Arup

CO2 Performance Ladder

Sustainability Portfolio

Financial year 2017/2018

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Job number

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1 Introduction

For a sustainable future it is becoming more and more important to balance the crossroads of economic growth with social and environmental development. At Arup we strongly feel our responsibility to contribute to this transition. This resonates in our mission statement: **"We shape a better world".**

We have adopted the CO_2 -performance ladder as a tool to map and reduce our CO_2-emissions, within our organisation and the chain in which we operate. The ladder is intended as a management system to stimulate continuous improvement. Proper implementation of the system is awarded with a system certificate, which provides benefits in the procurement process of construction projects. Increased efforts regarding energy savings, use of sustainable energy and CO_2 reduction are rewarded with a higher score on the ladder.

This document is our **CO_2 -performance portfolio 2017/2018**, in which we demonstrate our compliance to the requirements of the ladder.

Objectives
The main aims of the performance ladder system are to stimulate companies to:

- gain insight into their own CO_2-emissions and those of their suppliers;
- identify CO_2-emission reduction opportunities and implement measures;
- share acquired knowledge and targets transparently;
- participate in an active search for opportunities to further reduce emissions with colleagues, knowledge institutions, network partners and governments;

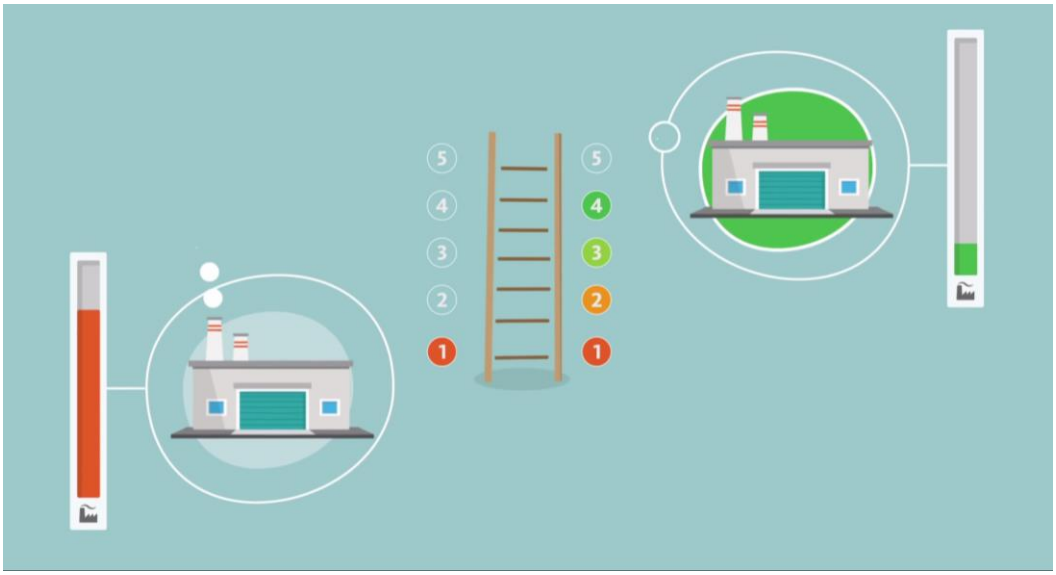

Figure 1 CO_2 Performance ladder (Source: SKAO)

Emissions

An important part of the CO_2-performance ladder compliance, is gaining insight into greenhouse gas emissions. For this purpose, CO_2-emissions are classified into the following scopes:

- **Scope 1:** direct emissions of the organization (business car fleet)
- **Scope 2:** indirect emissions of the organization, by installations not owned but used by the organization (generation of electricity, heating, business travel)
- **Scope 3:** other indirect emissions of the organization which arise from activities by the organization, although from sources not managed or owned by the company.

Scope 3 is further defined into upstream and downstream:

- **Upstream scope 3 emissions:** emissions arising from purchased or acquired materials and services (commuting, paper consumption)
- **Downstream scope 3 emissions:** emissions arising from the use of the project, service or delivery offered / sold by the organization. Therefore, emissions arising from the projects we work on as an engineering- and consultancy firm are classified as downstream scope 3.

The CO_2-emissions are calculated on the basis of a uniform list of CO_2-emission factors, published on www.co2emissiefactoren.nl. The CO_2-emission factors are updated at the beginning of each Arup financial year, based on the latest values published on www.co2emissiefactoren.nl and are maintained throughout the whole financial year (April to March).

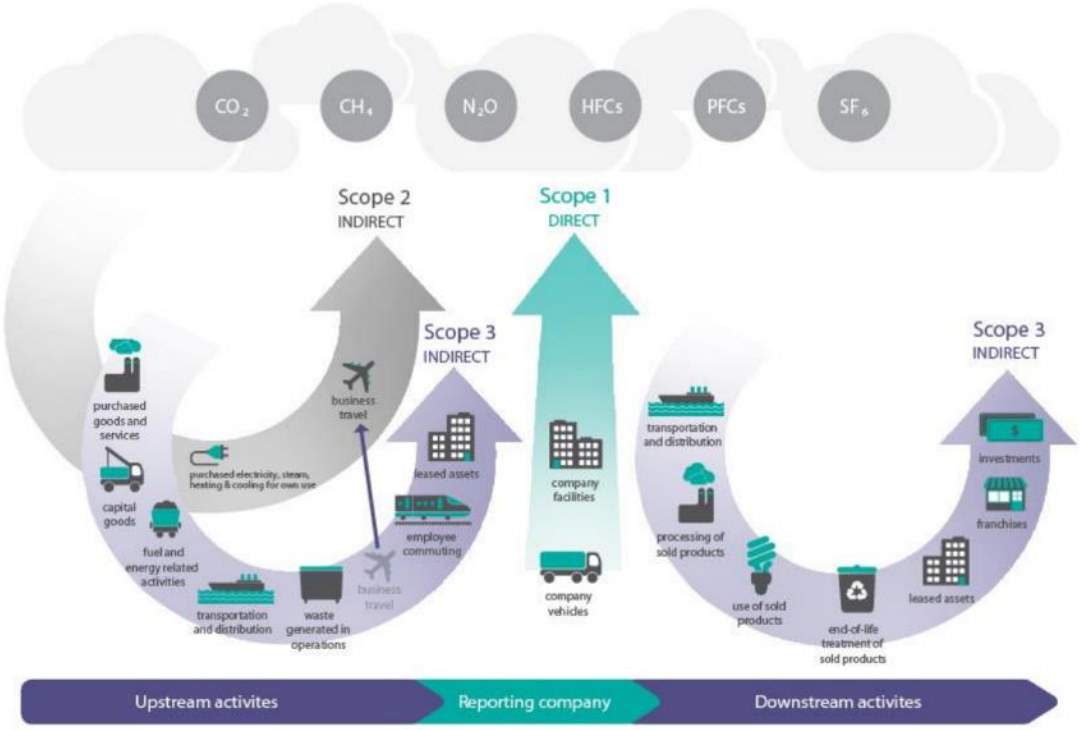

Figure 2 CO_2-performance ladder scope diagram (Source: Handbook CO2-performance ladder 3.0)

Certification

The certification of the CO_2-performance ladder contains 5 levels. To obtain a certain level, the organisation has to fulfil all the requirements associated with the levels below and the level pursued. Compliance is achieved when Arup receives >90% of the obtainable points for a certain level. Arup b.v. aims to comply to the highest level, nr. 5. The most important requirements for the levels are:

Level 1: Awareness of energy flows and possible measures

Level 2: Insight into own energy consumption and drive to reduce

Level 3: CO_2-inventory according to standards + quantitative reduction targets

Level 4: Research into CO_2 within the supply chain and CO_2 reduction in co-operation with chain partners.

Level 5: Participate in reduction programs and achieve CO_2-targets

Procurement

The CO_2-performance ladder tool can be used by the government or other businesses for the procurement process[1]. A higher score on the ladder is then rewarded with a concrete advantage in the procurement process, in the form of a fictional discount on the entry price. The contracting organization determines the award benefit per level of the ladder. At level 5, the awarded reduction on the bid price by ProRail is 10%. The most common reduction is 5% by most other parties such as Rijkswaterstaat.

Organizational boundaries

The CO_2-ladder certification will be applicable to the firm Arup b.v. in the Netherlands. Arup b.v. has a permanent facility in Amsterdam and a temporary facility in Groningen. The firm operates as a consultant for the planning, design, management and research of architectural and engineering related projects, primarily in the building- and infrastructure sector. There are no sub-companies operating under the control of Arup b.v.

Arup b.v. produces a total amount of CO_2 emissions above 500 tons a year, and below 2500 tons and therefore classifies as a medium sized company. The size classification determines the specific set of CO_2-ladder certification requirements.

[1] For further details, refer to the website http://www.skao.nl/

2 Requirements

The requirements are classified as **general requirements** and **audit-checklists.** The certification procedure is as follows:

Figure 3 Certification trajectory

2.1 General requirements

Management review

- The board of the organization must review the implementation of the CO_2-performance ladder. The Management overview in chapter 3 is set up to communicate the implementation of the ladder with the management board.

Internal audit

- The fulfilment of the CO_2-ladder requirements associated to the aimed level is reviewed internally
- Possibilities for improvement are identified.

External audit

- The report of the internal audit and management review are checked externally.
- The fulfilment of CO_2-ladder requirements associated to the aimed level are reviewed externally on the basis of the provided CO_2-ladder portfolio.

Contribution to SKAO

- The CO_2-performance certificate is valid if the yearly contribution is paid to SKAO.

2.2 Audit checklists

Besides the general requirements, the audit checklist exists of 4 core themes:


A. Insight

B. Reduction


C. Transparency


D. Participation.

To communicate our compliance with the 4 themes this portfolio contains the following subchapters and documents:

Theme	Requirement documents
A: Insight	• Environmental data excel sheet (updated per quarter) • CO_2-inventory • Downstream scope 3 emissions • Operational chain analyses
B: Reduction	• Energy management plan (quantified reduction targets)
C:Transparency	• Communication plan (internal and external communication)
D: Participation	• Participation plan

3 Management overview

3.1 Introduction

This chapter provides an overview of the implementation status of the CO_2-performance ladder for the management team. There are no changes relevant to CO2-performance ladder system comparing to 2016/17.

3.2 A: Insight

The CO_2-inventory provides an overview of the emissions of the organization. The CO2-emissions from the own organization were 3.11 tCO2e/employee/year for 2017/18. The four main posts which account for 90% of the operational emissions are:

Scope 1:	Lease cars	11%
	Private cars	5 %
Scope 2:	Business air travel	40%
Scope 3:	Commuting	37%

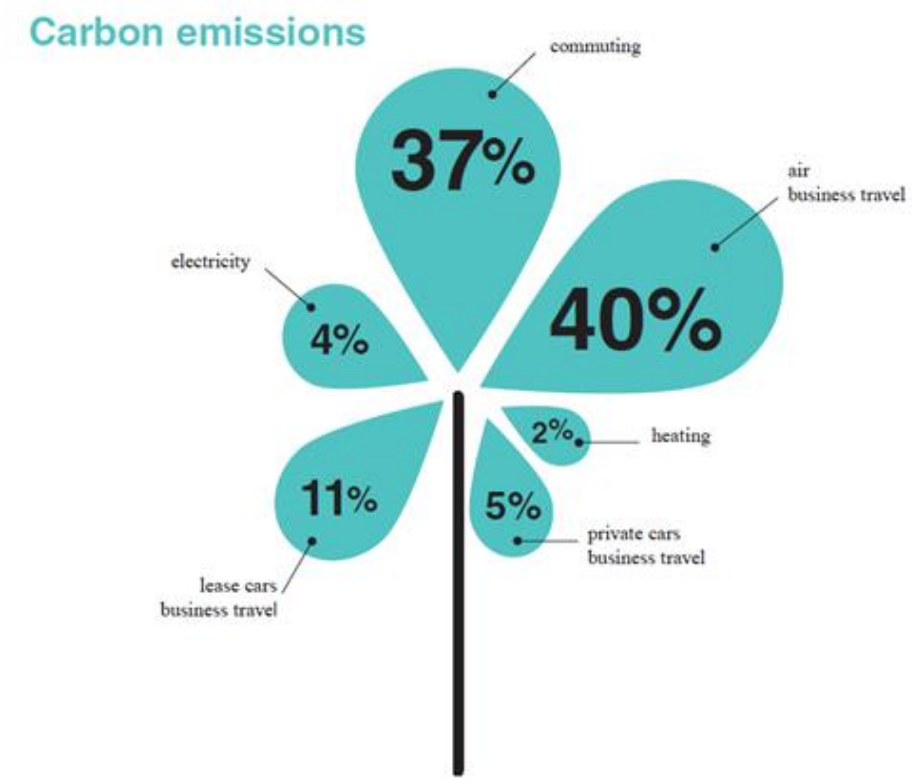

Figure 4 Distribution of CO2-emissions for 2017/18

3.3 B: Reduction

Arup Operations

In 2014 internal goals were set for the period of 2014-2017 to reduce carbon with a total of 8% for all scopes. Emissions of scope 1+2 are decreased due to the shift wind energy for electricity, but emissions of 3 have been fluctuating, partially due to the growth of the company and to modal shift for commuting. Overall a reduction of 12,1% in carbon emissions was achieved in the period 2014-2017, exceeding our initial target (Figure 5).

Our goals for 2018 are set in our 2018-2020 Energy management plan. Our ambition for 2020 is to reduce by 5% our emissions due to air travel and by 5% our emissions due to commuting by fossil fuel driven cars that together count for 3,85% reduction on our overall CO2 emissions for scope 1, 2 and 3.

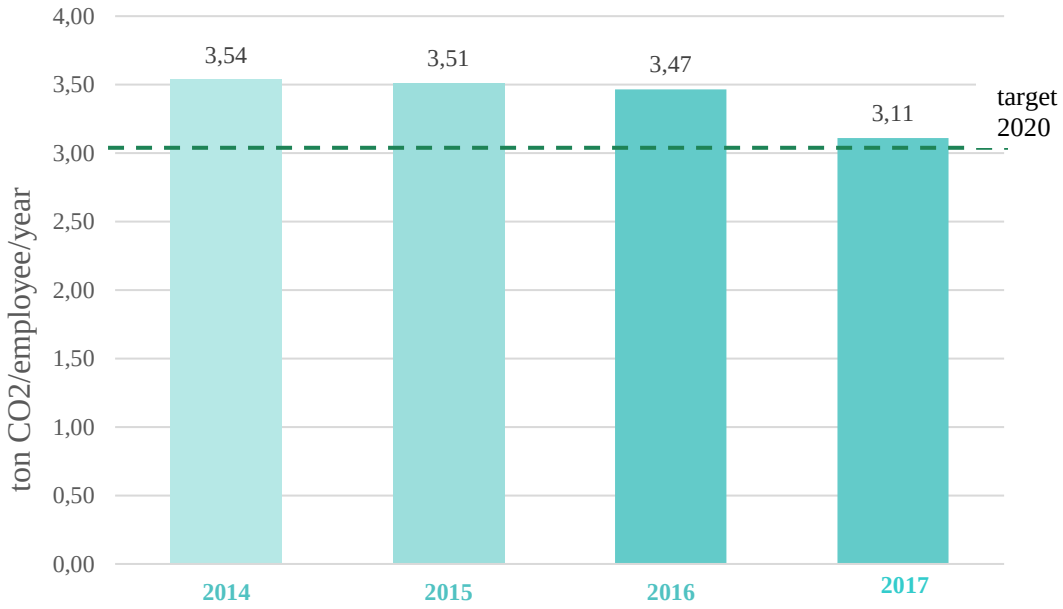

Figure 5 Total **CO_2e**/employee/year and reduction target of 3,85% for scope 1,2 and 3 for 2020

The following measures are proposed to achieve our reduction targets. A mobility plan taskforce is set-up to evaluate the feasibility of the measures. The definitive set of reduction measures will be presented at the end of 2018, according to the mobility plan.

