  - Political contributions
  - Whistleblower schemes

We will now look down into each of these three factors.

Environmental

The environmental focus is a full value-chain focus encompassing the total lifecycle of the constituent parts. Today, the primary focus has been on climate change and the reduction of carbon and other gases contributing to global warming[xii]. For the engineering & construction industry this presents a significant challenge but by no means the only one. For many projects water related issues can prove as challenging and focus on the water footprint will continue to grow. Construction waste is also a front of mind challenge and one which can provide financial benefits for constructors.

Let us drill down a bit on the climate focus. Climatic impacts are looked at as consisting of three scopes:

- **Scope 1** – your own direct emissions
- **Scope 2** – indirect emissions from purchased power which are deemed owned by you
- **Scope 3** – indirect emissions not owned by you but linked to your value chain.

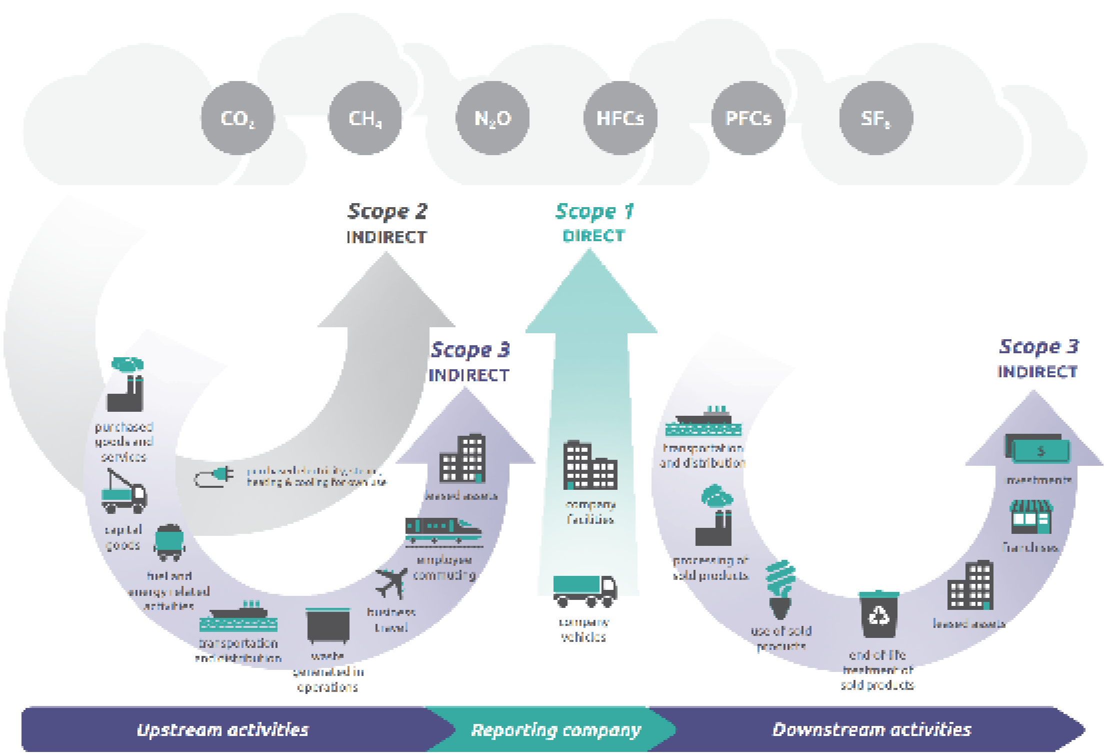

Figure 1 - Overview of GHG Protocol scopes and emissions across the value chain[xiii]

Figure 1 provides a comprehensive overview of all three scopes and the various elements are discussed below. Scopes 1 and 2 reporting will be mandatory (phased in) while scope 3 reporting will be voluntary (extended phase in) and will contribute to a competitive advantage with certain clients. In March 2022, the SEC promulgated rules for the Enhancement and Standardization of Climate-Related Disclosures. These rules require the inclusion of certain climate-related information in registration statements and periodic reports, such as Form 10-K. This information includes:

- Climate-related risks and their actual or likely material impacts on the business, strategy, and outlook
- Governance of climate-related risks and relevant risk management processes
- The company's greenhouse gas ("GHG") emissions, which with respect to certain emissions, would be subject to assurance
- Certain climate-related financial statement metrics and related disclosures in a note to its audited financial statements
- Information about climate-related targets and goals, and transition plan, if any

The proposed disclosures are similar to those that many companies already provide based on broadly accepted disclosure frameworks, such as the Task Force on Climate-Related Financial Disclosures and the Greenhouse Gas Protocol.

Specific disclosure requirements are reflected in the following table.

Table 1 **Proposed SEC Disclosure Requirements Related to Greenhouse Gases**
• The oversight and governance of climate-related risks by the registrant's board and management; • How any climate-related risks identified by the registrant have had or are likely to have a material impact on its business and consolidated financial statements, which may manifest over the short-, medium-, or long-term; • How any identified climate-related risks have affected or are likely to affect the registrant's strategy, business model, and outlook; • The registrant's processes for identifying, assessing, and managing climate-related risks and whether any such processes are integrated into the registrant's overall risk management system or processes; • If the registrant has adopted a transition plan as part of its climate-related risk management strategy, a description of the plan, including the relevant metrics and targets used to identify and manage any physical and transition risks; • If the registrant uses scenario analysis to assess the resilience of its business strategy to climate-related risks, a description of the scenarios used, as well as the parameters, assumptions, analytical choices, and projected principal financial impacts;

Table 1 Proposed SEC Disclosure Requirements Related to Greenhouse Gases

• If a registrant uses an internal carbon price, information about the price and how it is set;
• The impact of climate-related events (severe weather events and other natural conditions) and transition activities on the line items of a registrant's consolidated financial statements, as well as the financial estimates and assumptions used in the financial statements;
• The registrant's direct GHG emissions (Scope 1) and indirect GHG emissions from purchased electricity and other forms of energy (Scope 2), separately disclosed, expressed both by disaggregated constituent greenhouse gases and in the aggregate, and in absolute terms, not including offsets, and in terms of intensity (per unit of economic value or production);
• Indirect emissions from upstream and downstream activities in a registrant's value chain (Scope 3), if material, or if the registrant has set a GHG emissions target or goal that includes Scope 3 emissions, in absolute terms, not including offsets, and in terms of intensity; and
• If the registrant has publicly set climate-related targets or goals, information about:
    ○ The scope of activities and emissions included in the target, the defined time horizon by which the target is intended to be achieved, and any interim targets;
    ○ How the registrant intends to meet its climate-related targets or goals;
    ○ Relevant data to indicate whether the registrant is making progress toward meeting the target or goal and how such progress has been achieved, with updates each fiscal year; and
    ○ If carbon offsets or renewable energy certificates ("RECs") have been used as part of the registrant's plan to achieve climate-related targets or goals, certain information about the carbon offsets or RECs, including the amount of carbon reduction represented by the offsets or the amount of generated renewable energy represented by the RECs.

