

Managing carbon emissions for construction and engineering work

Since the United Nations Framework Convention on Climate Change (UNFCCC) was passed in 1992, various countries have continuously implemented measures for reducing greenhouse gas (GHG) emissions as well as energy management. Global trends in carbon management can be summarized in Figure 1. Overall development starts with carbon inventory control of the organization on the left of the figure below. The scope of the inventory check shall then be expanded to include relevant parts of the supply chain to focus on carbon footprints of products and services and to determine the entire life cycle of greenhouse gas emissions. Once organization's carbon inventory or carbon footprint plan has been completed, and once carbon emission data have been quantified, the focus would be carbon disclosure in order to publicly announce carbon emission information of the organization, its products, or services. This would be established as the basis for social communication as well as establishment of carbon reduction objectives and commitment. In order to achieve carbon reduction objectives, carbon reduction projects or measures shall be implemented. Through Carbon offset and trading systems regulated by international standards or voluntary carbon reduction measures, the carbon emissions that cannot be reduced through reduction efforts can be offset in order to achieve overall zero emissions or carbon neutrality within specified boundaries.

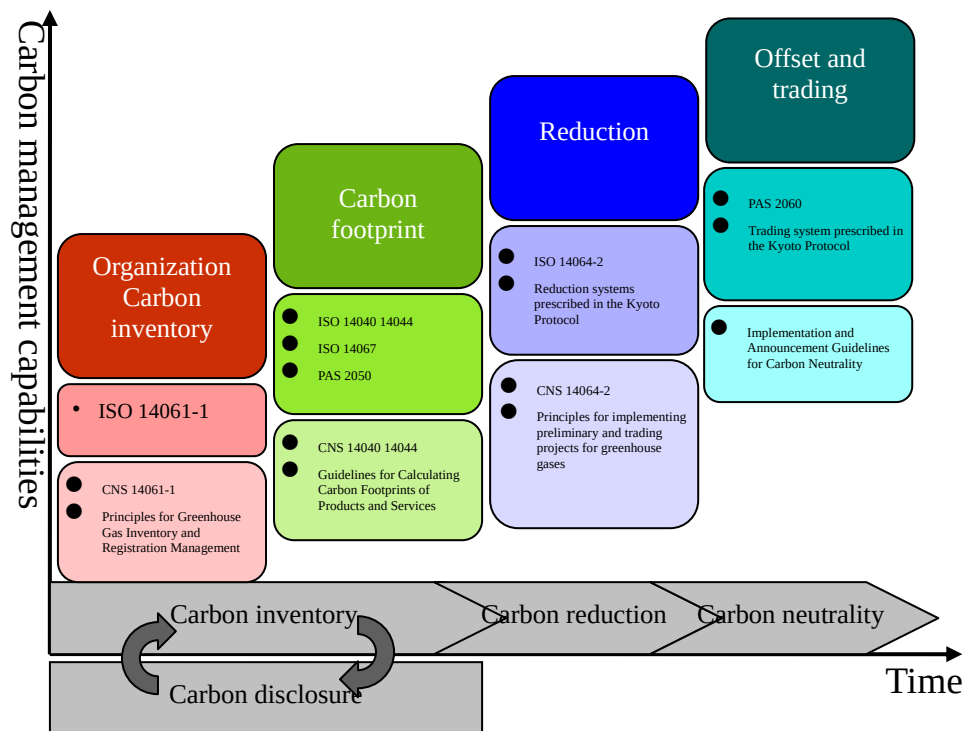


Figure 1 - Carbon management trends throughout the world

Methods for the calculation of greenhouse gas inventory checks as well as carbon footprint calculations were mainly conducted according to standards such as ISO / CNS 14040 14044, and 14064-1 in Taiwan. The Environmental Protection Administration (EPA) of Taiwan therefore established regulations such as the *Principles for Greenhouse Gas Inventory Checks and Registration Management* as well as *Guidelines for Calculating Carbon Footprints of Products and Services* according to the aforementioned standards. When business units implement greenhouse gas (GHG) inventory checks, the principles for checking and defining GHG sources are described in the following. Scope 1 refers to direct sources of emissions which primarily focuses on emissions generated by assets / equipment owned or controlled by the reporting unit. Scope 2 refers to indirect greenhouse gas emissions resulting from the purchase of external suppliers' electricity, heat, steam, or other forms of energy derived from the burning of fossil fuels. Scope 3 refers to emissions from sources not owned or not controlled by the business unit. However, most

of these items would be uncontrollable. Current greenhouse gas management regulations and guidelines therefore did not include these items within calculations and only emphasized the need to provide qualitative descriptions of emission sources in Scope 3.

The scope for carbon emission estimates of recent construction and engineering in Taiwan shall be based upon the aforementioned regulations. Ideal carbon emission estimates for construction work would be divided into 5 major carbon emission categories, namely: (1) direct carbon emissions, (2) indirect carbon emissions, (3) material carbon emissions, (4) transport carbon emissions, and (5) changes resulting from carbon sinks. These categories are shown in Figure 2:

1. Direct carbon emissions: Refer to carbon emissions generated by construction machinery, equipment, or direct fuel consumption at the site.
2. Indirect carbon emissions: Refer to carbon emissions generated by energy purchased by external providers.
3. Material carbon emissions: Refer to total carbon emissions resulting from materials required by the construction project.
4. Transport carbon emissions: Refer to carbon emissions resulting from fossil fuel consumed for transportation purposes.
5. Changes due to carbon sinks: Refer to differences in carbon fixing before and after changes to the vegetative cover of the ground surface.

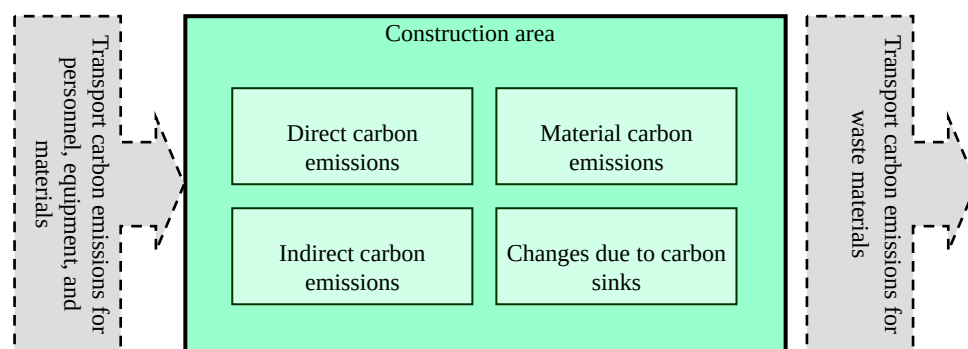


Figure 2 - Categories of carbon emissions for construction projects