Category	Measure	Potential % total emissions	Progress	Responsible
Scope 2: Business travel – air	Set-up incentives in new mobility [2] plan.	▼ 2,00% [5% of 40%]	● ○ ○	SDM

[2] The new mobility plan will be effective from 1 January 2019.

	- Provide alternative travel guideline: Our travel agency is instructed to provide travel by train as the first option for travelling within the EU (Germany, Belgium, UK or France). For flights to/from these destinations, an additional supervisor approval will be needed. - Promote VC meetings			
Scope 3: Commuting 	Set-up incentives in new mobility plan - OV business cards/ mobility cards - Electric pool cars + electric shared bikes - Free OV bike from and towards train station - Upper limit for commuting allowance for fossil fuel driven cars will be set to 50 km (one-way)	▼ 1,85% [5% of 35%]	● ○ ○	SDD

Besides focussing on the main reduction measures of scope 1,2, and 3 to decrease the CO2 emissions of our operations, Arup b.v. plans to put effort into increasing awareness amongst employees.

Category	**Measure**	**Potential %**	**Progress**	**Responsible**
Awareness 	Increase awareness amongst employees by introducing yearly 'awareness week' around the Global Sustainability day 10 October	-	● ● ●	SDM

Progress 2016/2017

The most impactful reduction measure of the period 2015-2017 was the transition towards a green energy supplier (100% wind energy) for the Arup Amsterdam office in April 2017. The focus of reduction measures for the period 2018-2020 will therefore be on the other 2 main drivers: air travel and commuting (refer to Energy management plan 2018-2020).

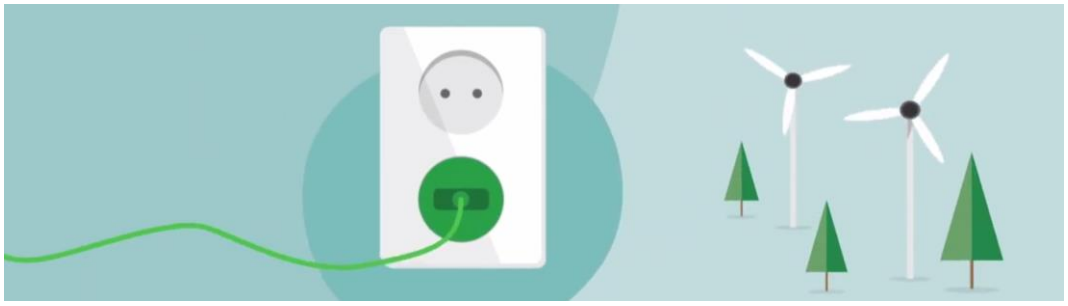

Figure 6 Towards Sustainable energy (Source: SKAO)

Arup projects

The main CO_2 mitigation measures for our projects (downstream scope 3) are:

Target	Category	Measure	Progress	Responsible
1	Projects – Objectives	Sustainability objectives in projects > €150k fee are recorded in the IPP	● ● ○	PM
2	Projects – Objectives	Development of Sustainability objectives tool	● ○ ○	SDM
2	Projects – design - Energy	Verify if projects comply with Dutch regulation in relation to the 'Energieprestatie' of a building.	● ○ ○	PM
3	Projects – design - Materials	Verify if projects comply with Dutch regulation in relation to the 'Milieuprestatie' of a building.	● ○ ○	PM
4	Projects - Communication	Each year a selection of our projects will be presented in the 'How We Shape a Better World' report	● ● ●	SDM

Progress 2017/2018

Chain analyses are performed on an architectural steel bridge and a more practical concrete bridge. Two chain analyses are performed for a timber residential tower. In 2017, 31% out of the projects with a fee above €150 k have set sustainability objectives. Awareness is raised amongst employees by organizing an internal election on the 'most sustainable project' and the Sustainability week in October

2018. Sustainable business travel is promoted by our new mobility plan that will become effective on the 1st of January. Travelling by train within Europe is promoted as an alternative to air travel, via our travel agency.

3.4 C: Transparency

Arup uses both internal and external channels to communicate the implementation of the CO2-performance ladder. The communication strategy is based on quarterly CO_2-performance updates, half yearly awareness weeks and yearly CO2-targets and portfolio update. Refer to: communication plan for more details.

	Internal				External	
Period	**CO_2-ladder**		**CO_2-awareness**		**CO_2-ladder**	
	Topic	Method	Topic	Method	Topic	Method
Q1	Update CO_2-performance	Screens			Targets and CL-portfolio	Arup site + SKAO
Q2	Update CO_2-performance	Screens + intranet	How we shape a better world-week	Report + lunchlecture		
Q3	Update CO_2-performance	Screens				
Q4	Update CO_2-performance	Screens + intranet	Sustainability -week	Campaign + lunchlecture		

Figure 7 Yearly communication calendar

3.5 D: Participation

Arup participates in a number of in-house research initiatives and network partnerships. For more information, refer to the Participation plan.

In-house research:
Cities Alive: Designing for Urban Childhoods

Participation to sector or chain initiatives:
Member of Sustainability Commission to the Dutch Steel association (TC1 BmS), Participant of the Green Deal Duurzaam GWW, Member of Madaster and Member of Circle economy.

3.6 Audits

Internal
An internal audit was held on the 17th of October 2018, by Paul van Horn. During this audit 9 deviations were observed, and 3 opportunities for improvement were identified.

External
An external audit was held by C.P. Glas of bureau Veritas on the 30th of October

2018. It was commented that a few documents weren't compliant or up-to-date. and that after adjustments, the certification of level 5 can be granted to Arup b.v.

3.7 Implementation of the CO2 performance ladder

- The sustainability portfolio was renewed to increase clarity and compactness of the information. In this way the portfolio is be more accessible and straightforward to update as part of the continuous improvement system.
- The cooperation with supporting teams as HR, facility management and communications is increased, to integrate the reduction goals into their action plans (for example: new mobility plan for NL). Furthermore, together with our facility management team we are looking into the sustainability performance of our office suppliers and investigating the possibilities for more sustainable office facilities.
- The transition towards green energy supplier for the Amsterdam facility provided a significant reduction of emissions contributing towards the achievement of our targets.

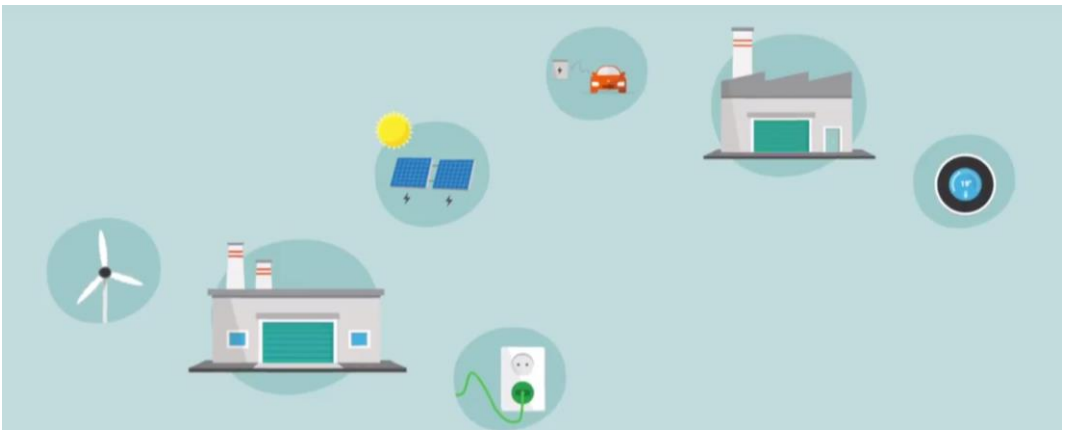

Figure 8 Possibilities to reduce CO_2-emissions (Source: SKAO)

Appendix A

Insight

CO2-inventory

Arup

CO2 Performance ladder

GHG Inventory 2017-18

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Contents

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1 Introduction

At Arup we strongly feel the responsibility to contribute to the transition towards a more sustainable future. We have adopted the CO_2 -performance ladder as a tool to map and reduce our CO_2-emissions. Measuring and reporting of the carbon footprint of our organization is a fundamental first step in our action cycle. Our footprint is reported every year in accordance with the GHG-protocol and ISO 146064-1, as to comply with our CO_2 Performance ladder certification. The reporting period is April 2017 until March 2018, in line with the Arup financial year. The performance is compared to prior Calendar years. The reporting of 2016 is a transition document reporting the CO2 emissions from Jan 2016 to March 2017. The new targets are set for the period 2018-2020 and 2017/18 is the new reference year.

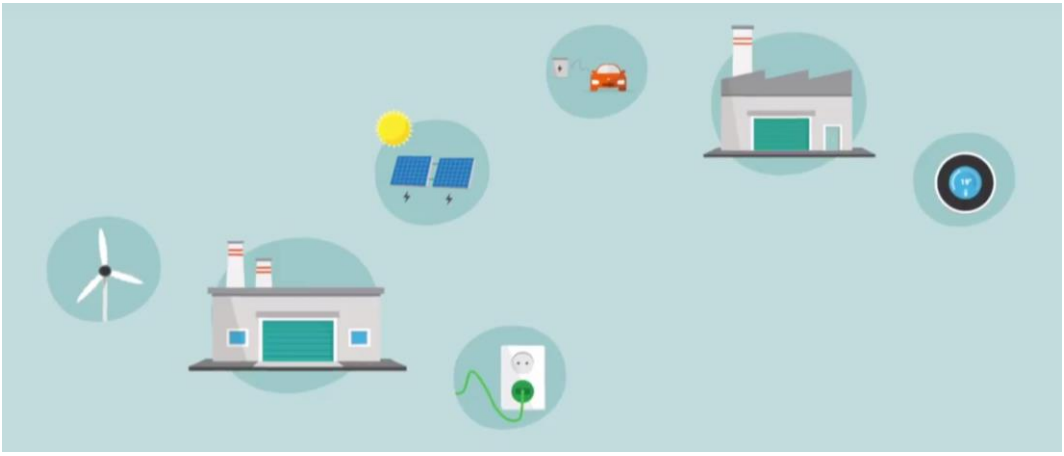

Figure 1 Identification of the emissions of our organization and chain (Source: SKAO)

1.1 Organization

Arup b.v. was established in the Netherlands, Amsterdam in 2001. The firm is currently under the leadership of Mr. Sander den Blanken and its management structure is divided into four cost-centres:

- Buildings and consulting;
- Infrastructure design;
- Groningen Earthquakes – Structural Upgrading;
- And business services.

1.1.1 Organizational boundaries

Refer to Chapter 1 of the CO_2-Performance Ladder Portfolio 2017/18.

1.1.2 Operational boundaries

Arup b.v. is responsible for the carbon emission related to all activities and projects that fall under its direct **operational control.** Arup utilizes two facilities:

Facility location	Consolidation	Operational control
Amsterdam (permanent facility)	Equity share	Arup b.v. rents 2 floors. Energy and central heating suppliers not chosen by Arup b.v. Energy/ climate is controlled centrally for the whole building, not falling under control of Arup b.v. Furniture, lighting and all operational devices such as computers and printers are property of Arup b.v.
Groningen (temporary site office for P500)	Equity share	Energy and gas suppliers, furniture, lighting devices are not chosen by Arup b.v. Office specific devices such as computers and printers are a property of Arup b.v.

1.2 Conformity to ISO-14064-1

This report is written such as the minimal requirements of GHG-emissions reporting according to ISO 146064-1 are satisfied.

ISO- 14064-1	Report section/ Remark
Organization, responsibility	1.1
Reporting period, base year	1
Organisational boundaries	CO2-portfolio H1
Direct emissions in ton CO2	3.2
Indirect emissions	3.2
CO2 emission related to biomass	None
Direct GHG removals	None
Excluded GHG emissions	All scope 3 other than commuting and paper. Business travel with public transportation is considered part of scope 2.
Reference to base year data	Not applicable.
Quantification methods and explanation	2.2/2.3
Change in quantification method	Not applicable
Reference literature conversion factors	https://co2emissiefactoren.nl/lijst-emissiefactoren/
Description influence uncertainties in quantification on accuracy	2.4
Statement on accuracy level and verification on the inventory	It will be certified with a limited level of assurance by DNV. GL.

2 Method, Scope & Assumptions

2.1 CO_2-emissions scopes

The inventory reports its CO_2-emissions for direct and indirect emissions:

Direct emissions
Scope 1

Business travel by lease cars

Indirect emissions
Scope 2

Facility energy and heating consumption

Business travel (air, private car and public transportation)

Scope 3 (upstream)

Commuting

Paper use

2.2 Data Sources

The main sources of data used to calculate the CO_2 emissions are:

Aspect	Data	Source
Total surface facility [m2]	The office facility is part of a building managed by an external party. The surface occupied by Arup b.v. is based on the rent contract, plus a portion of the shared space.	Building owner
Number of employees	Full -time equivalent for direct employment contracts as well as under secondment conditions, both full- and part-time and free-lancers.	Human Resources
Scope 1		
Lease cars mileage total [km]	The fuel consumption is tracked through the lease company refuelling records.	Lease companies
Scope 2		
Facility heating [Gjoules]	Measurement devices are linked to each rented space unit.	Building Owner
Facility electricity [kWh]	Measurement devices are linked to each rented space unit.	Building Owner
Business air travel [km]	Flight distances are tracked for the categories <700 km, <2500 and >2500 km.	External travel agency
Business travel by private cars	Declared mileage for business trips. The fuel distribution is assumed to be 50/50 for petrol/diesel.	Finance
Business travel by public transport	Declared cost for business travel by public transport divided by an average cost/km to get the total amount of km.	Finance
Upstream Scope 3		
Commuting travel [km] %	Distribution of commuting distances based on mobility survey 2017. A conversion factor was used to upscale the distances based on the total amount of employees that commute to the office. Distribution of frequency of use of each transport mode for each distance-category /average.	Mobility survey (2017) Mobility survey (2014)
Paper consumed [kg]	Purchased paper	Paper supplier

2.3 Calculation methods

GHG emission	Quantification method
Facility energy consumption [kWn/Gj]	= Total measured energy (kWh/Gj) x % Arup floor space
Business air travel [km	= Total Mileage per category distance (≤700 km, > 2500 km, etc.)
Business travel by private cars [km]	= Total declared mileage x Average Conversion factor per fuel type
Business travel by public transport [km]	= Mileage / transport mode (TM) x conversion factor TM
Commuting [km]	= Estimated commuting distance per month x % transportation type x correction factor

The conversion factors are obtained from: https://co2emissiefactoren.nl/

2.4 Uncertainties

Aspect	Uncertainty/ influence
Number of employees	The number of employees is not the same as the number of FTE's.
Lease car	The data delivered by the lease company consists of fuel consumption per lease car. This will include fuel consumption made for private trips.
The heating / electricity data for Groningen office	Consumption is measured for the whole building; Arup consumption is derived from % rented office space. The measurements for the 2nd floor extension start from February 2018. There are no earlier measurements available.
Electricity Amsterdam office	Consumption is measured for the whole building; Arup consumption is derived from % rented office space.
Business air travel	Included are all flights booked through the our travel agency. This also includes staff that sit in our office but are part of the Europe Region. Any self booked flights that are declared through expenses or other means of flights booked are not included.
Commuting travel	Distribution of transport modes is partly based on a survey from 2014. The mobility survey from 2017 included only the distribution among bike, private car and public transport. Distances people have to travel also comes from the 2017 survey.