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For engineering & construction firms, your Scope 1 and 2 emissions are part of your client's Scope 3 emissions and can be significant. As we will see later the timing and extent of the realization of an engineering and construction firm's Scope 1 & 2 emissions by a client in his Scope 3 emissions requires additional clarity.

Scope 1 Emissions

Scope 1 emissions are an organization's own emissions which they will have to track, reduce, or offset. Scope 1 emissions include:

- Stationary combustion including fuels and heating
- Mobile – cars, vans, trucks, and construction equipment
- Fugitive – leaks from A/C units or other refrigerants
- Process – manufacturing but also:
    - CO_2 during on-site cement manufacturing
    - Chemicals, many more impactful than CO_2

Stationary Combustion of "fuels in stationary (non-transport) combustion sources results in the following greenhouse gas (GHG) emissions: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Sources of emissions from stationary combustion include boilers, heaters, furnaces, kilns, ovens, flares, thermal oxidizers, dryers, and any other equipment or machinery that combusts carbon bearing fuels or waste stream materials."[xiv]

There are two main methods for estimating GHG emissions from stationary combustion sources:

- Direct measurement of CO_2 emissions through the use of a continuous emissions monitoring.
- Fuel analysis in which carbon content factors are applied to fuel input to determine emissions.

Mobile Combustion[xv] produces greenhouse gas (GHG) emissions as fuels are burned. Carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) are emitted directly through the combustion of fuels in different types of mobile equipment are shown in Table 2.

Table 2
Categories of Mobile Sources

Category	**Primary Fuels Used**
Onroad Vehicles	
—Passenger Cars	Gasoline
—Vans, Pickup Trucks & SUVs Diesel	Diesel Fuel
—Heavy-Duty Vehicles	
—Combination Trucks	
—Buses	
Nonroad Vehicles	
—Construction Equipment	Diesel Fuel
—Agricultural Equipment	
—Forklifts	
—Other Nonroad Equipment	
Waterborne	
—Ships	Diesel Fuel
—Boats	Residual Fuel Oil

Table 2 Categories of Mobile Sources	
	Gasoline
Rail	
—Freight Trains	Diesel Fuel
—Commuter Rail	Electric
—Amtrak	
Air	
—Commercial Aircraft	Kerosene Jet Fuel
—Executive Jets	

GHG emissions from mobile sources also include hydrofluorocarbon (HFC) and perfluorocarbon (PFC) emissions from mobile air conditioning and transport refrigeration leaks.

Fugitive Emissions

Direct Fugitive Emissions from Refrigeration, Air Conditioning, Fire Suppression, and Industrial Gases. These include "various Ozone Depleting Substances (ODSs), primarily chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs). However, in accordance with the Clean Air Act Amendments of 1990 (Title VI) and the Montreal Protocol, these ODSs are being phased out of manufacture and use in the United States. Hydrofluorocarbons (HFCs) and, to a lesser extent, perfluorocarbons (PFCs) are used as substitutes for the regulated ODSs. In addition, some air conditioning and refrigeration systems use non-halogenated refrigerants such as ammonia, carbon dioxide (CO_2), propane, or isobutane. Also, some fire suppression equipment, which historically used ozone-depleting halons, use carbon dioxide (CO_2), inert gases, and other substances."[xvi]

These gases have 100-year global warming potentials (GWPs), which are typically greater than 1,000 times that of CO_2.

Table 3 Select Global Warming Potentials		
Common Name	**Formula**	**GWP***
Carbon dioxide	CO_2	1
Methane	CH_4	25
Nitrous oxide	N_2O	298

Table 3 Select Global Warming Potentials		
HFC-134a	$C_2H_2F_4$	1430
PFC-14	CF_4	7390
HFC-23	CHF_3	14800

Process Emissions are more closely associated with manufacturing facilities but in the construction sector it would include CO_2 emissions during **on-site** cement manufacturing and chemical emissions, many more impactful than CO_2. Cement production globally accounts for about 3.4% of global CO_2 emissions from fossil fuel combustion and cement production.[xvii] Cement is an essential input into the production of concrete, a primary building material for the construction industry.

When evaluating the carbon footprint of concrete foundations and structures, it is important to recognize the difference between cement and concrete. Cement is an energy-intensive product while concrete is one of the most CO_2- efficient construction materials.

CO_2 emissions from a cement plant are divided into two source categories[xviii]:

- Combustion (40 percent of emissions) – related to fuel use
- Calcination (60 percent of emissions) – CO_2 emissions from calcination arise when the raw materials (mostly limestone and clay) are heated to more than 2500°F and CO_2 is liberated. Low-clinker cements offer the most significant potential for reducing the CO_2 footprint of concrete.

Cement not produced onsite would be accounted for as part of Scope 3 emissions.

Chemical emissions during construction arise from the use of chemical cleaners and off gassing from construction materials during the construction process. Clarity is required to confirm that these emissions shift from Scope 1 emissions to Scope 3 Upstream emissions (Capital Goods) at project completion.

Construction products can also be a significant source of indoor pollutants, including volatile organic compounds that may be a risk to the health and well-being of building occupants. The engineering profession specification of materials is increasingly addressing this issue and as a result reducing Scope 1 emissions for contractors from material offgassing as well as related Scope 3 Upstream emissions.

The shift to more carbon efficient newer materials can create potential new risks for engineers and contractors as failures may represent uninsured performance risks[xix].

Scope 2

Scope 2 Emissions are associated with your purchased power. These are indirect emissions deemed owned by you. This calls for attention to where power is sourced from, fossil or renewables. Carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) are emitted to the atmosphere as fuels are burned to produce heat and power. Therefore, activities that use purchased electricity indirectly cause emissions of greenhouse gases (GHG)[xx].

Emissions associated with on-site generation of electricity in equipment owned by the organization are direct Scope 1 emissions. On extensive sites, with multiple diesel generators, the use of microgrids represents one strategy to reducing overall sitewide Scope 2 emissions by operating the "fleet" at higher diesel engine performance levels and reducing idling and low load operations.

