Emission-free Construction Sites

Publication - Guidelines

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Nordic Sustainable Construction
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Today’s agenda

- Overview of the project
- Presentation of the report’s main sections
  - Plan and design
  - Procure
  - Implement
  - Evaluate
- Upcoming deliverables and how to follow
- QnA

Emission-free Construction Sites

- Work package 4 of 5 in Nordic Sustainable Construction
- A programme under the Nordic Council of Ministers
- Ministry of infrastructure, Housing and Construction Authority, University of Iceland and GBCI

Nordic Sustainable Construction

WORK PACKAGE 1

Nordic Harmonisation of Life Cycle Assessment

WORK PACKAGE 2

Circular Business Models and Procurement

WORK PACKAGE 3

Sustainable Construction Materials and Architecture

WORK PACKAGE 4

Emission-free Construction Sites

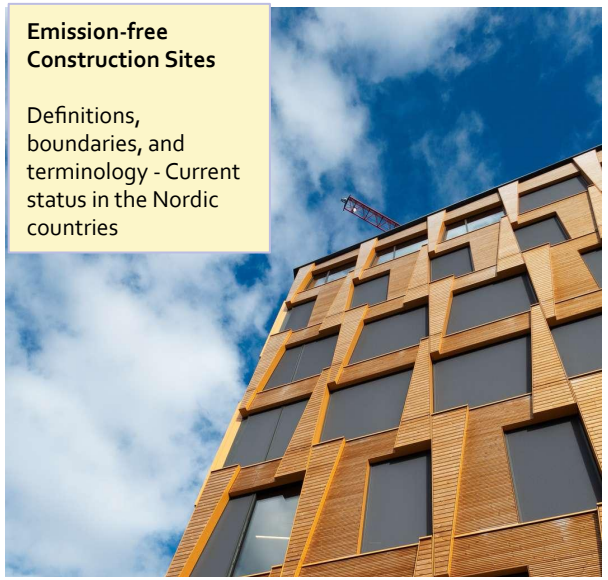
WORK PACKAGE 5

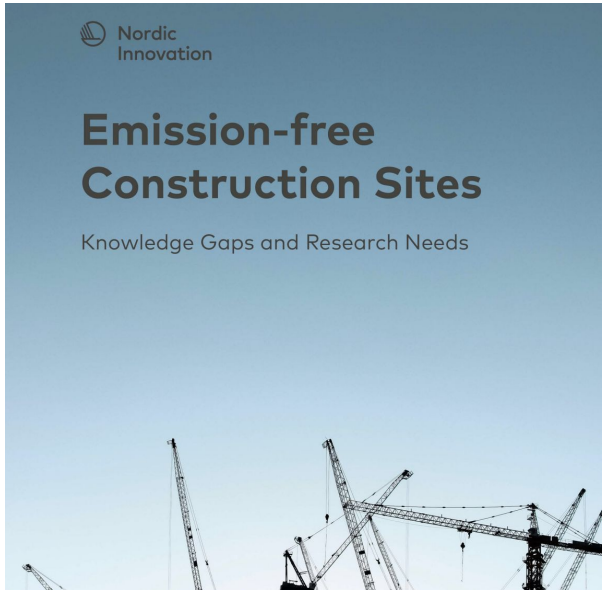
Competences for Reuse in Construction & Programme Secretariat