Most important possible improvements:

- Develop a more accurate measurement system for commuting. Based on the new mobility plan that will become effective on the 1st of January, all employees should use GPS tracking or register their business travel and commuting kilometres using the Reisbalans application on their mobile phone.
- Automation of the current measurements.

3 Carbon Footprint 2017/18

3.1 Distribution emissions

The distribution of emissions is shown in the figure below. The main sources are:

- Air travel (40%)
- Commuting (37%)
- Lease cars (11%)
- Private cars (5%)

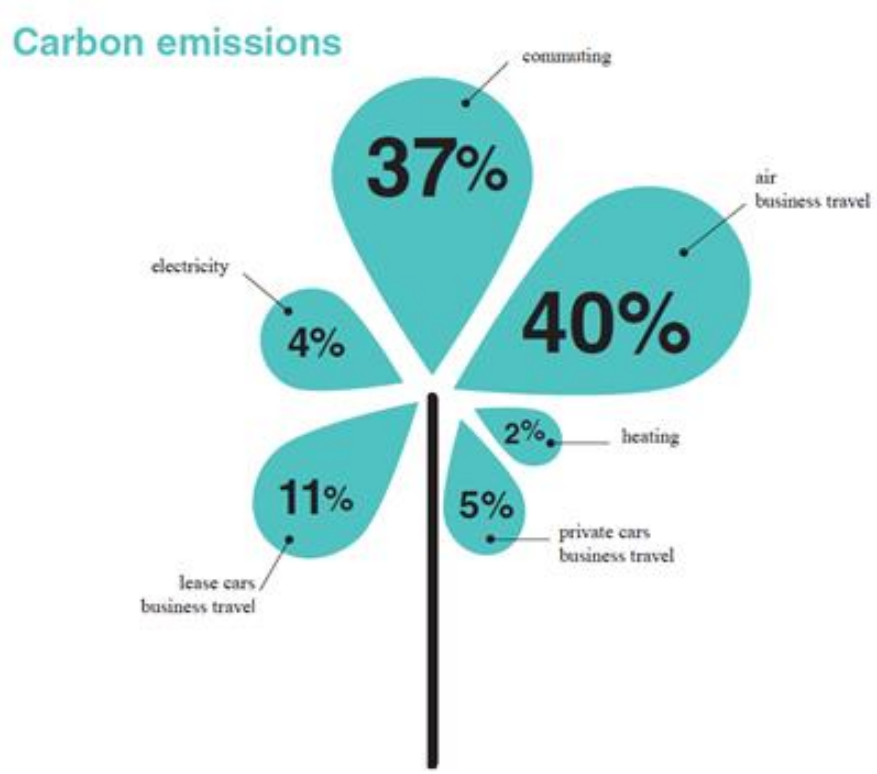

Figure 2 Distribution in scope 1+2+3 2017/18

3.2 Performance

The following table provides the quantified yearly emissions per category:

Scope / source GHG emissions		Emission [ton CO_2]
Scope 1	Business travel by lease cars	102
Scope 2	Business travel by private cars	42
	Business air travel	361
	Business travel by public transport	5
	Electricity	33
	Heating	20
Scope 3	Commuting	335
	Paper use	1
Total	**Scope 1, 2 and 3**	**889**

The trend in CO_2-emission performance is shown for the main emissions categories:

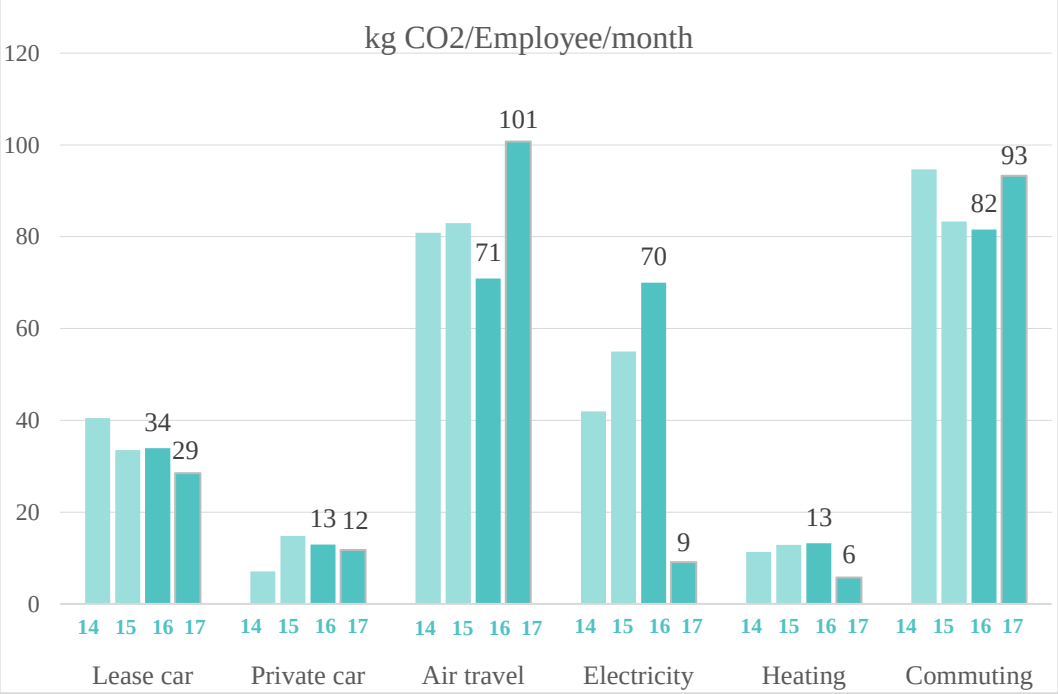

Figure 3 kgCO2 emissions for 2017/18 for the main emission categories

The emissions due to lease cars, private cars and heating have slightly decreased comparing to previous years. Emissions due to air travel have significantly increased (42%) comparing to 2016. The new target for 2020 is to decrease by 5% the CO2 emissions due to air travel, comparing to reference year 2017/18.

Electricity emissions have seen a significant decrease. The decrease is due to the shift to wind energy for electricity production that has zero carbon footprint in the Amsterdam office.

Based on the mobility survey from 2017 there was a change in modal split, with 44% of the staff commuting to work by car, comparing to 53% in 2014. That is a positive change, however since the amount of employees increased from 240 in 2014 to 300 in 2017 and the average travelling distance to work remained more or less the same (31 km), we can conclude that the carbon emissions slightly increased in 2017 (4%) in comparison to 2014. However, there is insecurity in these measurements which needs to be improved. An up to date, appropriate mobility survey or other automated system is necessary to gain more confidence in the results. The new target for 2020 is to decrease by 5% the CO2 emissions due to commuting by fossil fuel driven cars.

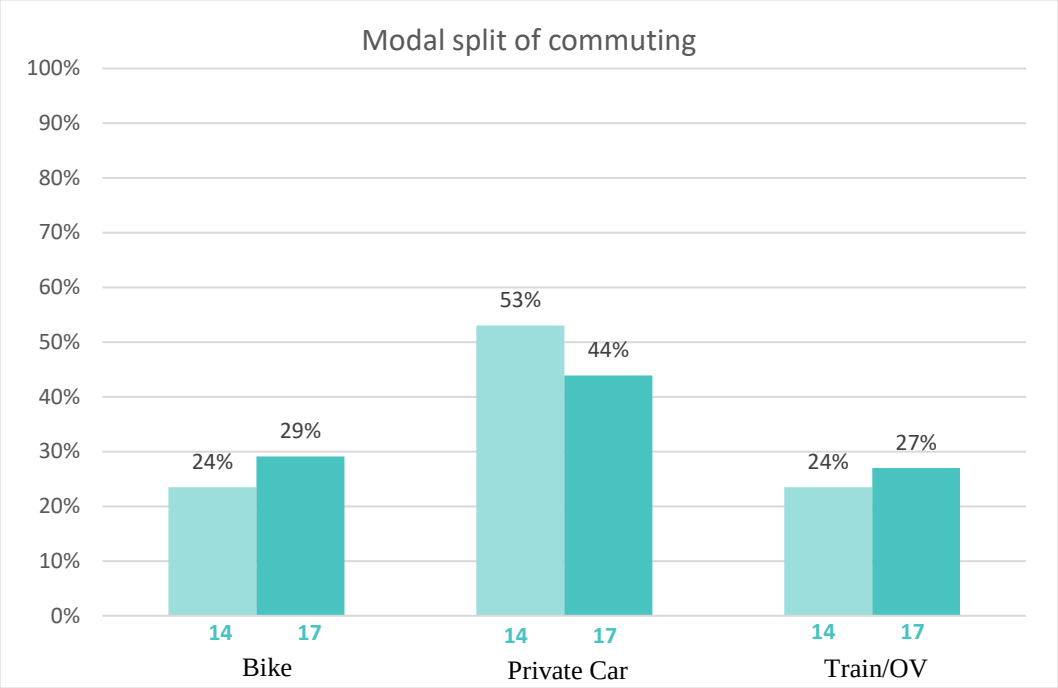

Figure 4 Modal split of commuting among employees based on mobility survey 2017

Scope performance

In 2014 goals were set for the period of 2014-2017 to reduce carbon with a total 8% for all scopes. For scope 1 + 2 the emissions increased with 4,6% in 2015 and with 6,0% in 2016 compared to 2014. Reasons include the internal moving in 2015. The carbon emissions decreased with 12,1% in 2017 compared to 2014, exceeding the initial target of 8%. The decrease is mainly due to the shift to wind energy for electricity production that has zero carbon footprint.

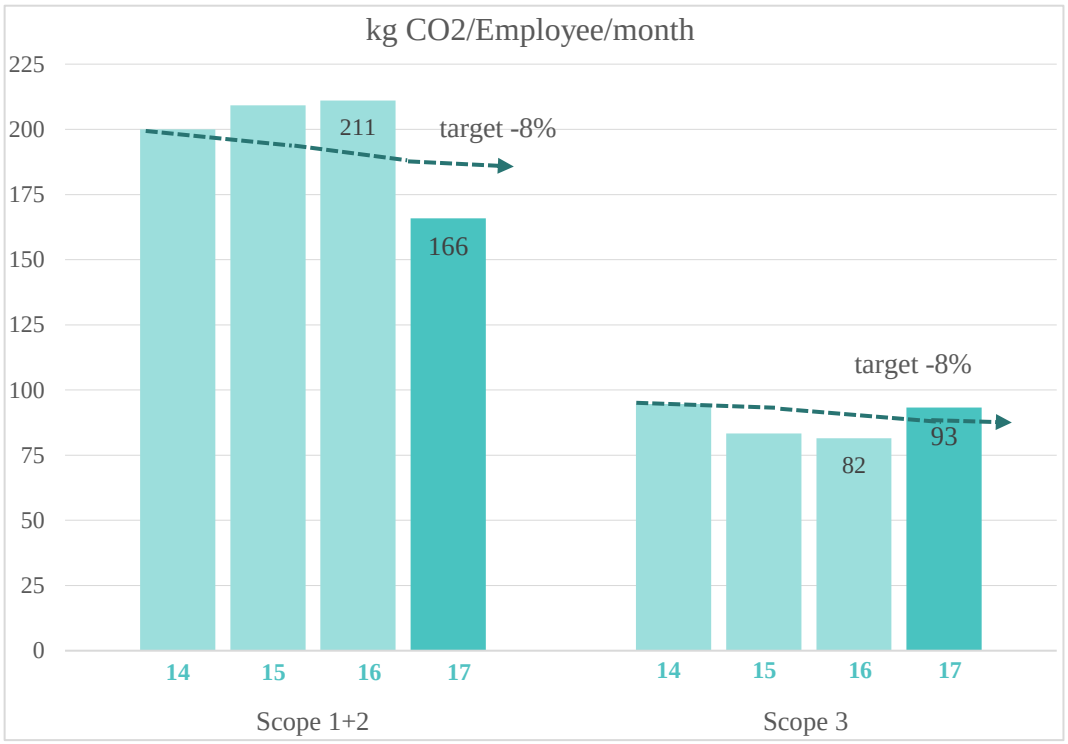

Figure 5 Reduction target of 8% for scope 1+2 and scope 3 vs. actual performance

Future performance

The global Arup CO2 target is 3.0 tonCO2/FTE/year for scope 1 and 2 in April 2019. This target is already meet, current value for scope 1 and 2 is around 2.2 tonCO2/FTE/year.

The new ambition for 2020 is;

- Reduce air travel emissions by 5% comparing to reference year 2017/18
- Reduce emissions by fossil fuelled car commuting by 5% comparing to reference year 2017/18

This would bring our scope 1, 2 and 3 emissions down to 2.99 ton/empl/yr.

Refer to the Energy Management plan for further details.

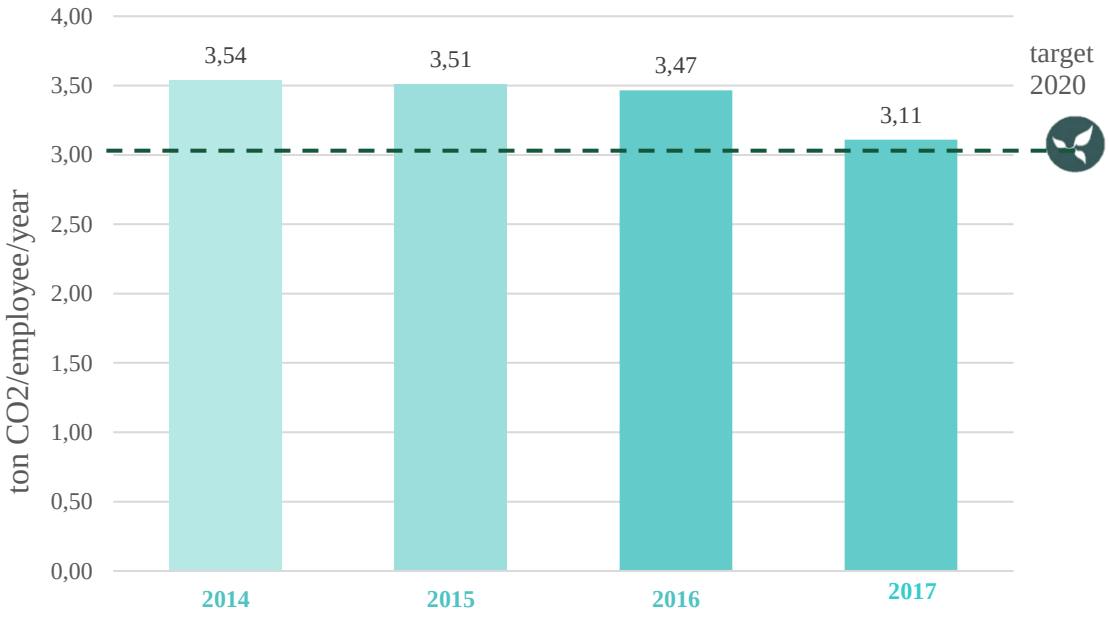

Figure 6 Total CO_2-emissions for scope 1+2+3

Scope 3 emissions, downstream

Arup

CO2-Performance Ladder

Downstream Scope 3 emissions

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ARUP

Inhoud

1 Introduction

This document describes an analysis of the most important emissions related our the design and consultancy projects. These emissions are classified as downstream scope 3. **Downstream scope 3 emissions:** emissions arising from the use of the project, service or delivery offered / sold by the organization. The objective of this analysis is to identify the opportunities for CO_2-reduction and serve as a basis for our reduction strategy.