Of the various emissions to be considered by contractors Scope 2 may be the easiest to track and influence.

Reporting of Scope 1 and 2 emissions are a today challenge to be addressed by the engineering and construction industry and potentially create new project and enterprise risks discussed later.

Scope 3

Remember your Scope 1 and 2 emissions are your client's Scope 3 emissions. Similarly, the Scope 1 and 2 emissions of your subcontractors and suppliers are your Scope 3 emissions. This leads to some open questions related to the ownership of emissions on projects. Let us consider the following project execution approaches:

- **Design, Bid, Build (DBB)** – the project is effectively managed by the owner's capital projects group who delivers an operating facility to the owner's operating organization. The owner's capital projects group awards a number of design and construction contracts and may also procure some major equipment directly. The Scope 1 and 2 emissions of each provider (engineer, contractor, suppliers direct to owner) become Scope 3 emissions associated with the delivered capital project by the owner's capital project group. Project (capital asset) emissions are Scope 1 and 2 from the owner's capital project group associated with management of the project and the Scope 3 emissions from the totality of third-party providers. No single contractor owns the preponderance of emissions or any risks which may arise from emissions levels or achievement of project level targets.

- **Design, Build (D/B) and Engineer, Procure, Construct (EPC)** – the project is delivered in totality by a single design builder who is responsible for all engineering, procurement, and construction. In the case of 100% self-perform construction all project-wide Scope 1 and 2 emissions, except those from purchased materials and equipment, reside with the design build contractor. Portions of work which are subcontracted move otherwise Scope 1 and 2 emissions to the subcontractor's account but are aggregated into the design builder's Scope 3 emissions. This highlights a concern. If the owner has only asked for the D/B contractor to report Scope 1 and 2 emissions, then distortions are immediately created through the use of subcontracting. This becomes even more important if incentives are provided to lower project emissions (boundary limits and definitions become important)

- **General Contractor (GC), CMGC and Construction Management at Risk (CMAR)** – In some ways emissions allocation questions mirror those that arise under D/B with subcontracting but to a much higher degree. Self-perform may be limited to general conditions and select procurement activities with the over whelming portion of construction subcontracted to multiple contractors. In some ways this is analogous to DBB but with a third party, the General Contractor, providing the management role provided by the owner in DBB. Here the GC's Scope 1 and 2 emissions are more limited, influenced by the extent of self-perform chosen or permitted, while Scope 3 emissions are summed from Scope 1 and 2 emissions from all the subcontractors. The GC now holds the totality of project emissions from construction until the project transfers to the owner.

- **Engineer, Procure, Construction Manage (EPCM)** – The contractor has an overall role in delivery of the project with expanded engineering and procurement responsibilities when contracted with a GC or CMGC role. Construction responsibilities differ from EPC in that self-perform may be limited, often to just offsites and utilities. Here the Scope 1 and 2 emissions for the EPCM are limited when compared to an EPC role and are more similar to what we see in CMGC. Project emissions are now comprised mostly of Scope 3 emissions of the CMGC. EPCM opens a broader question as to whether the EPCM contractor, through his CM role, is acting merely as an agent of the owner, and that all project emissions should be essentially Scope 3 emissions to the owner similar to DBB. Again, ownership of risk and responsibility for project level emissions remain a somewhat open question.

- **Program Management and Construction Management** – These are fee-based services that provide oversight to engineers and contractors selected by the owner. Other than their own Scope 1 and 2 emissions, reportable to the owner as his Scope 3 emissions, the PM and CM should not have any direct responsibility for Scope 1 or 2 emissions from the various engaged engineers and contractors.

The ownership of emissions at the project level will influence reporting requirements in the engineering and construction industry as well as the focal point for emission reductions. This creates a degree of uncertainty around ESG risks that may flow to contractors at the project level as well as to how project level ESG risks are to be rolled up at the enterprise level. Are enterprise ESG risks just to consider the summation of project level Scope 1 and 2 risks or also account for Scope 3? The influence of contracting strategies can be seen from the above discussion.

A related question is how does owner ESG commitments influence their selection of contracting strategies?

Turning now to Scope 3 emissions, they can be divided into upstream and downstream. "Scope 3 emissions are the result of activities from assets not owned or controlled by the reporting organization, but that the organization indirectly impacts in its value chain. Scope 3 emissions include all sources not within an organization's scope 1 and 2 boundary. The scope 3 emissions for one organization are the scope 1 and 2 emissions of another organization. Scope 3 emissions, also referred to as value chain emissions, often represent the majority of an organization's total GHG emissions."[xxi]

Scope 3 upstream emissions include[2]:

- Business travel by air, rail, bus, and business mileage using private vehicles
- Employee commuting and for construction companies this includes craft
- Waste generated such as waste sent to landfills as well as wastewater treatment
- Purchased goods and services
- Transportation & distribution including warehousing
- Fuel and energy related, not in Scopes 1 and 2. An example would be transmission losses.
- Capital goods. These would include a building for the company or equipment to be used such as a truck or a computer. **The total cradle to grave emissions are fully considered in the year of purchase and not depreciated as you do for a financial asset.**

Before turning to Scope 3 downstream emissions a few comments are in order. We have seen several leading engineering and construction companies achieve net zero on Scope 1 and 2 or have well defined plans to achieve net zero in the next couple of years. The real leaders are thinking about Scope 3 which is first a data challenge and then later it will influence who and what they buy.

The importance of Scope 3 emissions was highlighted as we looked at categorization of emissions under different contract forms.

[2] Categories not typically relevant to the E&C industry have been omitted from Scope 3 upstream and downstream emissions lists.

When asked by contractors on where to begin, the author has suggested starting by asking major suppliers to report their total (in addition to project specific) Scope 1 and 2 emissions to you. This will give you an initial feel for where they are on the journey and send a signal that it is important to you. Second, ask them what is allocable to your purchases from them (not just the singular project although that is also important). This will give you insight into any potential purchasing power you may have. At a later stage, incorporate these requests into purchase orders and subcontracts and ask them to be flowed down to lower tier suppliers.

Turning now to Scope 3 downstream emissions we discover this to be a much harder area with several potential open questions. Scope 3 downstream emissions include:

- **Investments** – this is really focused on financial institutions and as a result is driving regulatory and audit guidance and actions. Investments made by engineers and constructors could fall into this category and specific guidance should be sought.
- **Franchises**
- **Leased assets** – which involves complex calculations and an area where the engineering and construction industry will have to develop some specific guidance. Figure 2[xxii] illustrates the decision tree for selecting a calculation method for emissions from upstream leased assets.