Previous reports

- Definitions, boundaries and terminology
- Knowledge gaps and research needs

https://nordicsustainableconstruction.com/





Nordic Innovation

Guidelines for Emission-free Construction Sites

Emission-free Construction site

How to Plan and Design

Emission-free Construction site

How to Procure

Emission-free Construction site

How to Implement

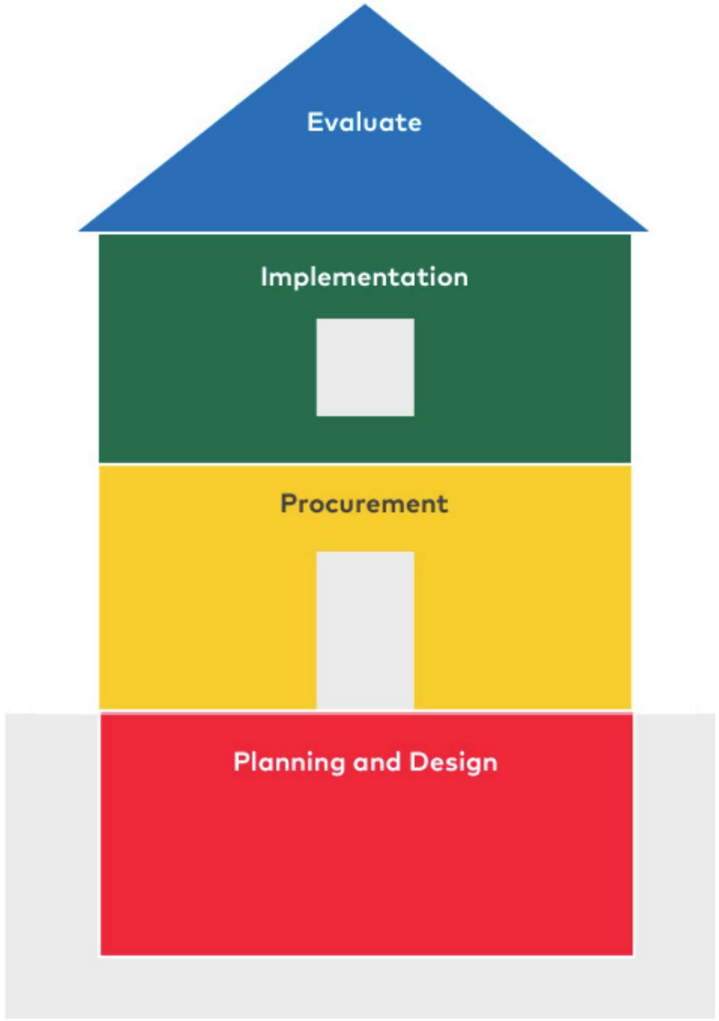
Emission-free Construction site

How to Evaluate

Table 1.2. Estimated emissions values for A4 and A5 in the Nordic countries.

	A4 (kg CO_2e/m^2)	**A5** (kg CO_2e/m^2)	
Iceland	19.79	42.50	Generic values for LCAs [7]
Norway	LCA databases +25%		Byggeteknisk forskrift TEK17 [8]
Denmark	20.50	50.00	BUILD Report [6]
Denmark	75.00		National strategy [4]
Sweden	44.00		KTH and Boverket [9]
Finland	20.40	50.00-59.00	Generic values for LCAs[10]

Finland: Generic values for LCAs[10]