The most important emissions are assessed for the two main design disciplines within Arup design and consultancy service, which are Buildings and Infrastructure.

2 Assessment buildings

Buildings are the greatest source of CO2 emissions in the Netherlands, accounting for almost 40% of the total emissions.

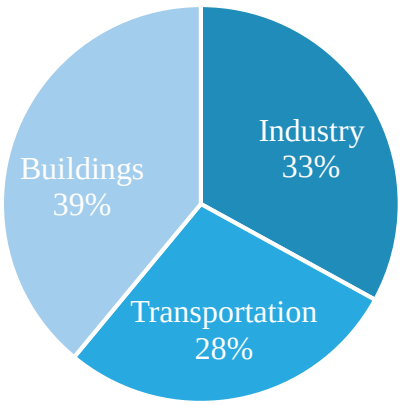


Figure 1: U.S. Department of Energy (DOE), 2008 Buildings Energy Data Book, Section 1.1.1, 2008.

2.1 Services

The activities of the Arup Buildings department in Amsterdam consist of engineering consultancy in the areas:

- Sustainability consulting
- Façade design
- Installation, mechanical
- Fire engineering
- Structural engineering and structural upgrading

- Lighting
- Acoustics

2.2 Identification of chain partners

The partners in the building chain are:

- Clients. Example: Rijksvastgoed bedrijf, Volker Wessels, Municipality of Tilburg, G&S Vastgoed
- Municipalities
- Architects. Example: OMA, IAA, Paul de Ruiter
- Contractors. Example: Volker Wessels, BAM, Heijmans
- Manufacturers
- End users of buildings
- Building Certification Schemes operators. (LEED, BREEAM, etc.)

2.3 Footprint data of partners

Rijksgebouwendienst

2014 data;
Total RGD carbon footprint in-use = 0,2Mton/yr

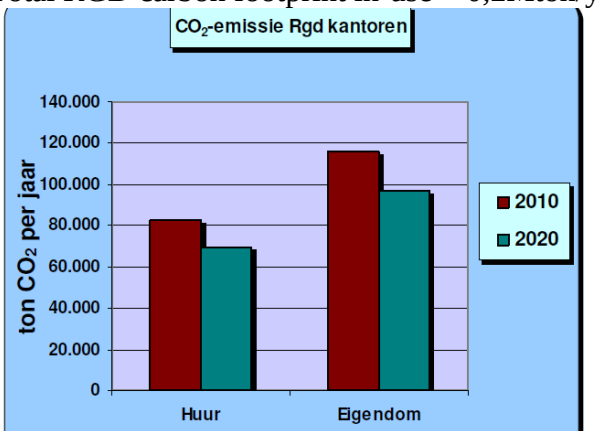


Figure 2 Footprint RGD

2.4 Footprint distribution of buildings

Over the life-time of a building, most CO_2-emissions (>80%) are produced when the building is in use. A significant proportion of 17% is embedded into the construction phase.

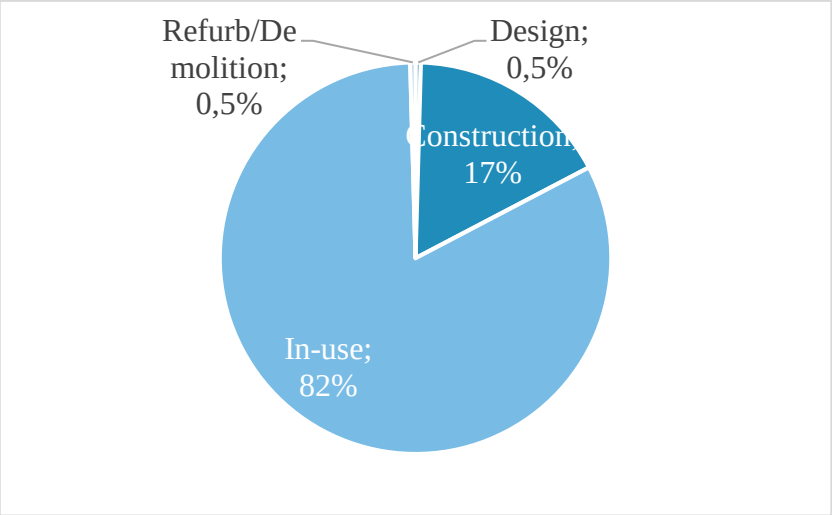
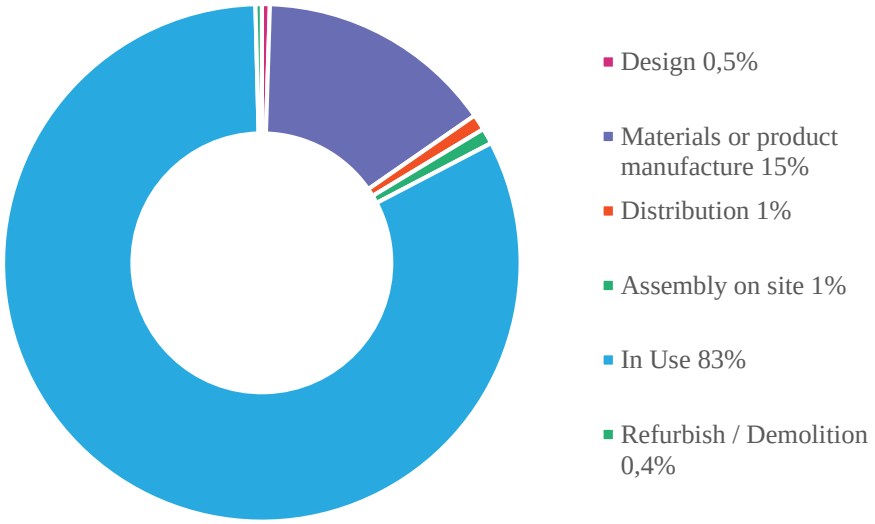


Figure 3 Energy use during life cycle of a building (Source: Deparment business innovation & skills[1])



[1] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/31737/10-1316-estimating-co2-emissions-supporting-low-carbon-igt-report.pdf

During construction phase

The CO2 emitted in the construction stage is subdivided into three categories. Of these categories, the actual manufacture accounts for the greatest emissions, and it is most directly influenced by Arup design. Concrete, stone and metal products are the greatest carbon producers.

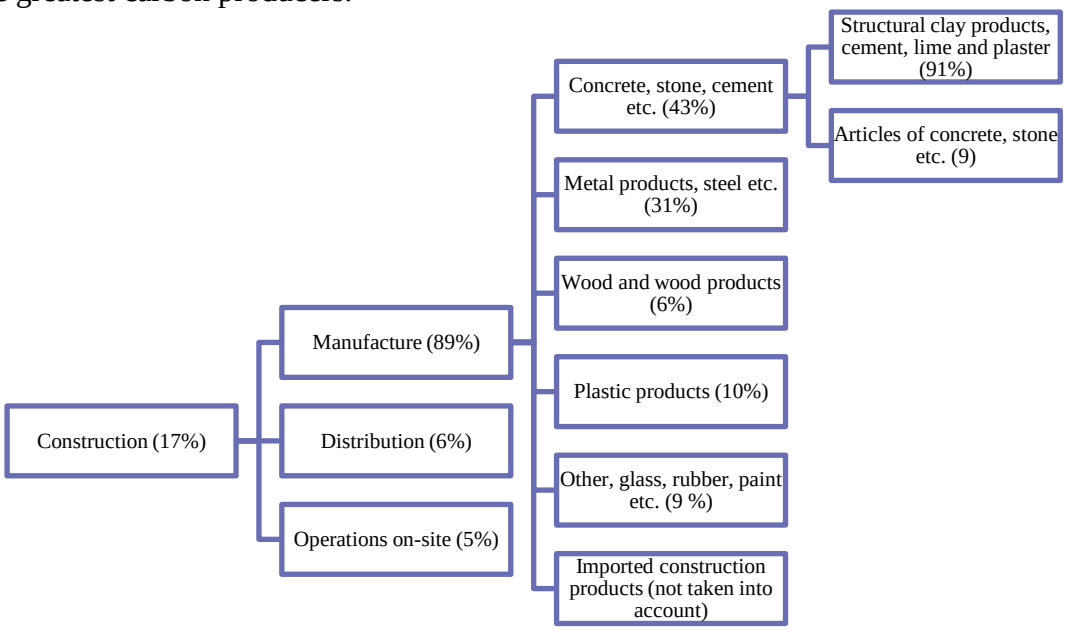


Figure 1: Relative emissions as a result of building construction, based on BIS data (2009)

During use of building

The main possibilities for reduction within the design lie in energy for heating, cooling and lighting.

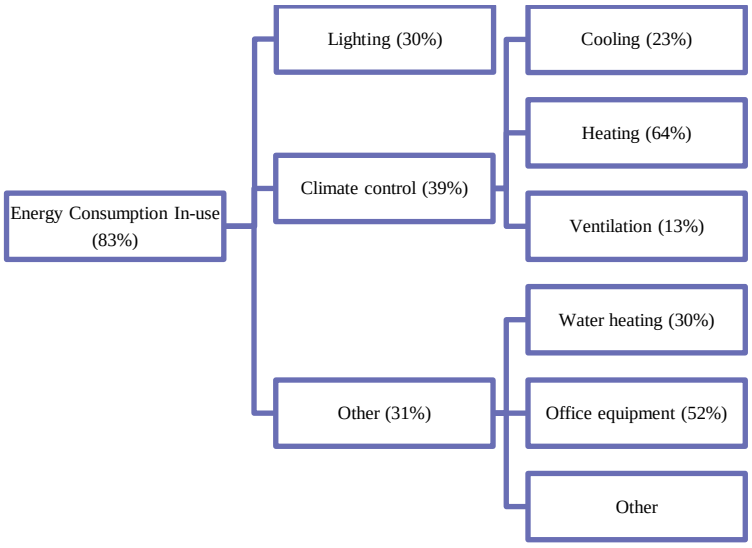


Figure 2: Relative energy consumption office building, based on bouwen met staal (2015)

3 Assessment infrastructure & transport

Transport is responsible for a quarter of EU greenhouse gas emissions, making it the biggest greenhouse gas emitting sector after energy [1].

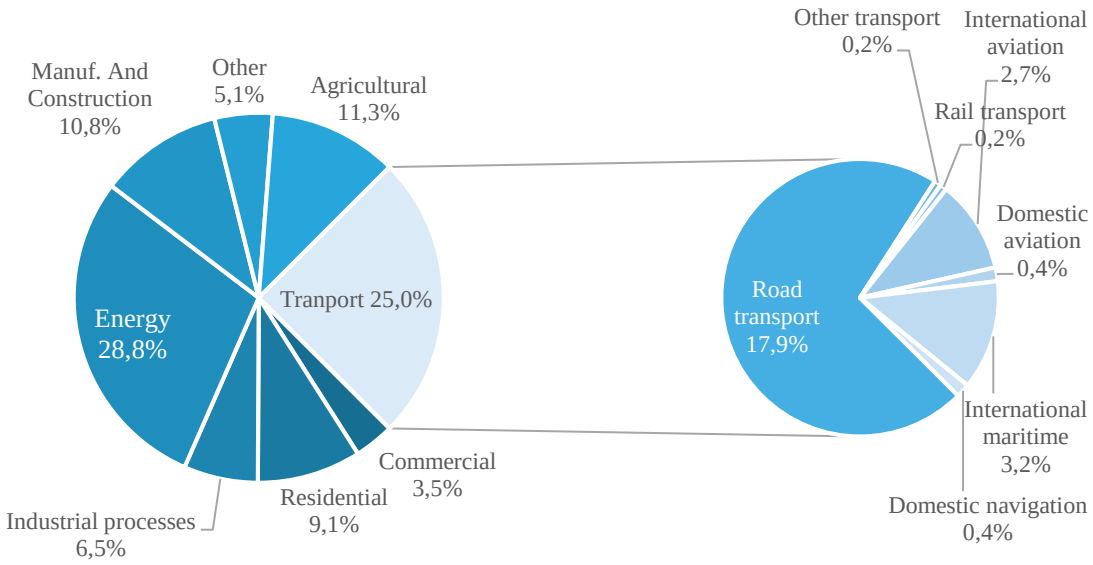


Figure 4 EU27 greenhouse gas emissions by sector and mode of transport, 2009 [1]

3.1 Services

The following are standard **transport planning** services of Arup in the Netherlands:

- Strategic modelling (static);
- Traffic modelling / assessment (static & dynamic);
- Road design (including extensive cycling infrastructure);
- Municipal and provincial transport plans.

Main activities of the **infrastructure** department include:

- Highways
- Urban infrastructure (pedestrian and cyclist bridge)
- Structural assessment of bridges
- Renovation of steel bridges

The infrastructure services are concentrated around large scale bridge renovations.

Figure 6 presents the chain activities of Arup in relation to road transport CO_2 emissions. The colored boxes indicate the fields/activities where Arup has the most influence.