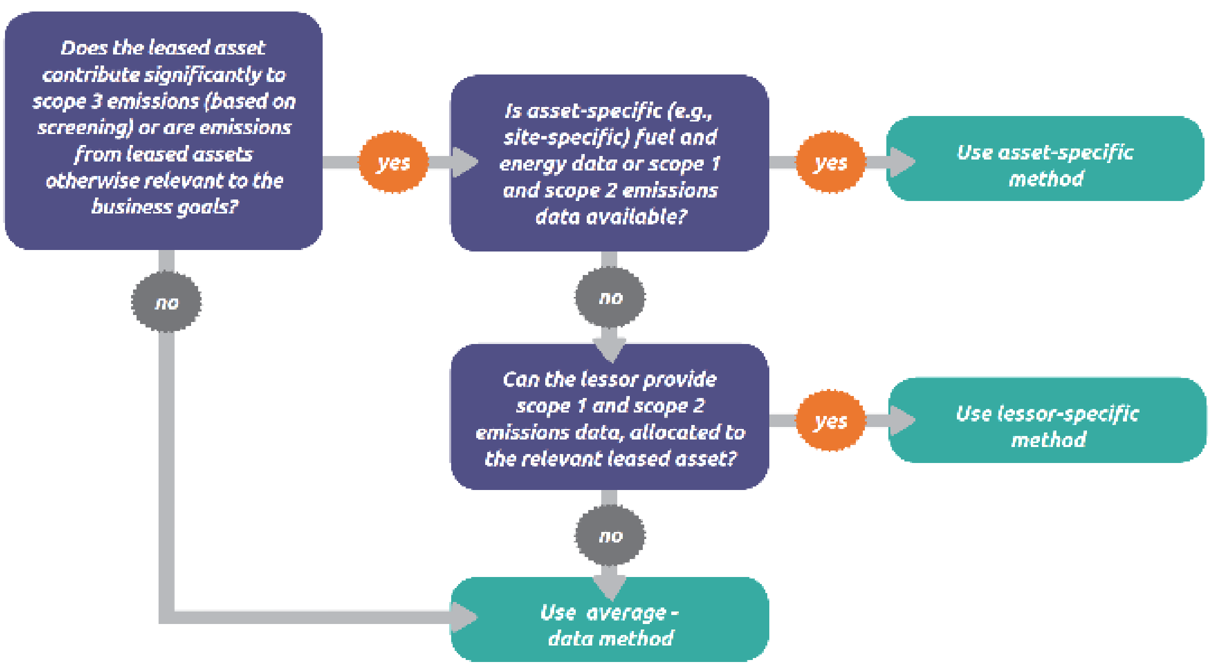

Figure 2 – Decision tree for selecting a calculation method for emissions from upstream leased assets

- **Use of sold products** – an example would be the use of an iPhone versus its production which would be captured in Scope 3 upstream
- **End of life treatment** – The emissions from downstream end-of-life treatment of sold products (the project facility) is calculated[xxiii] similar to the Scope 3 upstream waste category. The difference is that instead of collecting data on total mass of waste generated, companies would collect data on total mass of the project facility from the point at which it was turned over to the client by the contractor through the end of the facility's life by the client. An open question is to whether what the construction industry builds is included in the owner or contractor's Scope 3 downstream emissions. This question is all the more relevant in light of emissions allocations by contracting approach previously discussed. Retention of these emissions in the engineering and construction company Scope 3 emissions reporting would require us to assess how an asset we build is to be disposed of and to design for recycle versus land fill disposal.

Uncertainty in Calculating Emissions

Uncertainties associated with greenhouse gasses[xxiv] can be categorized as:

- **Scientific uncertainty** – Scientific uncertainty arises when the science of the actual emission and/or removal process is not sufficiently understood. For example, many of the direct and indirect emissions factors associated with global warming potential (GWP) values that are used to combine emission estimates of different greenhouse gases involve significant scientific uncertainty.

- **Estimation uncertainty** – Estimation uncertainty arises when emissions are quantified. All emission or removal estimates are associated with estimation uncertainty. Estimation uncertainty consists of two types – model uncertainty and parameter uncertainty:

  - Model uncertainty refers to the uncertainty associated with mathematical equations used to characterize the relationships between parameters and emission processes.

  - Parameter uncertainty refers to uncertainty associated with quantifying the input parameters to estimation models. Parameter uncertainties can be evaluated through statistical analysis, measurement precision determinations, and expert judgment.

There is uncertainty associated with all methods of calculating GHG emissions. EPA does not recommend organizations quantify uncertainty as +/- % of emissions or in terms of data quality indicators.

ESG Risks

ESG risk in the engineering and construction sector can be viewed relative to that anticipated in other sectors. Figure 3 shows such a comparison illustrating engineering and construction as having mid-range risks.