Evaluate

Research
Academia
Everyone else

Imple-mentation

Contractors
Sub-contractors
Workers
Suppliers

Industry groups
Utility providers
Grid operators

Procurement

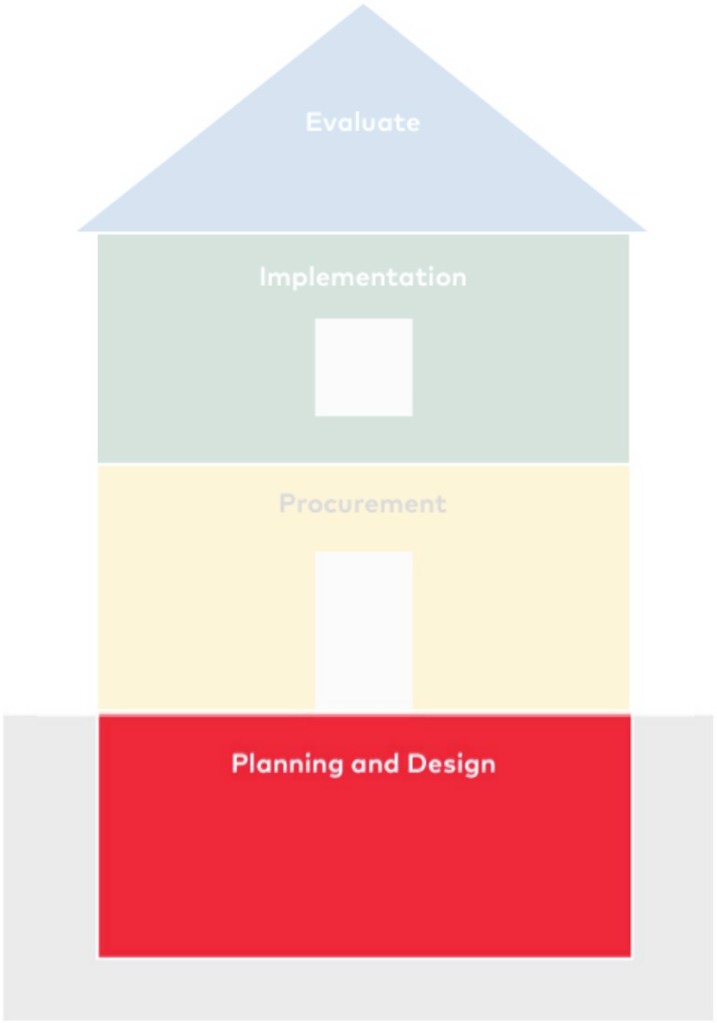
Owners
Clients
Procurement managers

Planning and Design

Designers
Urban planners
Govern-ment
Municipalities

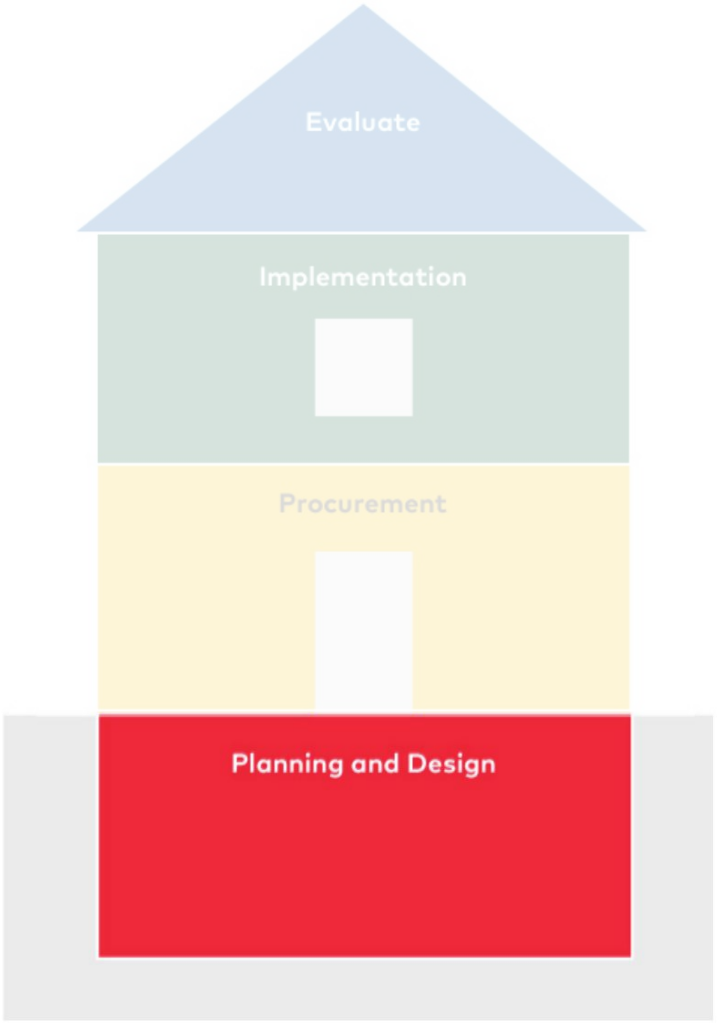
Plan and design

- Do we really need new construction?
- Location
- Infrastructure
- Timing
- Waste management



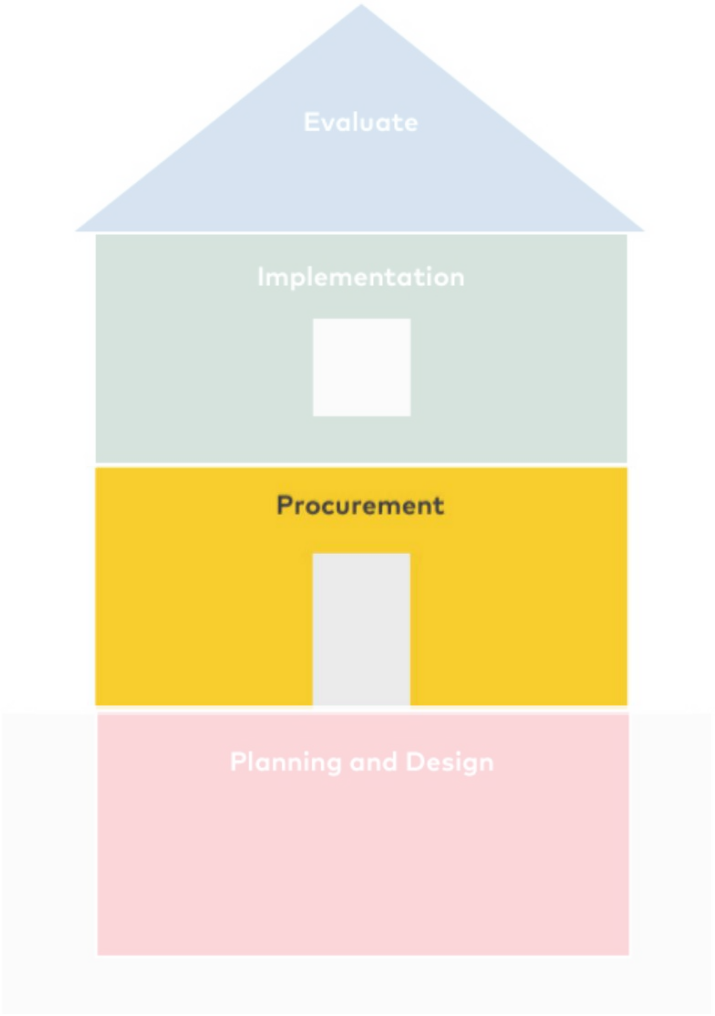
Plan and design

- Prefabricated
- Excess material and packaging
- Local material
- Earthworks
- Soil management