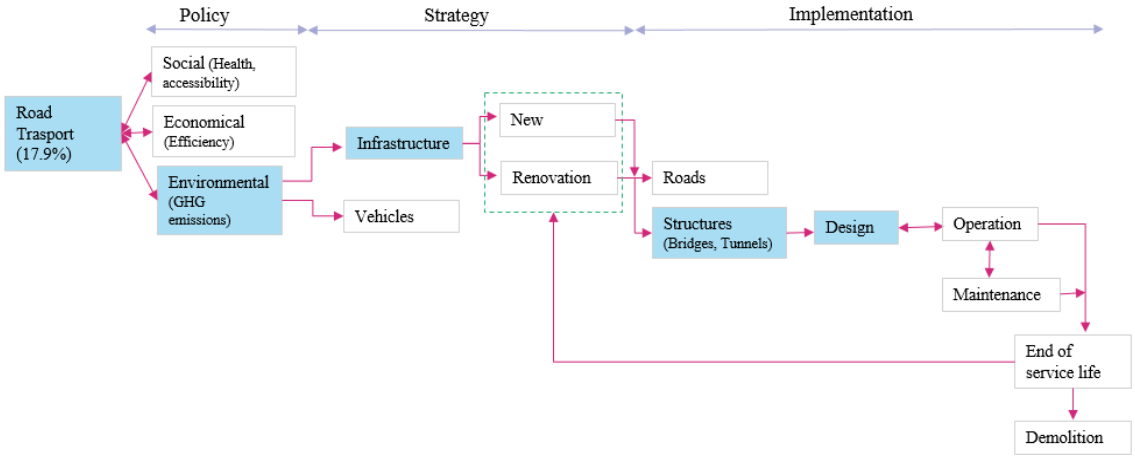


Figure 5 Chain analysis of infrastructure in relation to road transport emissions

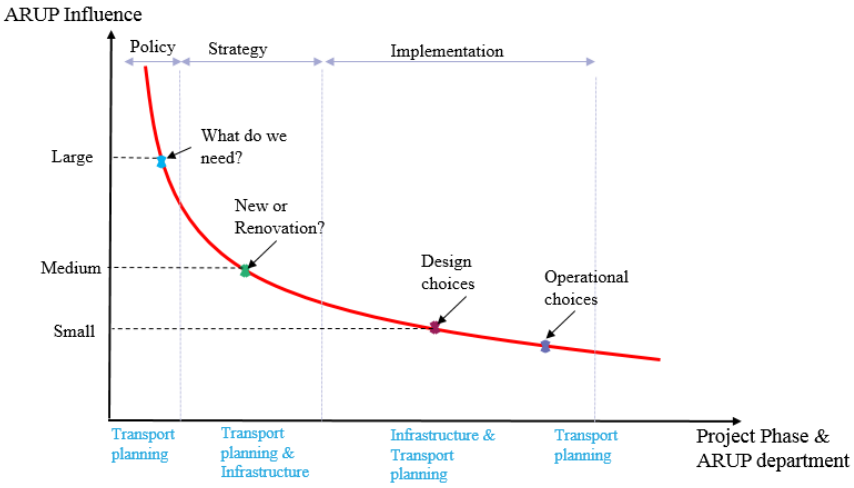


Figure 6 Arup's influence per project phase and activity

3.2 Identification of chain partners.

In order to investigate the CO2-footprint of our chain partners, first the most important partners are identified:

- National governmental bodies (Rijkswaterstaat)
- Prorail (partner)
- Municipalities / Waterschappen
- Project developers
- Architects / designers
- Contractors
- Suppliers

3.3 Footprint data of partners

We have identified the emission data of our most relevant partners and suppliers.

Rijkswaterstaat

According to 'Duurzaamheidsrapportage Rijkswaterstaat 2015' [5] the following footprint data is available;

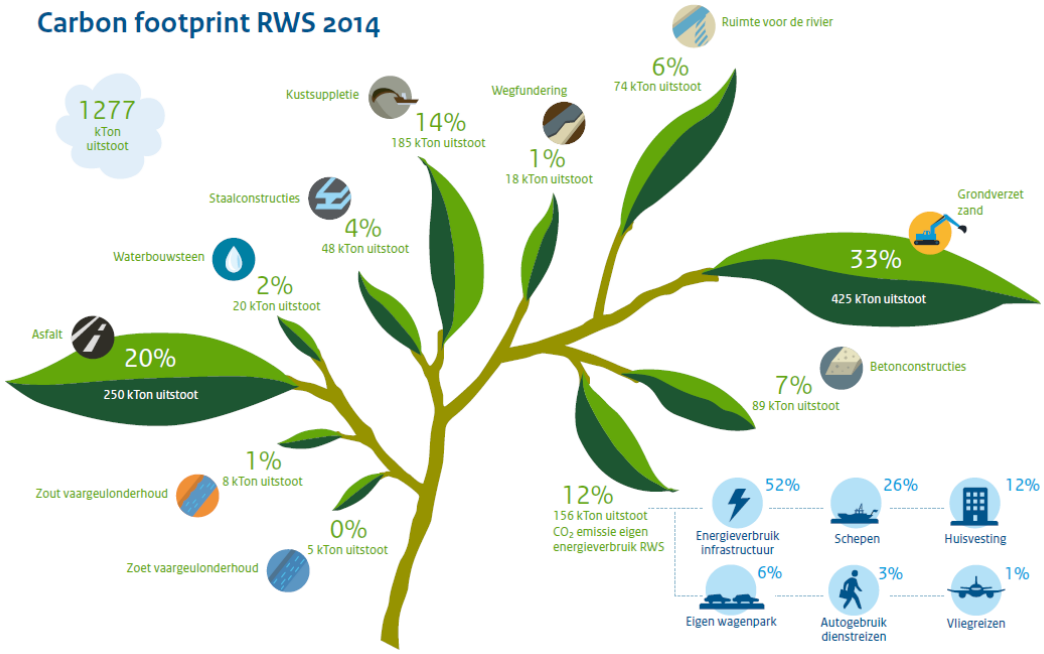
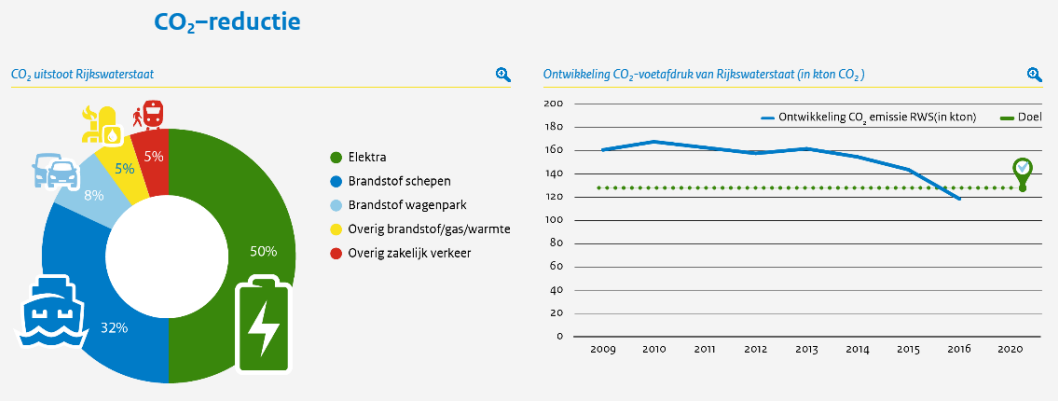
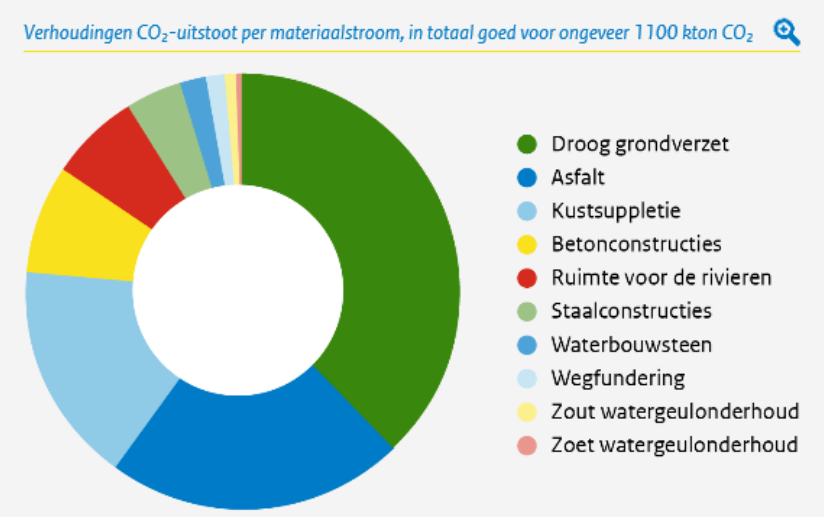


Figure 7 RWS footprint 2014





Figuur 3 Uitstoot RWS 2016 (bron; https://www.ienmduurzaamheidsverslag.nl/rws.html)

Prorail

According to https://www.prorail.nl/sites/default/files/co2-emissie_inventaris_2017-def.pdf the following footprint data is available;

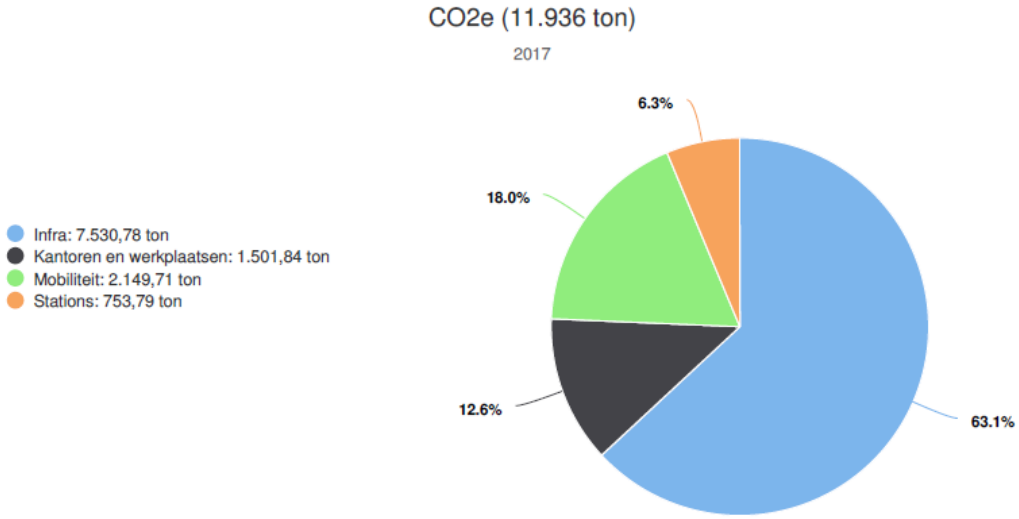
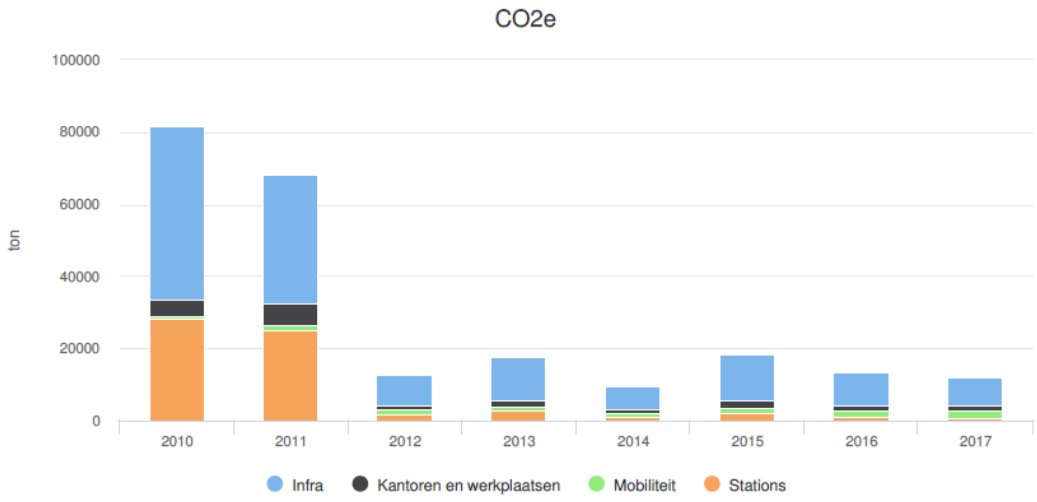


Figure 8 ProRail footprint 2017



Figuur 4 Footprint ProRail over the years

Supply Chain analysis

Arup Netherlands

CO2 Performance ladder

Value-chain analysis for two types of bridges

4.A.1 and 5.A.1, 5.A.2-1, 5.A.2-2

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Job number

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ARUP

Contents

1 Introduction

At Arup we strongly feel our responsibility to contribute to the transition towards a more sustainable future. We have adopted the CO_2 -performance ladder as a tool to map and reduce our CO_2-emissions. As Arup, we can have a positive influence on the CO_2 reduction of projects in the built environment through our design and consulting practice.

As part of level 5 of the CO_2 performance ladder, the requirement is to gain insight into downstream scope 3 emissions by executing two chain analyses. The chain analysis work is performed by our graduate intern Mark Gerritsen [1].

The main areas of influence for Arup b.v. are in buildings and infrastructure sectors. For this assessment, the environmental impacts are evaluated of two alternative bridge designs, executed in the most frequently used infrastructure construction materials: steel and concrete. The new bridge will replace an existing bridge to ensure the canal is accessible for Class Va and four-liner container ships. The bridge design has a total span of 193 meters.

The steel arch bridge proposal represents an architectural design, whereas the concrete bridge represents a more practical bridge span. The effects are calculated using the computing program DuboCalc [1], which uses data from the National Environmental database.

Objectives

The objectives of the chain analyses are:

- Determine the main CO2 emissions during the whole life cycle of a project;
- Identify the main areas of influence where carbon reduction can be achieved;

In this way, the analysis delivers input into the search for more sustainable design methods. The intention is not to compare the two construction materials concrete and steel, as the character of the bridge designs varies significantly. The steel bridge design has inefficiency in material use, due to the architectural ambition to extend the arch below the bridge deck.

Steel arch bridge

Concrete girder bridge

Figure 1: Alternative designs for the Zuidhorn railbridge ©ProRail & Arup.

[1] https://www.milieudatabase.nl/imgcms/Functionele_Specificatie_Dubocalc_rev_13.pdf

2 Scope of analysis

2.1 Scope bridge geometry

For the chain analysis the main construction elements are taken into account:

Steel bridge design	Concrete bridge design
Substructure	Substructure
Foundation piles Support points	Foundation piles Support points
Superstructure	Superstructure
Arch Longitudinal girder Cross-member girder Columns Transition plate Mounting plate Bridge deck Train rails Coating	Longitudinal girders Cross-member girders Tube Pillar Transition plate Mounting plate Bridge deck Train rails

2.2 Life cycle phases

A life cycle analysis is a method to determine the environmental impacts of a product's lifespan. The following life cycle phases are identified for our projects:

1. Design phase
2. Winning- and production phase
3. Transport phase
4. Building Phase
5. Maintenance and use phase
6. Demolition and processing phase

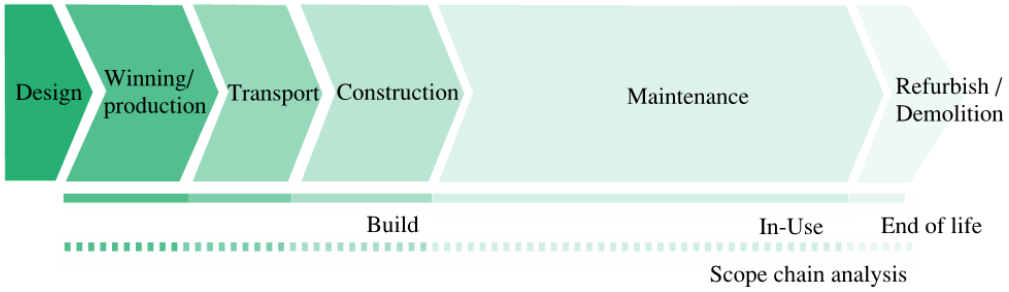


Figure 2 Main life cycle phases of a construction

In the chain analyses the emissions are assessed from the winning of materials up to demolition.