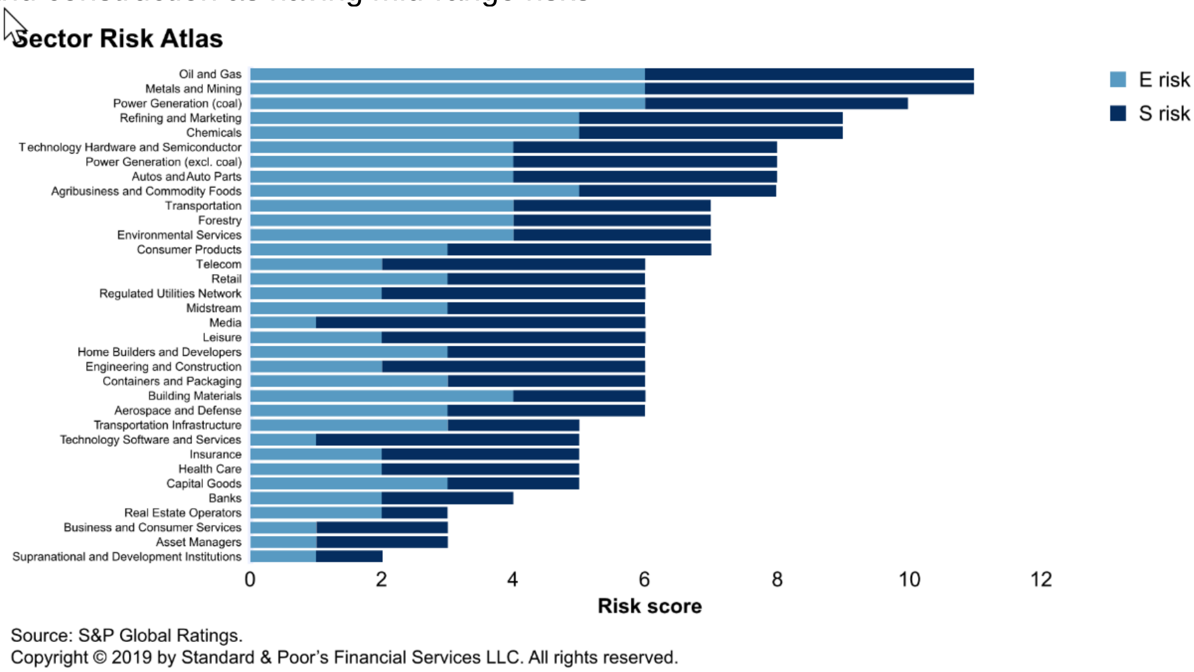

Figure 3 – ESG Sector Risks *(Source S&P Global Ratings)*

ESG risks in the engineering and construction industry include both implicit and explicit financial risks and can be segregated by environmental, social and governance risks. An important framing discussion has not yet been brought to a clear conclusion. What portion of ESG risk is "owned" by the contractor versus the ultimate facility owner and operator?

The answer to this question shapes not only the reality of retained risk but as important its perception. One rating agency when evaluating ESG environmental risk potentials states "We believe waste and pollution have limited impact on the sector, as E&C companies execute projects on behalf of asset or project owners, where the residual environmental liabilities reside."[xxv] It is not clear that the view is broadly shared but is indicative of the need to clearly define ESG accounting (ownership of overall project related emissions) and risk allocation.

Environmental

Environmental risks in the engineering and construction sector can be framed by considering the range of potential environmental impacts (Figure 4).

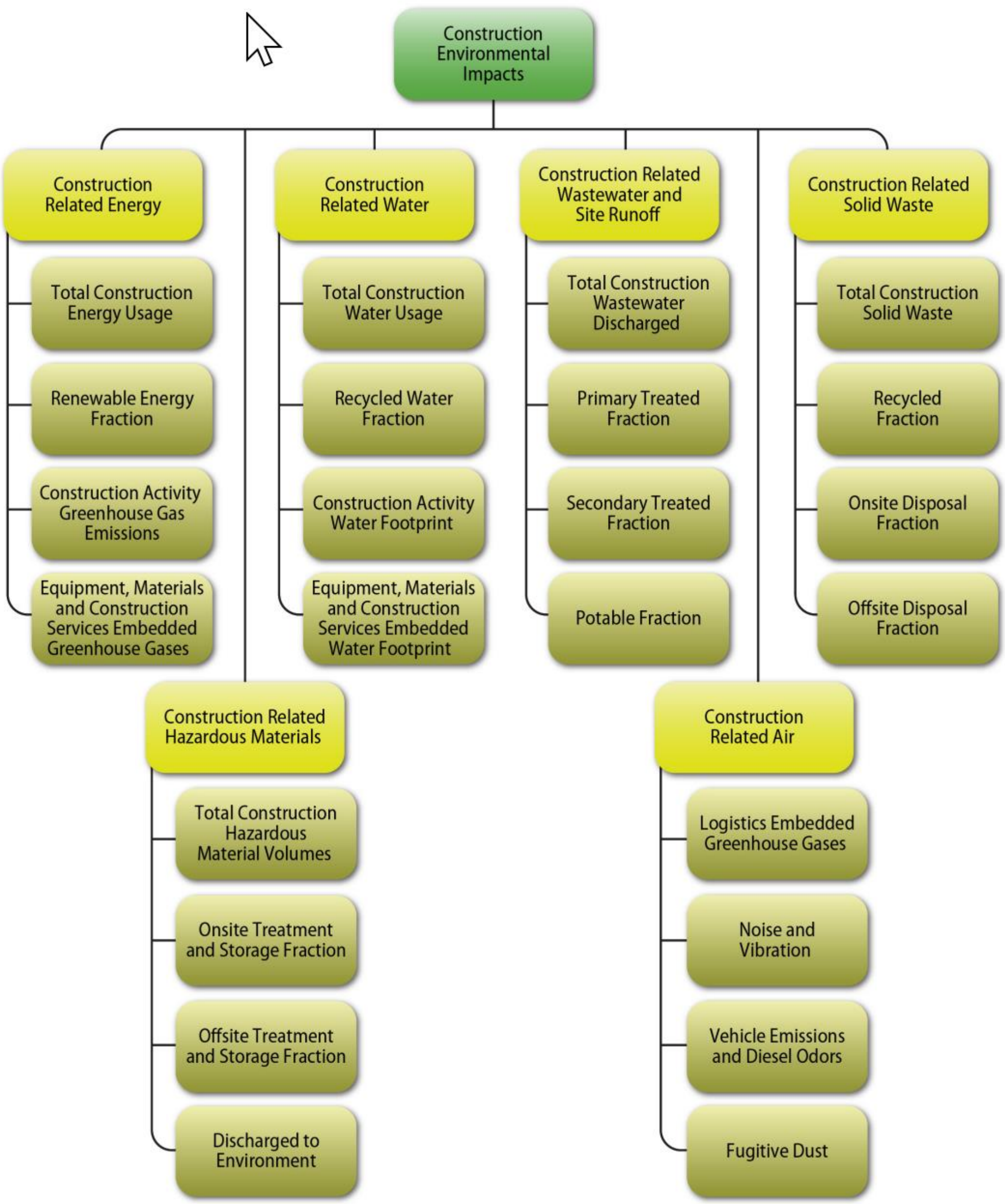

Figure 4 – Construction Environmental Impact Framework

While this paper has focused heavily on carbon and other greenhouse gas emissions, environmental ESG risks also must consider:

- **Construction related water**, including the water footprint (Figure 5) of embedded construction materials and services, especially if sourced from water sensitive areas.
- **Construction related wastewater and site runoff**, including the potential benefits that might accrue through the creation of "new" potable water.
- **Construction related solid waste**, considering recyclable portion.
- **Construction related hazardous materials** and how they are ultimately handled.
- **Construction related air**, including emissions, diesel odors from both onsite storage and use, fugitive dust, noise and vibration, and logistics chain embedded greenhouse gases.