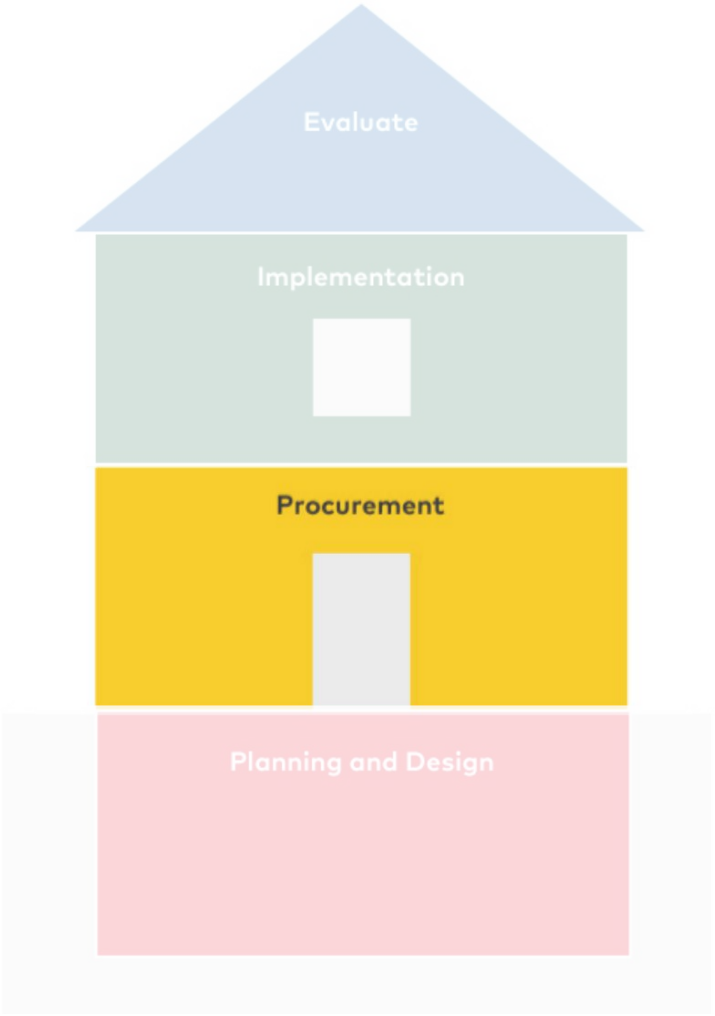
Procure

- Plan
  - Expect extra time and cost
  - Establish goals that align with the organisation’s strategies
  - Engage with potential contractors



Suggested criteria

- Application of bonuses
- Award criteria: Quality points are awarded for reducing emissions from
- Minimum requirements



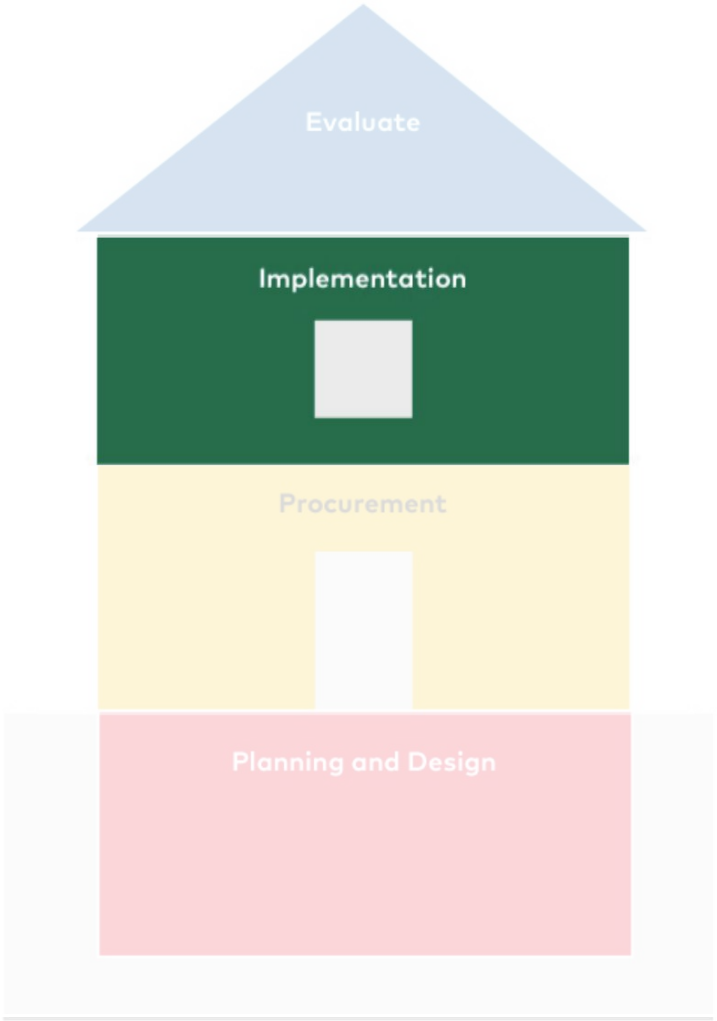
Implement

A4 Emissions from Transportation

- All projects are not the same

- Find shortest distance
- Use local
- Coordinate with other projects

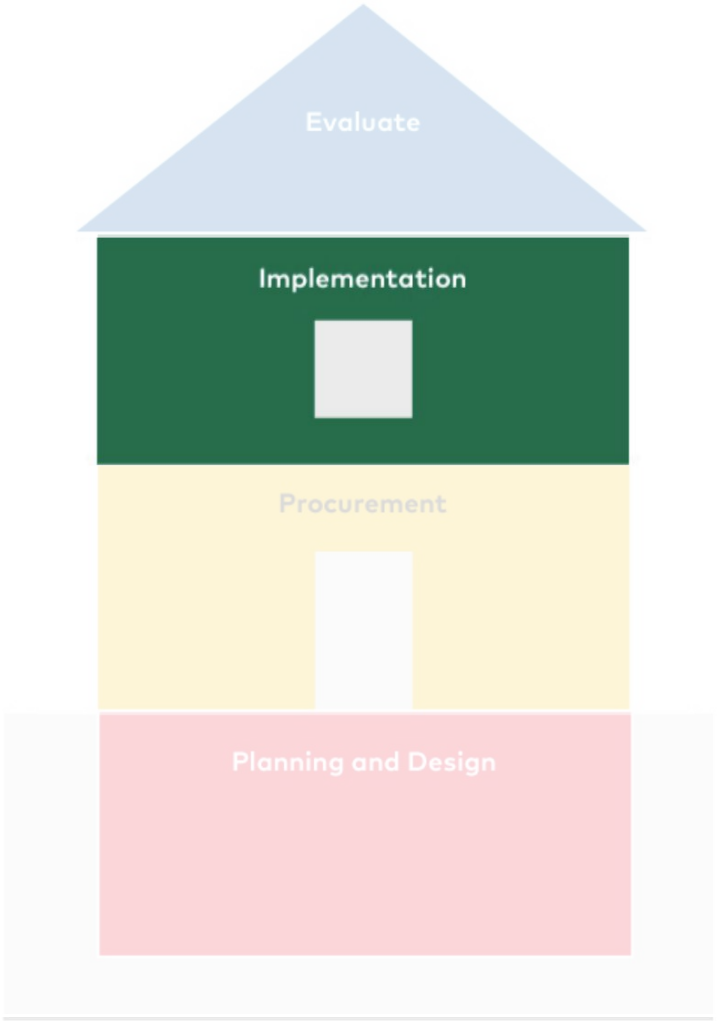
- Electric transport
- Biofuels - HVO & Methane
- Hydrogen is coming …