1. **Design**

The construction of a building or bridge is initiated by a client, after which a design is made by engineers. The activities of Arup lie mostly in this phase, ranging from feasibility studies to detailed designs. CO_2-emissions arise by:

- Energy use and transport by architects/planners/engineers
- Indirectly through design, which defines the amount and type of building materials, the construction activities and influences in-use emissions.

Via the design phase the engineer has indirect impact on emissions produced in subsequent phases.

2. **Winning- and production phase**
    - Winning of the raw materials
    - Processing and production of construction materials
3. **Transportation phase**
    - Transport of building materials and people from production- towards construction site. CO_2-emission is due to fuel use of vehicles.
4. **Construction**
    - On-site operations for assembly of the structure
5. **Maintenance and usage phase**
    - The bridge has no in-use energy consumption. The emissions by the traffic on the bridge are not taken into account.
    - Maintenance and repair of the bridge
6. **Refurbishment / demolition**
    - Emissions arising from refurbishment.
    - Indirect and direct emissions from demolition and waste removal and processing.

2.3 Partners in the chain

To achieve CO2-reduction in the chain of our projects it is important to have insight in the partners in our chain. The most important partners are:

- The client
- The architect
- The designer/ engineer
- Industry / Producer / Supplier building materials

- Transport companies
- Contractor / engineering in building phase, maintenance phase and demolition
- Manager use- and maintenance phase

3 Approach & database

In order to define the CO_2-emissions of the two alternative bridge designs, we have used calculation software and databases on material- and energy use in the construction sector.

Calculation method

The software program used for the chain analysis assessment is Dubocalc. The program is developed by Rijkswaterstaat to perform life-cycle analyses of projects in the GWW (soil, roads and hydraulic engineering). Dubocalc calculates the embodied energy for the whole life-cycle of the structure [2]. Material amounts are entered manually into the project documentation of the program.

Tally is a Revit-plugin which automatically extracts the material amounts from the Revit model. The tool is based on de GaBi database, which is developed in America. It is questioned how applicable their database is to the Dutch building industry, but it could provide a handy tool during design process as it is linked to the Revit Model. Tally calculations are not documented in this report.

Data collection

Data is preferably gained from primary sources, but as an engineering firm Arup does not have full control and information on all the steps in the chain. The determination of material consumption is deducted from the designs made by Arup. The other aspects concerning construction equipment, transportation and maintenance are deducted from comparable references in environmental databases.

- The Revit models of the (VO) bridge designs are used to extract the amount of materials used for the design of the bridges.

The DuboCalc library makes use of the National Environmental Database [3] and stores the following information:

- Environmental impacts and units
- Materials and processes
- Items containing materials and processes
- The calculation model, calculation the total MKI
- Material types
- The waste scenario’s per material type.

The CO_2 conversion factors are deducted from:

https://co2emissiefactoren.nl/

MKI-value

DuboCalc calculates the environmental impact as an MKI value. The MKI-value is a fictional amount of money that would be needed to prevent or compensate the environmental impact.

The tool distinguishes 11 environmental impact categories:

Environmental impact	Equivalent unit	Weighing factor (€/kg equivalent)
Exhaustion of abiotic raw materials	Sb eq	€ 0,16
Depletion of fossil energy carriers	Sb eq	€ 0,16
Climate change	CO_2 eq	€ 0,05
Degradation of the ozone layer	CFK-11 eq	€ 30
Photochemical oxidant formation (smog)	C_2H_4 eq	€ 2
Acidification	SO_2 eq	€ 4
Eutrophication	PO	€ 9
Human toxicological effects	1,4-DCB eq	€ 0,09
Ecotoxicological effects, aquatic (freshwater)	1,4-DCB eq	€ 0,03
Ecotoxicological effects, aquatic (saltwater)	1,4-DCB eq	€ 0,0001
Ecotoxicological effects, terrestrial	1,4-DCB eq	€ 0,06

Table 1: Environmental impact and weighing factors used by DuboCalc. [4]

Assumptions

- The life-cycle analysis is performed according to standards ISO 14040 and ISO 14044.
- A lifecycle is assumed of 100 years
- Within this lifecycle the phases construction, maintenance and demolition are taken into account.
- For the choice of building components the most comparable elements are chosen in the databases.
- The distance for the transport activities is assumed at 20/50 km.

4 Analysis environmental impacts

4.1 Steel bridge design

The structural design under consideration is the tender design by Arup for the new Zuidhorn railbridge, which has not been built. The steel design contains a double arch with a hanging deck. The span of the arch is 160 m. The total height is 38 m. The bridge is a single-track railway bridge.

The deck consists of two longitudinal beams with cross members in between. Both beam types are executed as steel hollow section profiles. The longitudinal beams have a maximum height of 3m. The cross members are spaced 2,5 m apart and taper from 300 mm in height to 85 mm. The deck is made of concrete, with a built-in train track.

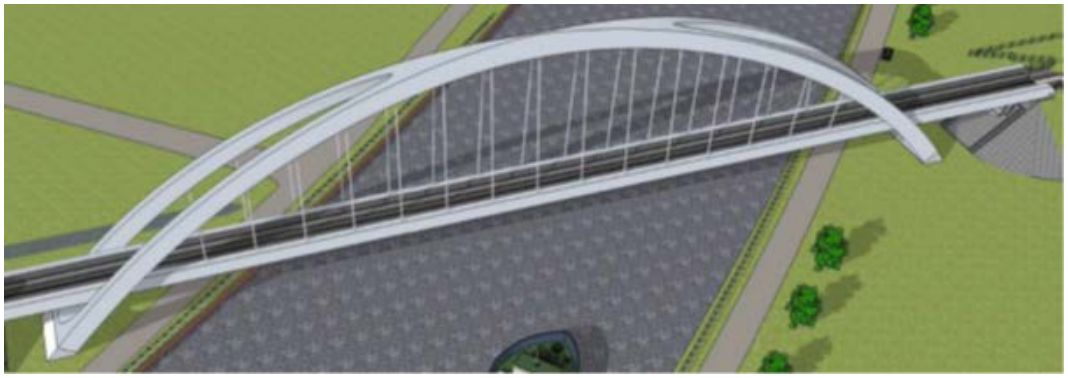


Figure 3: New steel design for the Zuidhorn railbridge. ©ProRail.

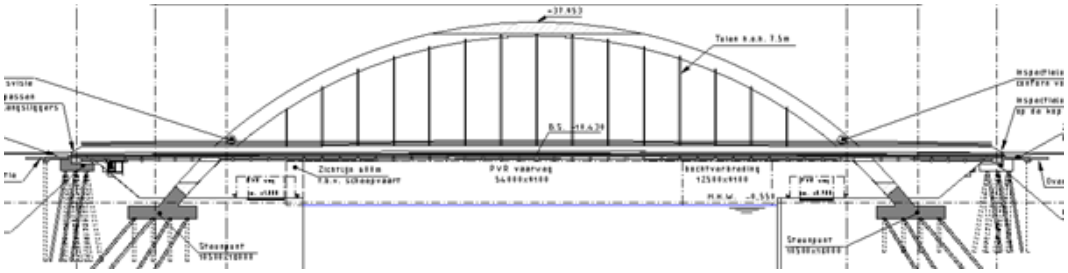


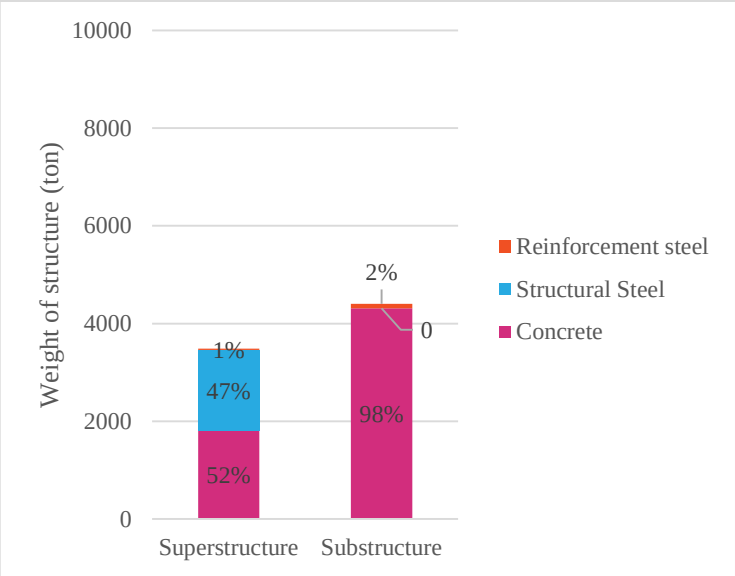
Figure 4: Section of the steel design for the Zuidhorn railbridge. ©ProRail.

4.1.1 Material distribution

The steel super structure is relatively light, with a total weight of 7887 ton. Due to the architectural ambition to extend the arch below the bridge deck, a heavy foundation is necessary to withstand the reaction forces in the foundation.

Structural part	Weight (ton)	Percentage
Super structure total	3485	44%
Substructure total	4402	56%
Total Structure	**7887**	

The arch bridge mass consists of 22% steel and 78% concrete.



4.1.2 Results DuboCalc calculation

The CO_2 contributions are calculated per life-phase of the bridge construction.

Construction phase	Total MKI-value (€)	CO_2 MKI-value (€)	Percentage
Build	147457	94959	85%
Maintenance	1360	596	1%
End of life	52350	16310	15%
Total	**201167**	**111865**	

The building phase represents the largest part of emissions for the steel bridge design. The contribution of the end-of-life phase is only 15%. For one, the steel material is easier to remove from building site than concrete (1 ton steel per hour vs. 1,5 ton concrete). And Secondly, the steel structure can be largely recycled into high-end steel.

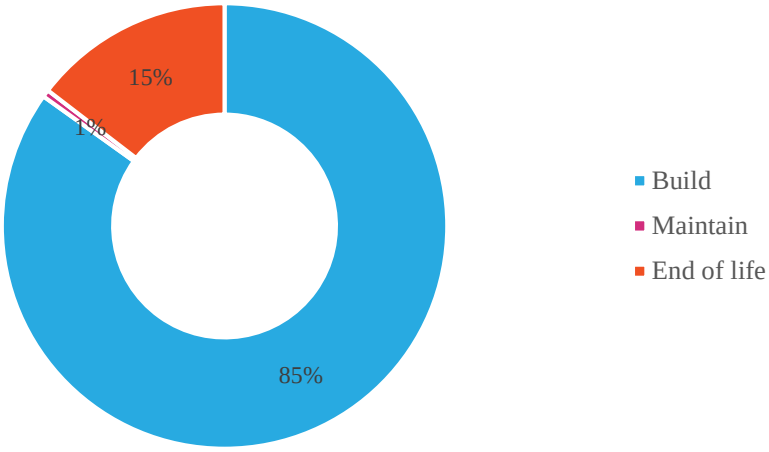


Figure 5 CO_2 MKI-value per life phase of the bridge

The following bridge elements have the most influence on the CO_2-emissions:

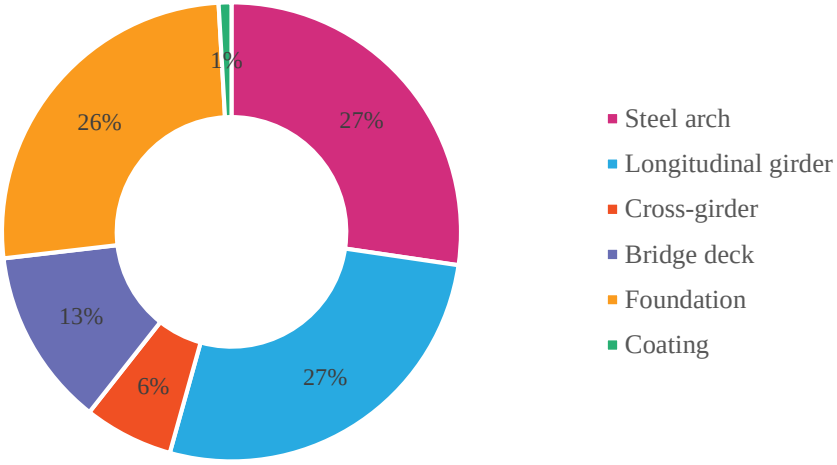


Figure 6 MKI-value contribution per structural component of the bridge

4.1.3 Optimization

The arch structure and longitudinal beams form the main cause of emissions. The embodied energy can be reduced by choosing to apply recycled steel for the arch structure and longitudinal beams. The embodied energy is then related to the amount of recycled steel used and the processes required for the sections (profile, tube or plate). An architectural feature (the extension of the arch below the bridgedeck) causes extra material use. The engineer could emphasize this issue towards the client and propose an elegant alternative.

4.2 Concrete bridge design

The concrete bridge is specifically designed for this chain analysis. The design is located at the same location and has the same span as the steel arch bridge. The bridge consists of 3 spans, of which the main span accounts for a distance of 112 m. The longitudinal beams are pre-stressed concrete with a height of 5m. The cross members are solid concrete, with a height of 1m and a spacing of 2,5m. The deck is made of concrete, with a built-in train track.

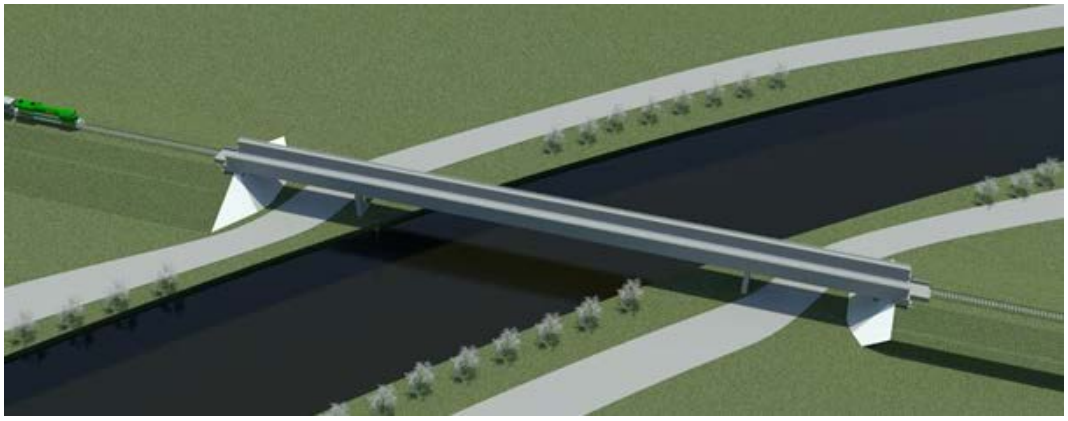


Figure 7 Alternative design for the Zuidhorn railbridge (Source: Arup)

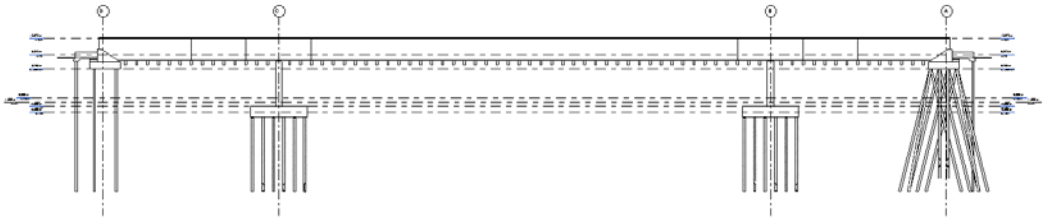


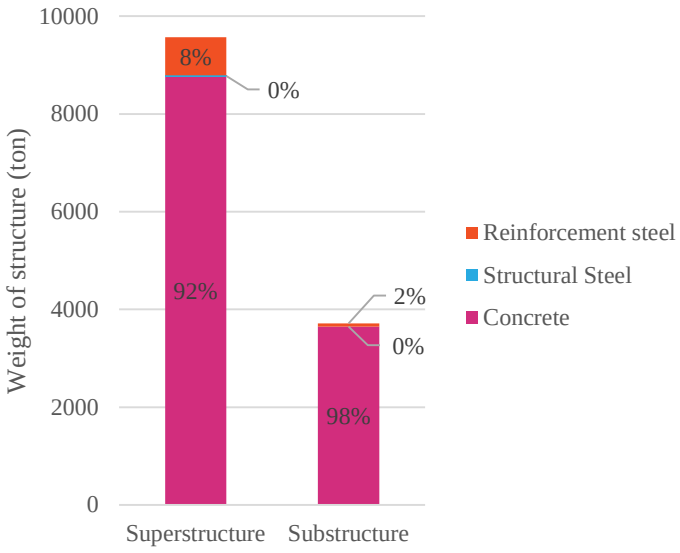
Figure 8 Section of the steel design for the Zuidhorn railbridge. ©ProRail.