Increasingly, water related impacts are growing in importance. Water impacts must not be viewed homogeneously but rather looked at as three distinct water types:

- **Green water**: Rainwater consumed insofar as it does not become run-off water
- **Blue water**: Consumption of water along the supply chain but excluding non-consumptive water use (example – cooling water). Consumption refers to loss of water from the available ground-surface water body
- **Grey water**: Water pollution related volume of freshwater that is required to assimilate the load of pollutants given natural background concentrations and existing ambient water quality standards. Water impacts, like energy related impacts, must consider both direct as well as indirect (or embodied) water usage.

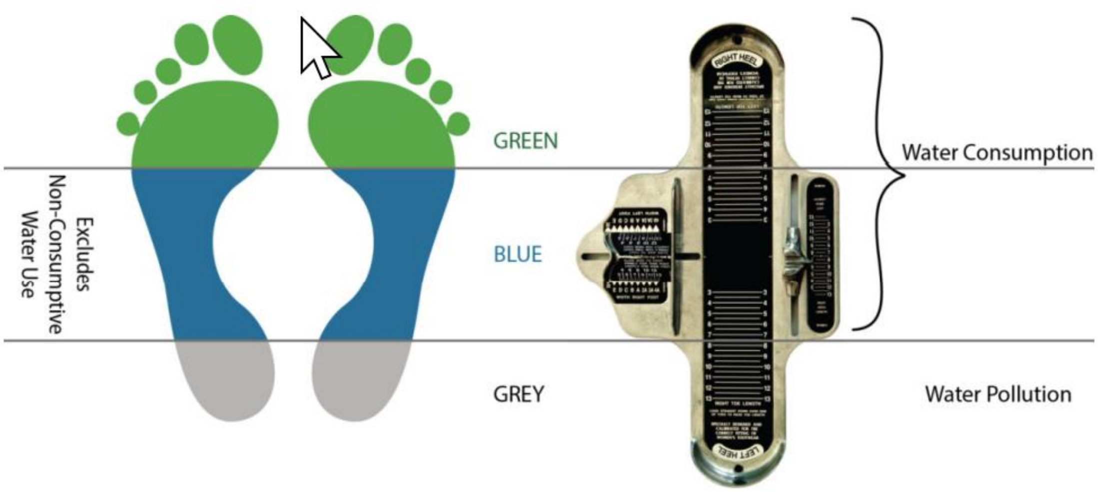

Figure 5 – Water Footprint

Table 4 details some environmental risks that the engineering and construction industry must account for while Table 5 lays out some potential risk mitigation strategies.

Table 4 Environmental Risks in the Engineering & Construction Industry
Exposure to global climate change (extreme weather created delays)
Risk of land remediation
GHG emissions
Pollution and waste
Water consumption
Wastewater management
Other water related risks
Environmental accidents
Materials related risks (health and environmental)
Resilience to catastrophic disaster
Renewable energy (opportunity)
Sustainable procurement
Noise
Fugitive dust
Embedded carbon
Adequacy of environmental management systems
Fuel efficiency
Resource conversation and efficiency

Table 5 Environmental Mitigation Strategies	
Establish and monitor environmental sustainability targets	Incentivize performance for Scope 1 emissions
	Partner with suppliers on Scope 3 emissions
Construction material consolidation	General reduction in shipments to the site
	Large loads and heavy plant still delivered direct
	Reduced onsite storage and damage
	Reduced vehicle queuing times
	Maximize pre-fabrication, pre-assembly, and modularization as a construction materials consolidation strategy
Reusable pallet boxes to handle electrical items	

Table 5 Environmental Mitigation Strategies	
Local sourcing	Reduced transport costs
	Consolidate journeys
	Reduced logistics related embedded carbon
Minimization of mixed waste to promote recycling	Separate trash such as steel, copper, plastics, glass, sheetrock, cellulose materials (paper, timber) and oil-based wastes (fuels, lubricants)
	Understand maximum transport distances for reclaimed materials to have environmental benefits
	Single material packaging to reduce mixed waste streams
Consider sourcing recycled products	
Reusable formwork	
Recycled concrete as roadbed aggregate	
Fly ash in concrete	
Silt fences and hay bales to keep suspended solids out of rainwater flows facilitating capture and reuse or mitigating offsite impacts	
Minimize water stress through capture of site runoffs and reuse of gray water streams	
Reflect sustainability in all procurement decisions	Select suppliers that prioritize sustainable practices such as waste reduction and Scope 3 emissions reduction
	Find replacements for high carbon materials (cement as an example) or designs that minimize carbon
Purchase materials on “consignment”	Suppliers pick up surplus materials for use elsewhere
Reduce waste by coordinating with other organizations to use leftover materials	
Standardization at a component level to reduce over ordering and waste streams	Minimize bolt sizes encountered in a typical construction operation

Table 5
Environmental Mitigation Strategies

Balance cuts and fills to reduce "earth" transport	
Minimize site footprint to reduce costs and overall environmental impact	
Maximize activities undertaken in a "manufacturing" environment	Create point source and more readily mitigatable environmental impacts
Utilize prefab and modules to minimize shipment of future waste streams to and from the site	
Employ a range of dust mitigation strategies	Wash and clean roads and work surfaces
	Tire wash stations
	Use collected runoff and gray water for dust suppression
Site logistic flows to minimize equipment idling periods	
Decarbonize fleets and heavy construction equipment	Consider electrification of heavy construction equipment
Proper maintenance of equipment including lubrication and filter replacement or cleaning to improve fuel consumption	Consider remote monitoring and maintenance technologies
Consolidation of employee transport to site or utilization of available mass transit	
Reduce business travel	Optimize use of hybrid working and meeting
Utilization of microgrid for improved power generation efficiency from onsite diesel power generation	Dispatch generators at higher performance levels
Identify opportunities for the use of onsite and offsite renewable energy	
Segregate and recycle electronic waste	
Implement lean and green building strategies	

Social

Impacts to the social bottom line encompass five principal areas:

- Human rights
- Labor practices
- Environment (different perspective than impacts from the environmental bottom line)
- Fair operating practices
- Community involvement and development

The term impacts, as used here, refers to both negative as well as positive impacts as a result of life cycle activities of the company and project.

The Social dimension of ESG is perhaps the area with least specificity but in many ways may be among the most impactful. Figure 6 looks at social factors and areas of interest during the project procurement and construction phase and is readily extended to a corporate view, where many of the social measures will likely occur.

Social criteria cover a range of issues, but all are essentially about social relationships. One of the key relationships is with employees.