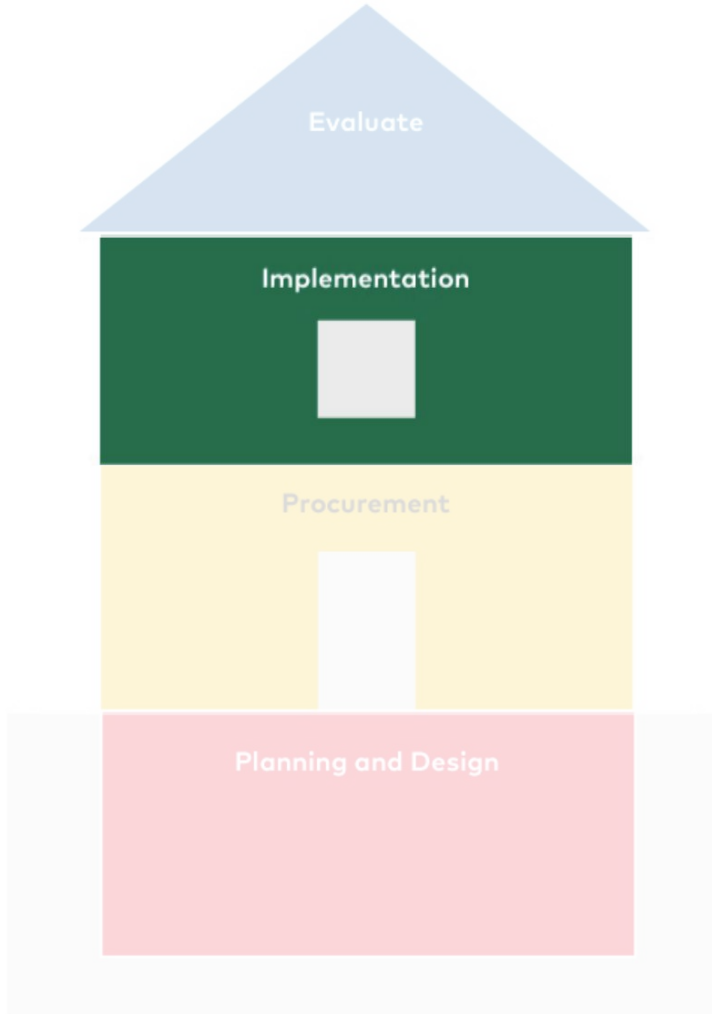
Implement

A5.E Emissions from Energy

- Organise site for saving energy
- Earthworks and mass transport
- Low emission district heating
- Biofuels for heating
- Electric machinery
- Biofuels - HVO & Methane
- Hydrogen Power packs