4.2.1 Material distribution

The concrete bridge design weighs 70% more than the steel bridge design with a total of 13290 ton.

Structural part	Weight (ton)	Percentage
Super structure total	9573	72%
Substructure total	3717	28%
Total Structure	**13290**	

The material distribution is 93% of concrete and 7% of steel (including reinforcement steel.



4.2.2 Results DuboCalc calculation

The end-of-life phase represents almost half of the total emissions associated to the bridge. Reasons are that concrete takes more effort to remove from site (1 ton steel per hour vs. 1,5 ton concrete) and concrete can only be recycled to a low-grade aggregate.

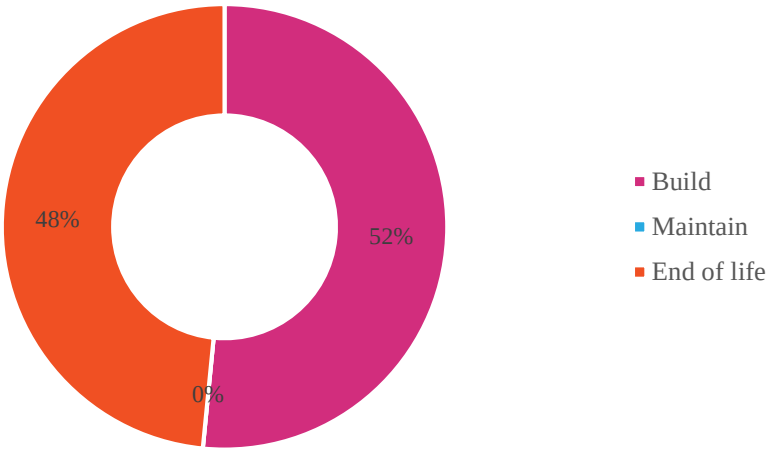


Figure 9 CO_2 MKI-value per life phase of the bridge

The following bridge elements have the most influence on the CO_2-emissions:

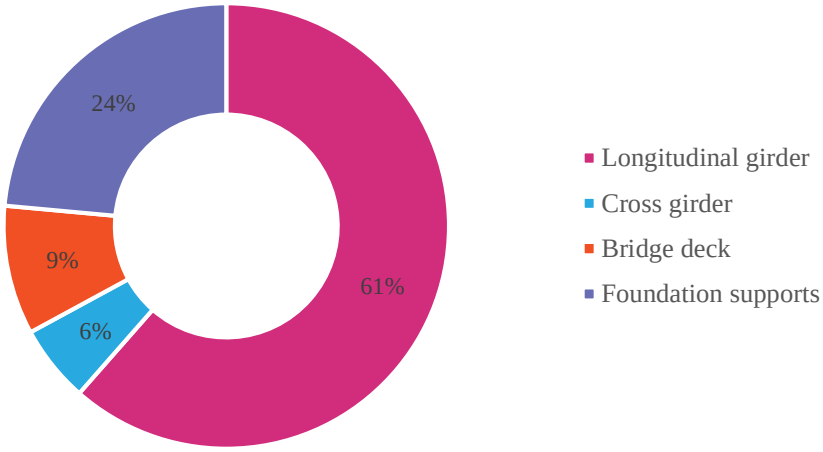


Figure 10 MKI-value contribution per structural component of the bridge

4.2.3 Optimization

The pre-stressed concrete longitudinal beams form the main cause of emissions. Consists largely of cement, additives (sand and gravel) and water. Possible optimisation strategies include [5]:

- The embodied energy increases for higher strength concrete. It is therefore advised not to pick higher concrete grades then necessary.
- The highest embodied energy lies in cement. Replace the usual Portland cement by types CEM III which contain either:
- Addition of blast furnace slag to concrete aggregate
- Addition of fly ash to concrete aggregate (min 25%, max 50%)

A comparison shows how the addition of the percentage fly ash can provide a reduction of 16% in emissions.

Environmental impact [tonCO2eq]	25% fly ash	50% fly ash	Reduction
Global warming	3821	3222	-16%

Table 2: Results optimization concrete design 25% and 50% fly ash.

5 Potential reduction strategies

The results of the DuboCalc chain analysis show that both for the steel arch bridge, as for the concrete girder bridge the winning- and production of materials and the demolition phase are governing in CO_2-contribution. For the steel bridge the contribution of the winning- and production phase of the material is almost 85% and only 15% to demolition, whereas for the concrete bridge 50% of emission contribution is associated to the demolition phase.

The concrete bridge has a lower demand for maintenance then the steel bridge, although the share of maintenance appears low (≥1%) for bridges compared to the total embodied carbon over the whole life cycle.

The main possibilities for reducing CO_2 emissions are therefore found in:

- Reduction of CO_2-emissions during materials or product manufacturing
  - Re-use and recycling of temporary building materials
  - Re-use and recycling of the demolished structure
- Material efficient structures
  - Using efficient building materials
  - Mixing the material with low-energy aggregates
  - Optimizing the structural design to decrease material use

An important part in the last exercise is to collaborate and advice the client and architect on material-efficient design solutions.

References

[1] M. Gerritsen, (2016) Thesis: environmental impact study on building materials for bridge engineers. Arup

[2] DuboCalc. (2015). DuboCalc Project 4.0 StartersHandleiding. Geraadpleegd van http://www.dubocalc.nl/media/1060/starters-handleiding-dubocalc-project-40.pdf

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Appendix B

Reduction

Energy management plan

Arup

CO2 Performance Ladder

Energy Management Plan 2018-2020

Issue | 11 december 2018

Opdracht nummer n.v.t.

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ARUP

Inhoud

1 Introduction

At Arup we strongly feel the responsibility to contribute to a transition towards a more sustainable future. We have adopted the CO_2 -performance ladder as a tool to map and reduce our CO_2-emissions. The Energy Management Plan outlines our company's aims and strategies to reduce CO_2-emissions. Reduction targets and measures are set-up for emissions of scopes 1, 2 and 3 on the basis of the insight gained through the documents: GHG-inventory report, analysis of downstream scope 3 emissions and the chain analysis. The plan is for a 3 year period, starting in 2018 up to end of 2020 and builds on the previous plan from 2014 - 2017. The plan is written according to the ISO 50001 standard, as to comply to the CO_2-ladder certification.

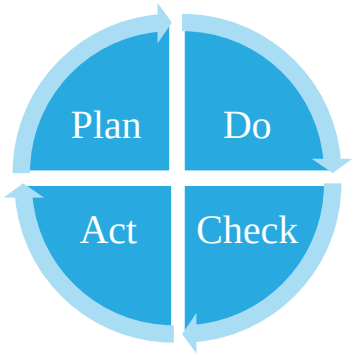
The energy management planning is intended to be a process of continuous improvement, on the basis of a Plan, Do, Check and Act system:

Plan: Set energy management targets and measures

Do: Implement the CO_2 strategy.

Check: Measure and monitor performance

Act: Analyse the variances, recommend improvements



1.1 Organizational boundaries

Refer to Chapter 1 of the CO_2-Performance Ladder Portfolio.

1.2 Responsibilities

The energy management team and organizational framework is introduced in the tables below. The team is also responsible for the yearly document maintenance.

Role	Name	Tasks
Sustainable Development Director (SDD)	Sander den Blanken	Sets priorities and goals for the next 3 years Reviews governance policies Discusses with management team for approval of plans and implementation policies Audits if new projects meet the goals set by European board Yearly evaluates the goals Reports to Group Leader
Sustainable Development Manager (SDM)	Edwin Thie, supported by Margarita Tsavdaroglou and Enny Breure	Researches future scenarios Coordinates if goals meet CO2-prestatieladder Manages implementation of plans Checks governance with sustainability objectives Measures and monitors the effect of plans Analyses measurements Assists PM's of projects won with CO2-prestatieladder Reports to SDD

The responsible collaborators for project specific targets are:

Role	Name	
Project Director (PD)	-	Includes EC review the sustainability objectives Monitors progress on the sustainability objectives
Project Manager (PM)	-	Implementation sustainability objectives projects Measures and monitors CO2-footprint on project Measures and monitors the project objectives Analyses non-conformances and advises PD Update of sector- initiatives relevant for project

Additional collaborators within the office are:

Role	Name	Tasks
Quality control	Linda Joossen	Organisation audits (temporary replacement Hilde Millekamp)
Human Resources	Tamara Gieze	Mobility plan
Marketing / Com.	Pien Niehe	Communication strategy
Facility manager	Leonie de Jong	Facility management
Finance	Mathijs Lammertse	Input for Environmental reporting

2 Reduction plan own organization

In this section, the reduction strategy is outlined for emission categories associated to the operational activities of our own organization (scope 1 + scope 2 + upstream scope 3). The main areas of influence are defined in GHG-inventory report.

2.1 Evaluation reduction targets

The most impactful reduction measure of the certification period 2015-2017 has been the transition towards a green energy supplier (100% wind energy) for the Arup Amsterdam office in April 2017. Overall a reduction of 10,3% in carbon emissions was achieved in 2017 (Figure 1).

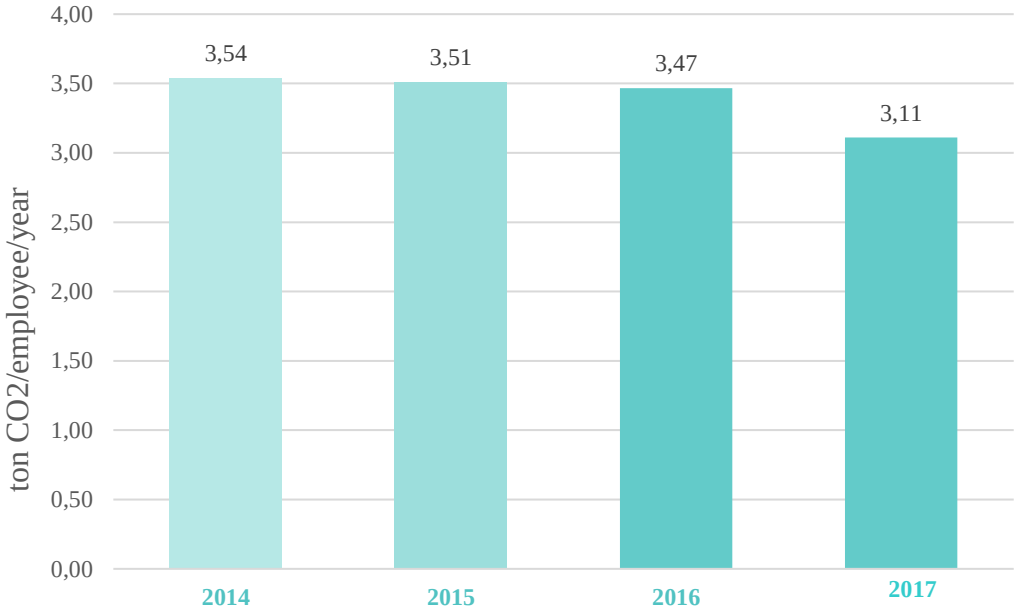


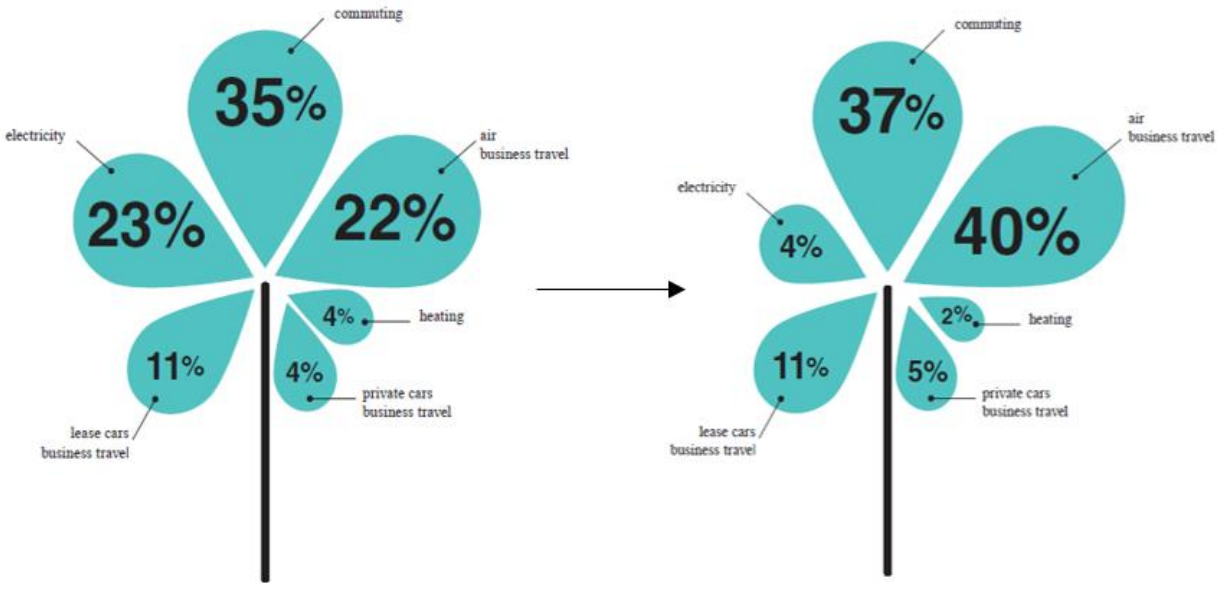
Figure 1 Total **CO_2e**/employee/year

2.2 Reduction strategy

The focus of our reduction strategy for the period 2018-2020 will be to reduce the impact of 2 main emission drivers:

- air travel;
- commuting by fossel fuel driven cars.