Some issues to be considered include:

- Company vision, mission statement, values, and culture (degree of trust and transparency); commitment to ESG
- Hybrid and flexible working arrangements
- Employee compensation and benefits (total comp) – fair pay; type of retirement plans offered; company contribution to those plans; benefits provided (recognizing shifting norms especially generationally)
- Workplace policies regarding anti-corruption; health, safety and environmental (HSE); diversity, equity, and inclusion (DE&I); and prevention of sexual harassment
- Employee training and education programs; support for continuing/higher education; new skills training
- Employee engagement and ability to influence work processes and procedures
- Recruitment, development, and retention
- Customer relationship management
- Political, social, and charitable postures

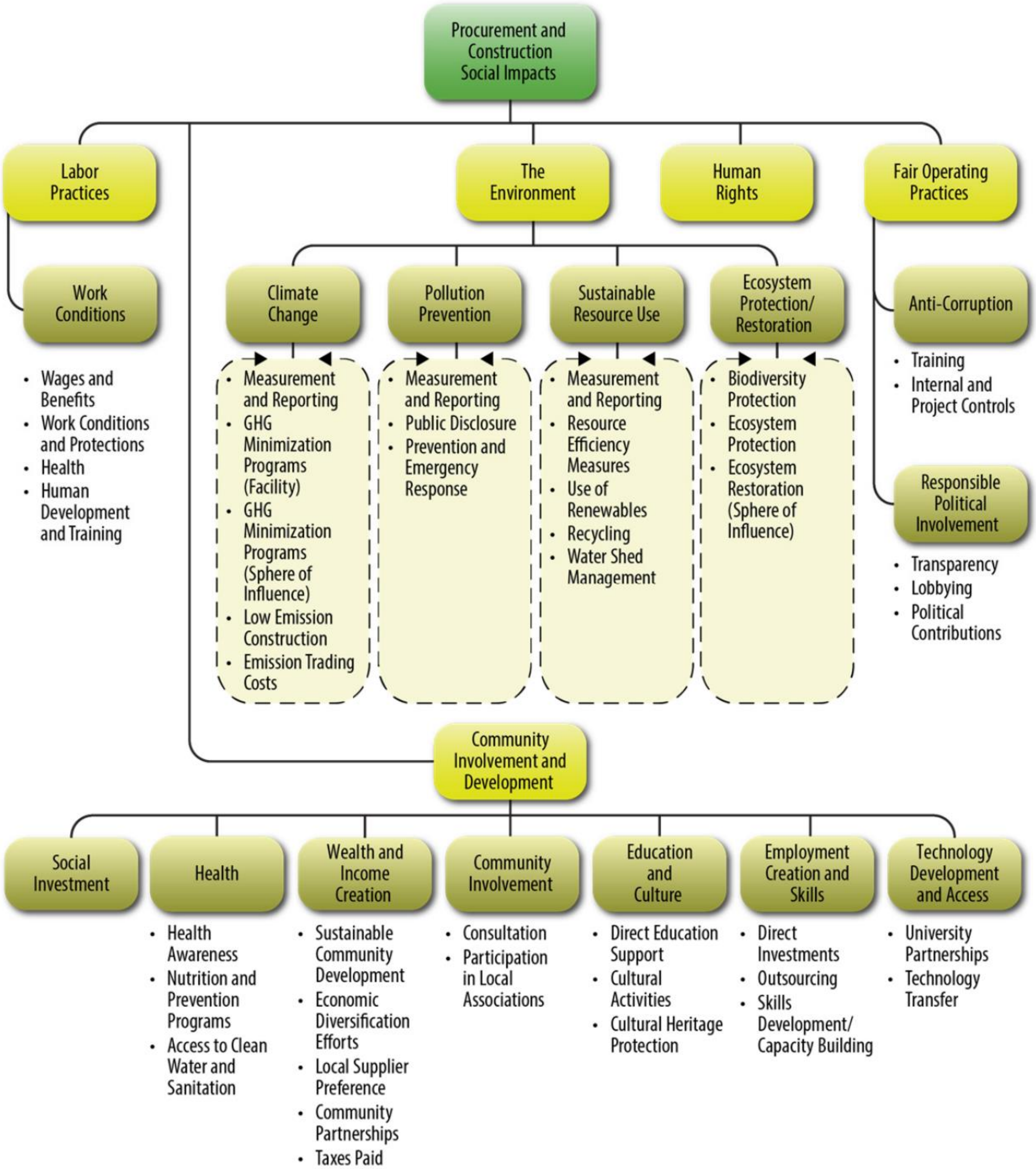

Figure 6 – Company and Project View of the Social Dimension of ESG

Metrics are particularly challenging in the Social dimension of ESG and a truncated set of potential metrics is provided in Table 6. Additional guidance can be found in a range of international reporting standards such as AA1000 Stakeholder Engagement Standard; Dow Jones Sustainability Index; FTSE4Good Index Series; Global Reporting Initiative (GRI); Organization for Economic Cooperation and Development (OECD) Guidelines for Multinational Enterprises; and UN Global Compact.

Table 6
Illustrative Social Metrics

Diversity, Equity & Inclusion	Existence of equal opportunity policies or programs
	Percentage of senior executives who are women
	Percentage of staff who are members of visible minorities
	Percentage of staff with disabilities
Industrial Relations	Percentage of employees represented by independent trade union organizations or other bona fide employee representatives
	Percentage of employees covered by collective bargaining agreements
	Number of grievances from employees
Child Labor	Whether contractors are screened (or what percentage are screened) for use of child labor
Modern Day Slavery	Screening of suppliers for use of building materials produced using forced labor
Community	Earnings donated to the community
	Use of local contractors and suppliers
	Involvement in projects with value to the greater community

Risks that E&C companies may face in the social dimension of ESG are reflected in Table 7. Benchmarking of ESG risks in the Social dimension is most appropriate when compared to industry peers versus cross industry comparisons.