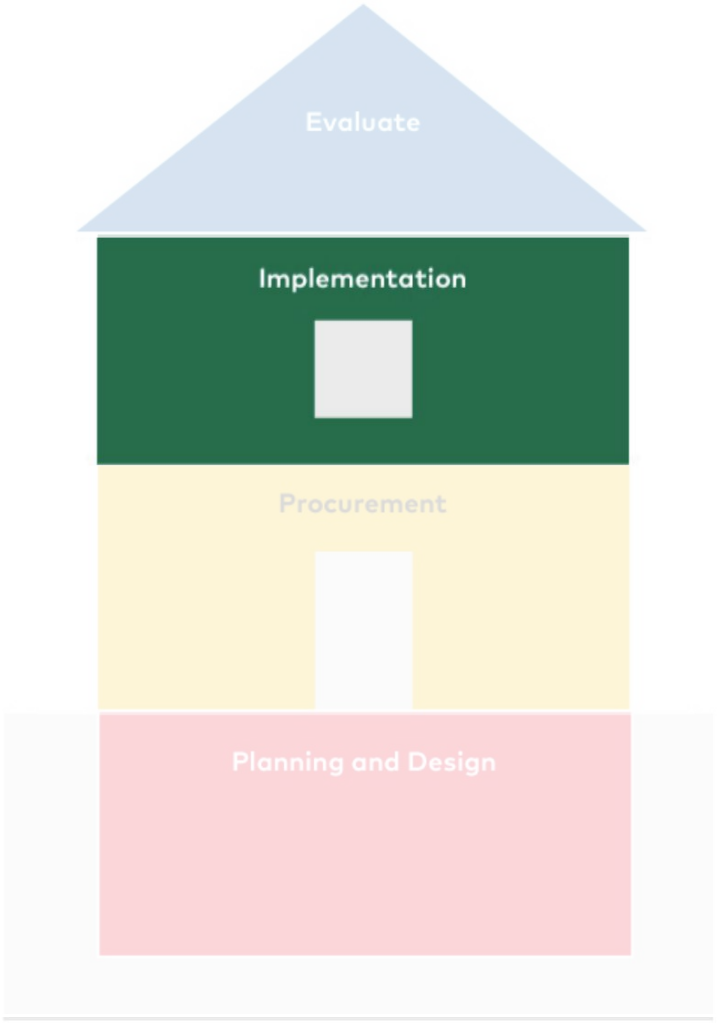
	Benefits	Barriers	Best practices
Electric	-Zero on-site emissions -Reduced noise -No local air pollution -Energy security	-Limited supply of electric construction machinery and vehicles -Limitations in grid capacity -Charging infrastructure often inadequate	Involve the power provider and grid operator early on -Adapt work procedures to accommodate charging needs -Plan machine fleet according to available charging capacity -Use peak shaving equipment
Biodiesel **HVO** **Biogas**	Vehicles and machines widely available -For large machines that have a long range	Local emissions -Poor energy efficiency -Sustainability issues	Use where energy infrastructure is lacking -Choose fuel from local sources -Only use certified sustainable fuels
Hydrogen Combustion	Low local air pollution -For large machines that have a long range	Poor energy efficiency -Limited availability of vehicles and machines	Interim solution while fuel cell machinery is developed -Use sustainably sourced hydrogen
Hydrogen fuel cells	No local pollution -High level of energy efficiency -Reduced noise	-Limited availability of vehicles and machines	Use sustainably sourced hydrogen



Implement

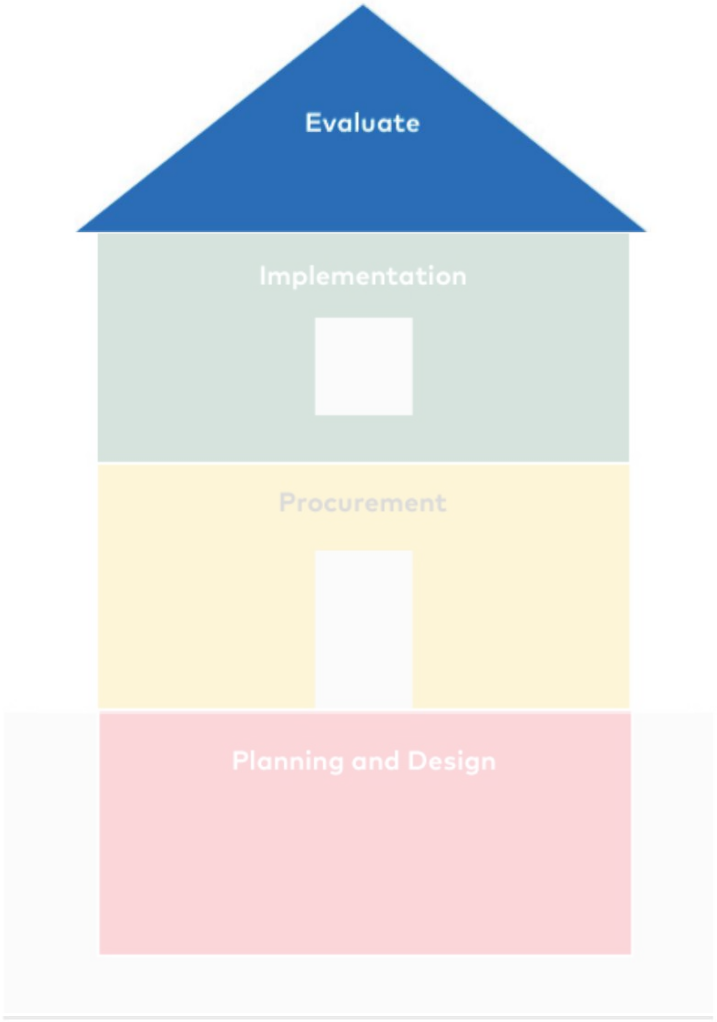
A5.W Waste

- Waste has embodied carbon
- Waste management plan
- Culture of our grandparents
- Reuse, Reuse, Reuse
- Dialogue with the Waste Industry



Evaluate

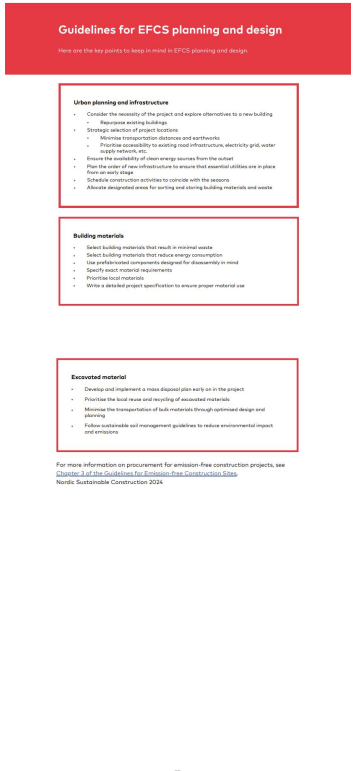
- Documented emission reductions
- Plan for data collection
- Data collection
- LCA methods
- Provide feedback



LCA module	Activity	What to consider	Values	How to measure	Stakeholders
A4	**Transportation**	Transport of materials, products, and equipment to the construction site from: -Manufacturer -Storage/warehouse -Retailer	-Distance -Energy source	-Verification (of energy source) -Travel logs	Suppliers Material, product, and equipment hauliers
A5.E	**Energy use**	Emissions from: machinery	Type of machinery Energy source Amount	Verification (of energy source and worked hours)	Suppliers Subcontractors
		Heating and cooling: -district heating -power station sources (for temporary works or other processes)	Energy source Amount	Automatic or manual meter reading Verification	Utility providers
A5.W	**Waste**	Construction waste:	-Volume -Weight -Type	-Waste management company reports or verification	Waste hauliers
		Transport of waste from construction site	-Distance -Energy source	-Verification	Waste hauliers

Appendix

- Printable summaries of each chapter from the guidelines.



Guidelines for EFCS planning and design

Here are the key points to keep in mind in EFCS planning and design.

Urban planning and infrastructure

- Consider the necessity of the project and explore alternatives to a new building
  - Repurpose existing buildings
- Strategic selection of project locations
  - Minimise transportation distances and earthworks
  - Prioritise accessibility to existing road infrastructure, electricity grid, water supply network, etc.
- Ensure the availability of clean energy sources from the outset
- Plan the order of new infrastructure to ensure that essential utilities are in place from an early stage
- Schedule construction activities to coincide with the seasons
- Allocate designated areas for sorting and storing building materials and waste

Building materials

- Select building materials that result in minimal waste
- Select building materials that reduce energy consumption
- Use prefabricated components designed for disassembly in mind
- Specify exact material requirements
- Prioritise local materials
- Write a detailed project specification to ensure proper material use

Excavated material

- Develop and implement a mass disposal plan early on in the project
- Prioritise the local reuse and recycling of excavated materials
- Minimise the transportation of bulk materials through optimised design and planning
- Follow sustainable soil management guidelines to reduce environmental impact and emissions

For more information on procurement for emission-free construction projects, see Chapter 3 of the Guidelines for Emission-free Construction Sites, Nordic Sustainable Construction 2024

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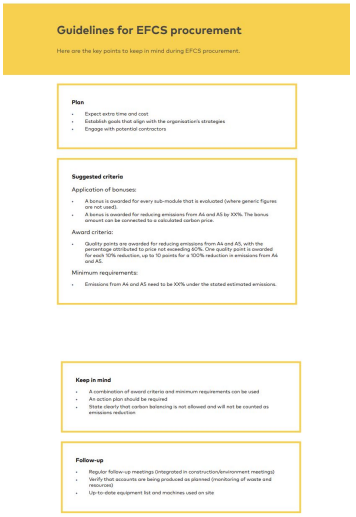

Guidelines for EFCS procurement

Here are the key points to keep in mind during EFCS procurement.

Plan

- Expect extra time and cost
- Establish goals that align with the organisation's strategies
- Engage with potential contractors

Suggested criteria

Application of bonuses:

- A bonus is awarded for every sub-module that is evaluated (where generic figures are not used).
- A bonus is awarded for reducing emissions from A4 and A5 by XX%. The bonus amount can be connected to a calculated carbon price.

Award criteria:

- Quality points are awarded for reducing emissions from A4 and A5, with the percentage attributed to price not exceeding 60%. One quality point is awarded for each 10% reduction, up to 10 points for a 100% reduction in emissions from A4 and A5.

Minimum requirements:

- Emissions from A4 and A5 need to be XX% under the stated estimated emissions.

Keep in mind

- A combination of award criteria and minimum requirements can be used
- An action plan should be required
- State clearly that carbon balancing is not allowed and will not be counted as emissions reduction

Follow-up

- Regular follow-up meetings (integrated in construction/environment meetings)
- Verify that accounts are being produced as planned (monitoring of waste and resources)
- Up-to-date equipment list and machines used on site

For more information on procurement for emission-free construction projects, see Chapter 3 of the Guidelines for Emission-free Construction Sites, Nordic Sustainable Construction 2024

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Guidelines for EFCS implementation

Here are the key points to keep in mind in the implementation of EFCS.

A4 Transportation

Reducing emissions from transportation means reducing energy use. The "avoid, shift, improve" hierarchy can be used to reduce energy use.

Avoid ↓	• Source building material from local suppliers and prioritise the use of locally available resources. • Keep transportation of materials down by reusing and recycling materials on site where possible. • Include suppliers and subcontractors early to plan for material availability and minimise transportation.
Shift ↓	• Use vehicles with the lowest emissions available (e.g., electric or biofuel). • Plan early for charging infrastructure or biofuel supply. • Discuss low-emission transport options with stakeholders. • Prefer sea or rail transport for long distances to minimize emissions.
Improve ↓	• Train drivers to minimize idling, drive efficiently, and report vehicle maintenance needs promptly. • Optimize delivery routes and schedules to minimize travel distances and avoid traffic. • Coordinate with suppliers to optimize delivery times and load vehicles efficiently to reduce trips. • Utilize logistics software for transport optimization where available.