Table 7 **E&C Risks in the Social Dimension of ESG**
Breakdown of corporate culture (also considered in Governance)
Incidence of corruption (also considered in Governance)
Corporate or executive scandal
Inadequate access to required skilled and unskilled labor
Excessive turnover of labor force
Labor strife including strikes
Failure in diversity, equity, and inclusion
Allegations of sexual harassment
Workplace injuries and deaths
Health & Safety
Injury or death to third parties
Inadequate customer relationship management
Inadequate stakeholder engagement (corporate and project levels) creating negative social perceptions and response (also considered in Governance)
Inadequate or improper political or charitable engagement and contributions impacting perception of firm, brand, and reputation
Failure to effectively manage social media and brand reputation
Inadequate ESG efforts as viewed by stakeholders and employees
Inadequate protection of stakeholders and environment in project contexts
Community impacts and opposition resulting in project delays
Failure to protect client and employee data and privacy
Labor standards and working conditions, including supply chain labor standards
Human capital development
Labor retention
Controversial sourcing
Compliance with regulations
Other compliance requirements
Community development
Human rights
Corporate citizenship and philanthropy

Governance

Governance is the third dimension of ESG and encompasses considerations around:

- Shareholder engagement
- Stakeholder engagement (important in the engineering & construction industry project model)
- Code of conduct
- Board composition
- Audit committee structure
- Bribery and Corruption, which remains a significant risk in the engineering & construction industry
- Executive compensation
- Lobbying
- Political contributions
- Whistleblower schemes

The purpose of the Governance focus is to ensure that the company acts in a responsible and sustainable manner. Shareholder engagement must build on a well-articulated and accepted corporate culture with core values and ethical behaviors. Stakeholder engagement includes not only the stakeholders of the corporation by the project-by-project stakeholder sets for each project in the company portfolio. We have seen stakeholder difficulties on a singular project cascade into a broader set of stakeholder challenges for the company. This is particularly true when the company's code of conduct is breached, or accusation of bribery or corruption are alleged.

This aspect of ESG also incorporates the standard corporate governance considerations around board composition and operations; adequacy of audit and risk oversight; presence and effectiveness of whistleblower programs; and executive compensation.

Table 8 suggests some governance risks to be considered as part of ESG risks in the engineering & construction industry.

Table 8 **Governance Risks in Engineering & Construction**
Risk appetite
Risk management culture, processes, and oversight
Unmitigated and contingent liabilities
Unresolved claims and disputes
Excessive change order values

Table 8 **Governance Risks in Engineering & Construction**
Negative changes in client financial condition and exposed receivables
Extent of active and pending litigation and potential amounts at risk
Risk reserves as percentage of residual and unmitigated project risks
Management reserves relative to Enterprise Risk
Unbalanced project portfolio (concentration risks; lack of conformance with risk appetite)
Likelihood of exposure to bribery, corruption, and uncompetitive practices
Ethical breaches resulting in third party investigations or penalties
Value at risk in high-risk countries
Overdue receivable amounts
Inadequate cash balance or access to ready cash
Credit downgrade of securities or debt
Transparency of advanced payments and changes in capital
Tax transparency
Delayed audit
Shareholder engagement and transparency of performance
Client assessment of performance of firm (Net Promoter Score)
Incomplete or inadequate ESG reporting
Code of business conduct
Compliance with export controls
Corporate governance
Customer relationship management
Enterprise Risk Management system effectiveness
Litigation risks
Contingent liabilities arising from complexity
Client cancellation of projects or extended delays in start of project
Subcontractor risk
Anti-competitive practices
Investigations by public authorities
Repatriation of cash
Completed work under litigation
Cybersecurity
Data protection and privacy
Legal and regulatory fines
Stakeholder relations
Risk and crisis management
Supply chain management

Indirect ESG Risks

Much of the focus on ESG risks is centered around risks that an enterprise can directly control either through their own operating decisions or in the case of Scope 3 emissions through supply chain decisions. There is however another class of ESG risks which are more indirect. These indirect risks arise from a failure of clients or key suppliers that arise from their ESG risk failures. In effect these are exposure risks. A few hypothetical examples are illustrative:

- A major client has completely tied its future to the production and processing of oil without regard to growing global shifts away from oil. Additionally, it has implemented no measures to reduce their Scope 1 and 2 emissions, viewing reporting as the only requirement. Increased regulations invalidate this business model overnight as emission standards are sharply reduced to reflect where the broader industry is and where it needs to go.

- A key supplier has chosen to ignore social requirements related to diversity, equity, and inclusion, reflecting the views of the CEO and board. Their approach has been to periodically pay fines but largely persist in their approach. A tipping point is reached suddenly as the result of egregious behavior with labor walkouts and sudden loss of key parts of their value chain bringing them to the verge of bankruptcy.

- An overseas customer is a corrupt actor. While they understand that a US company will not pay a direct bribe the influences of their corrupt behaviors are felt in other parts of the projects value chain. A new, reformist government focuses on eliminating corruption and suddenly cancels your "corrupt" contract citing corrupt acts in your subcontractors and suppliers and your failure to act.

The above scenarios are illustrative only but highlights the need for engineering and construction firms to assess the risks they might face from the loss of key clients or suppliers from their failure to adequately manage their ESG risks.
Just as we assess subcontractor and supplier financial conditions, so to should we assess their inherent ESG risk exposure. These value chain-based risk assessments will be particularly important as industries, clients, and suppliers transition to a more ESG aware and compliant state and imprecision exists in Scope 3 reporting and various social and governance metrics.

Conclusion

In this paper we looked at a new class of emerging risks affecting projects in the engineering and construction sector as well as the enterprises that undertake them.

We have defined ESG and its scope. The environmental focus dives into climate change as a driver and the associated greenhouse gas protocol scopes are discussed from an engineering & construction industry perspective. Scope 1 and 2 emissions are described and some of the challenges presented by Scope 3 discussed. The challenges of Scope 3 emission accounting and ownership are considered for various contracting forms and highlights the challenge the engineering & construction faces.

We have compared ESG risks for engineering & construction with other sectors but must be cognizant that many of our clients are in the most ESG challenged industries. This will impact how we conduct our work and the reporting and actions they will likely require.

Initial tabulations of candidate risk for each of the three ESG dimensions are provided as a starting point.

Throughout this paper we have flagged items requiring closer examination and guidance within the industry. These include:

- Relationship of ESG to Enterprise Risk Management
- Tailoring of specific disclosure requirements to reflect industry contracting approaches as well as the project nature of the business
- Implications of site of manufacture (project site; third party facility) in categorization of emissions
- Potential distortions in reporting and ownership of emissions as a function of client contracting approach
- The need to collect data on and account for Scope 3 emissions at an earlier stage to provide meaningful cross project and cross enterprise comparisons and benchmarking
- Need for clear guidance on leased construction assets
- Need for clarity in treatment of end-of-life Scope 3 downstream emissions and determination of ownership (if any) by the contractor
- Consistent industry guidance on handling uncertainty in calculating emissions
- The need for or ability to construct aggregate social and governance metrics at the enterprise level
- The aggregation of project level ESG risks into a portfolio component of enterprise risk.

Engineering & construction is a project-based industry and as such these risks must remain front and center and open questions must be answered and codified.

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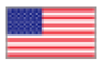

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