A5.E Energy use

Reducing emissions from energy use on site. The "avoid, shift, improve" hierarchy can be used to reduce energy use.

Avoid ↓	• Avoid unnecessary energy use by reviewing all expected energy consumption. • Prevent heat loss and avoid heating unused spaces.
Shift ↓	• Use electric machinery when possible; opt for biofuels or other clean energy instead of diesel to cut emissions. • Assess machinery availability early; discuss with subcontractors about accessing green energy equipment. • Coordinate with power suppliers and grid operators to manage investments in battery and electric machinery. • Use electric vehicles to charge electric battery containers and appoint a charging coordinator to optimize schedules. • Consider district heating systems for heating and drying, and arrange early connections to central heating systems if applicable.
Improve ↓	• Plan machinery and equipment with digital controls to improve logistic. • Provide training for workers in efficient machine operation. • Implement strategic work planning logistics like reducing idling to enhance energy efficiency.

A5.W Waste

The "reduce, reuse, recycle" hierarchy can be used to reduce emissions from waste.

Waste management plan ↓	• Set up a comprehensive waste management plan. • Estimate material needs, optimize usage, and prevent excess waste. • Specify the amount of material planned for reuse and recycling. • Decide where waste sorting containers will be placed and how many are needed. • Appoint an employ to oversee and manage the plan.
Reduce ↓	• Precisely estimate materials in a material takeoff to avoid excess. • Considere the purchased sizes to minimize cutoffs. • Properly store materials and optimo delivery times to reduce waste from product damage. • Use a software such as BIM to organize the storage of building materials and waste on-site.
Reuse ↓	• Precisely estimate materials in a material takeoff to avoid excess. • Considere the purchased sizes to minimize cutoffs. • Properly store materials and optimo delivery times to reduce waste from product damage. • Use a software such as BIM to organize the storage of building materials and waste on-site.
Recycle ↓	• Have an early dialogue with waste management companies to optimise the process and communicate needs. • Have a dialogue with workers on site and train them to use the waste sorting system and reduce waste generation.

For more information on procurement for emission-free construction projects, see Chapter 3 of the Guidelines for Emission-free Construction Sites, Nordic Sustainable Construction 2024

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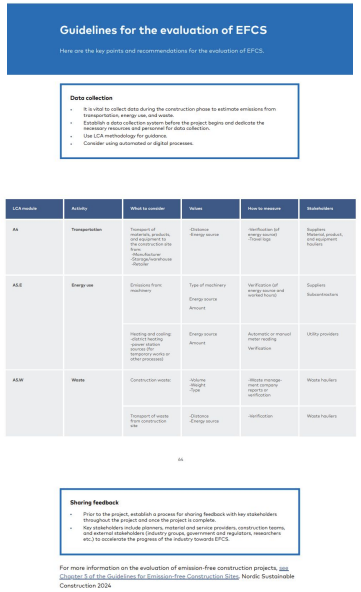

Guidelines for the evaluation of EFCS

Here are the key points and recommendations for the evaluation of EFCS.

Data collection

- It is vital to collect data during the construction phase to estimate emissions from transportation, energy use, and waste.
- Establish a data collection system before the project begins and dedicate the necessary resources and personnel for data collection.
- Use LCA methodology for guidance.
- Consider using automated or digital processes.

LCA module	Activity	What to consider	Values	How to measure	Stakeholders
A4	Transportation	Transport of materials, products, and equipment to the construction site Sub-modules: -Storage/warehouse -Service	-Distance -Energy source	-Verification (of energy source) -Travel logs	Suppliers Material, product, and equipment haulers
A5.E	Energy use	Emissions from machinery	Type of machinery Energy source Amount	Verification (of energy source and worked hours)	Suppliers Subcontractors
		Heating and cooling: district heating, electricity, sources (for temporary works or other processes)	Energy source Amount	Automatic or manual meter reading Verification	Utility providers
A5.W	Waste	Construction waste:	-Volume -Weight -Type	-Waste manage-ment plans/summary reports or verification	Waste haulers
		Transport of waste from construction site	-Distance -Energy source	-Verification	Waste haulers

A4

Sharing feedback

- Prior to the project, establish a process for sharing feedback with key stakeholders throughout the project and once the project is complete.
- Key stakeholders include planners, material and service providers, construction teams, and external stakeholders (industry groups, government and regulators, researchers etc.) to accelerate the progress of the industry towards EFCS.

For more information on the evaluation of emission-free construction projects, see Chapter 5 of the Guidelines for Emission-free Construction Sites, Nordic Sustainable Construction 2024.

Coming up

- Report on standards, rules and regulations that can be hindering and other barriers. Published late 2024
  - Survey →
- Newsletters

Survey - Barriers

Questions - Slido

Thank you!

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Programme partners

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Nordic Innovation

Form Design Center

Government of Iceland
Ministry of Infrastructure

danish housing and planning authority

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