The transport-related emissions have an increased share of our total CO_2 footprint since the transition towards wind energy for the Arup Amsterdam office (refer to 2016/17 vs. 2017/18 CO2 distribution in Figure 2).



2016/17 2017/18

Figure 2 Distribution of CO2 in 2016/17 vs. in 2017/18

In 2017/2018 the main focus for direct emissions reduction is air travel. In order to reduce the commuting related emissions, the following actions are planned in the year 2017/2018:

1. Perform a mobility survey to gain more insight in emissions
2. Develop a mobility plan to reduce emissions

2.3 Reduction targets

The ambition for 2020 are:

- 5% less air travel per employee compared to 2017
- 5% less commuting by petrol and Diesel cars compared to 2017
- Keeping the others at a level not more than those of 2017

The specific targets for business air travel and commuting are developed according to the mobility plan to be implemented at the end of 2018.

Above reduction ambition will lead to the following overview for the next certification period (2018-2020):

Scope	**Source of emission**	**CO_2-emission [tCO_2-/empl/yr]**		**Reduction Ambition**	
		2016	2017	2020	2020 result

Scope 1	Business travel: lease cars	0,42	0,34	Equal	0,34
Scope 2	Business travel: private cars	0,15	0,14	Equal	0,14
	Air travel	0,83	1,21	5%	1,15
	Electricity	0,85	0,11	Equal	0,11
	Heating	0,16	0,07	Equal	0,07
	Business travel: public transport	0,12	0,12	Equal	0,12
Scope 3	Commuting	0,98	1,12	5,00%	1,06
Total					
Scope 1,2 en 3		3,47	3,11	3,85 %	2,99

2.4 Potential reduction measures

The following measures are proposed. A mobility plan taskforce is set-up to evaluate feasibility of measures. The definitive set of reduction measures will be presented at the end of 2018, according to the mobility plan.

Category	**Measure**	**Potential % total emissions**	**Progress**	**Responsible**
Scope 2: Business travel – air 	Set-up incentives in new mobility plan - Provide alternative travel guideline: Our travel agency is instructed to provide travel by train as the first option for travelling within the EU (Germany, Belgium, UK or France). For flights to/from these destinations, an additional supervisor approval will be needed. - Promote VC meetings	▼ 2,00% [5% of 40%]	● ○ ○	SDM
Scope 3: Commuting 	Set-up incentives in new mobility plan - OV business cards/ mobility cards - Electric pool cars + electric shared bikes	▼ 1,85% [5% of 35%]	● ● ○	SDD

	- Free OV bike from and towards train station - Upper limit for commuting allowance for fossil fuel driven cars will be set to 50 km (one-way)			

Besides focussing on the main reduction measures of scope 1,2, and 3 to decrease the CO2 emissions of our operations, Arup b.v. plans to put effort into increasing awareness amongst employees.

Category	**Measure**	**Potential %**	**Progress**	**Responsible**
Awareness 	Increase awareness amongst employees by introducing yearly 'awareness week' around the Global Sustainability day 10 October	-	○ ○ ○	SDM

3 Reduction for projects downstream scope 3

In this section, the reduction strategy is outlined for emission categories associated to our projects, downstream scope 3. The main areas of influence are defined in the downstream scope 3 analysis and the chain analyses.

3.1 Reduction strategy

Via our design and consultancy practice we can stimulate sustainable decisions in the design process. To assist project managers in setting sustainability objectives a tool will be developed to give insight in the driver for sustainability and help them set and monitor objectives in projects. A focus on energy targets in projects is priority.

The objectives are recorded in the Arup internet Project Plan (IPP)

Figure 3 UNSDGs (Source: United Nations)

3.2 Reduction targets

In compliance with Arup European Objectives:
50% of projects with a fee > €150k are setting sustainability objectives.
Performance 2017: 31% achieved. Goal 2020: 50%

3.3 Reduction measures

Target	Category	Measure	Progress	Responsible
1 	Projects – Objectives	Sustainability objectives in projects > €150k fee are recorded in the IPP	● ● ○	PM
2 	Projects – Objectives	Development of Sustainability objectives tool	● ○ ○	SDM
2 	Projects – design - Energy	Verify if projects comply with Dutch regulation in relation to the 'Energieprestatie' of a building.	● ○ ○	PM
3 	Projects – design - Materials	Verify if projects comply with Dutch regulation in relation to the 'Milieuprestatie' of a building.	● ○ ○	PM
4 	Projects - Communication	Each year a selection of our projects will be presented in the 'How We Shape a Better World' report	● ● ●	SDM

Appendix C

Transparency

Communication plan

Arup

CO2-prestatie ladder

Communication plan

Issue | 4 januari 2019

Opdracht nummer

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ARUP

Inhoud

1 Introduction

In this document Arup Netherlands shares its communication plan for the period 2017-2018 within the frame of our sustainability strategy and the CO_2 - Performance ladder. This document is an update of the 2016-2017 plan.

Arup uses both internal and external channels to communicate the implementation of the CO2-performance ladder. The communication strategy is based on quarterly CO_2-performance updates, half yearly awareness weeks and yearly CO2-target updates.

Yearly calendar:

	Internal				External	
Period	**CO_2-ladder**		**CO_2-awareness**			
	Topic	Method	Topic	Method	Topic	Method
Q1	Update CO_2-performance	Screens			Information websites	Arup site + SKAO
Q2	Update CO_2-performance	Screens + intranet	How we shape a better world-week	Report + lunchlecture		
Q3	Update CO_2-performance	Screens				
Q4	Update CO_2-performance	Screens + intranet	Sustainability -week	Campaign + lunchlecture		

Figure 1 Yearly communication calendar

2 Communication strategy

2.1 Target groups

	Target Group
Internal	• Employees • Project managers • Cost Centre Leaders • Management team
External	• Arup Global and Arup companies • Clients: public and private sector • Sector / network associations and knowledge exchange platforms: NLingenieurs, KiviNiria, etc. • SKAO “Stichting Klimaatvriendelijk Aanbesteden en Ondernemen: • Project partners: architects and engineering firms • Students and potential employees

2.2 Content per Target Group

In the table below we explain the content of communication for each target group:

Target group	Content of communication
General	• Reduction target and progress of Arup BV in meeting these targets
Internal	• Actual footprint, reduction goals and measures to be taken to reduce emissions • Measured progress in reducing emissions • Expected / measured environmental performance of relevant projects • CO_2 Performance ladder requirements and reporting procedures
Arup Global and Arup companies	• Progress of Arup Netherlands in complying with Arup Regional and Global sustainability strategy and plans. • Progress of Arup BV in meeting reduction goals • Participation in setting new goals and feedback about results of locally implemented strategies.
Clients, Sector and knowledge exchange platform	• Carbon footprint, reduction targets and measures (to be) taken. • Progress in meeting reduction targets • Our measures and visions about a collaborative progress towards more sustainable designs
SKAO	• Documents and links required according to certified level requirements of CO2-performance ladder • Valid certificates
Partners and clients	• Continuous reporting on design propositions, feasibility studies and decisions to increase the sustainability outcome of a project

3 Internal communication channels

Arup uses multiple channels to convey information on the CO_2-performance ladder to employees.

3.1 TV-screens

Overviews of our CO2-footprint and our main emissions sources are shared by means of quarterly updates on internal tv screens at the coffee machines. Also important updates on the participation in the CO_2-performance ladder are communicated.

List of (planned) updates on internal TV screens:

- Q2 2018: Overview of Carbon emissions 2017
- Q3 2018: Carbon emissions Q2 2018
- Q4 2018: Carbon emissions Q3 2018
- Q1 2019: Overview of carbon emissions 2018

3.2 HWSAB-report

The yearly ‘How We Shape A Better World’-report communicates the CO_2-performance of our office with our employees, clients and partners. Furthermore, it gives an overview of our most sustainable projects, on the basis of our sustainability framework, and our sustainable initiatives. The report is shared on our intranet page.

3.3 Lunchlectures

Lunchlectures for all staff are organized to increase the awareness of employees on sustainable developments and our CO_2-performance.

4 External communication

4.1 Website Arup Netherlands

Arup communicates our participation in the CO_2-performance ladder system via the website of Arup Netherlands. The link towards the CO_2-information has a prominent position on our homepage.

https://www.arup.com/perspectives/towards-sustainability

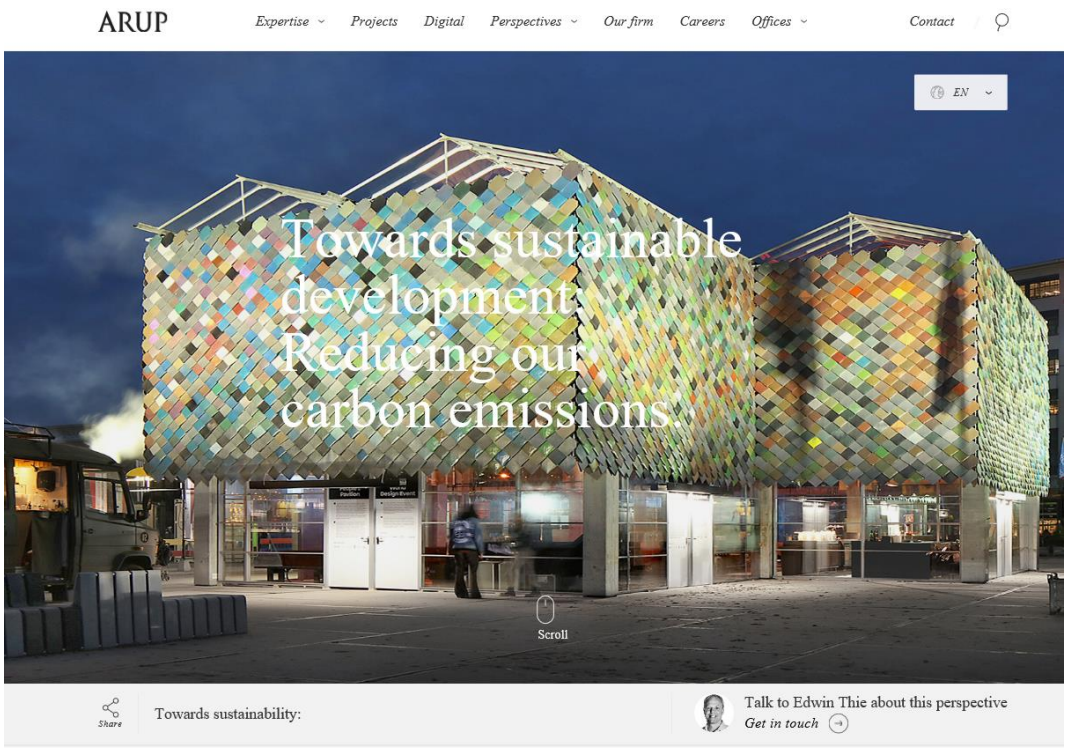
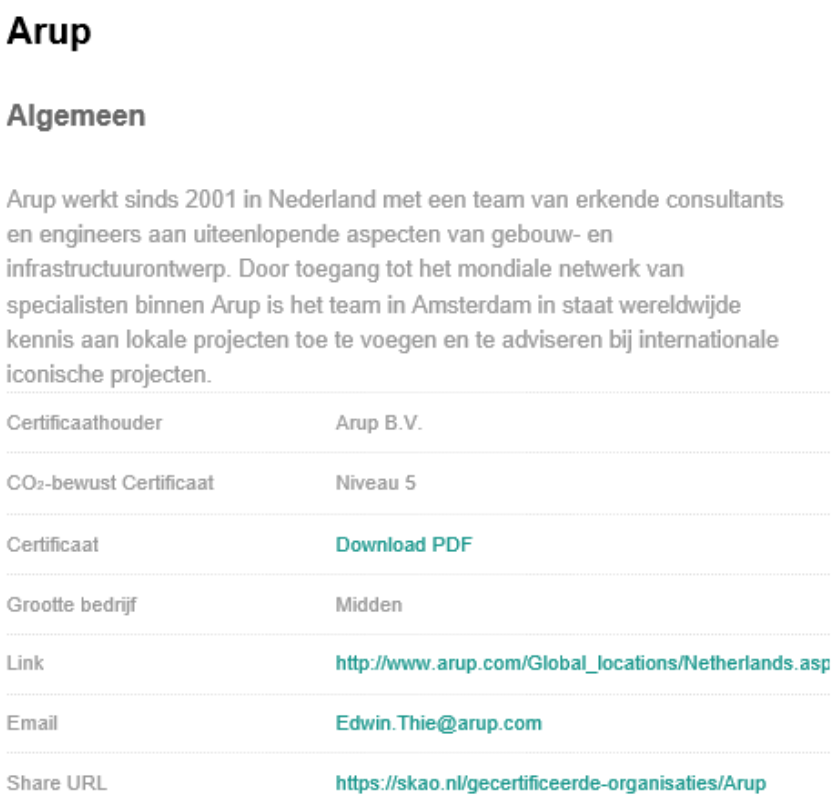


Figure 2 Printscreen of the Arup Netherlands homepage, taken on 26-06-2018.

4.2 SKAO

On the SKAO Arup b.v. shares the information according to the requirements of the audit checklist. The information stays available on the website for at least 2 years. Arup is listed on the website of SKAO as a level 5 certified company.

https://www.skao.nl/gecertificeerde-organisaties?tab=undefined



Arup

Algemeen

Arup werkt sinds 2001 in Nederland met een team van erkende consultants en engineers aan uiteenlopende aspecten van gebouw- en infrastructuurontwerp. Door toegang tot het mondiale netwerk van specialisten binnen Arup is het team in Amsterdam in staat wereldwijde kennis aan lokale projecten toe te voegen en te adviseren bij internationale iconische projecten.

Certificaathouder	Arup B.V.
CO_2-bewust Certificaat	Niveau 5
Certificaat	Download PDF
Grootte bedrijf	Midden
Link	http://www.arup.com/Global_locations/Netherlands.asp
Email	Edwin.Thie@arup.com
Share URL	https://skao.nl/gecertificeerde-organisaties/Arup

Figure 3 Arup information on the SKAO website (obtained on 26/06/2018)

Appendix D

Participation

Participation plan

Arup

CO2-performance ladder

Participation plan

Issue | 4 januari 2019

Opdracht nummer

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ARUP

Inhoud

1 Introduction

As part of our sustainability strategy Arup b.v. is committed to the active participation in initiatives in the field of CO_2-reduction. This involves performing in-house research and employing partnerships with academic and industry partners.

2 In-house research

Arup has a wide range of in-house research projects, which resonate with our sustainable objectives. The past year we have been involved in *"Cities Alive: Designing for Urban Childhoods"*. An outline of the project is given below.

2.1 Cities Alive: Designing for Urban Childhoods

A child-friendly approach to urban planning is a vital part of creating inclusive cities that work better for everyone. Designing for urban childhoods inspires us to respond positively to the challenges, and sets out actions that can help take us to a more child-friendly future – moving well beyond simply providing playgrounds. In our report ***Designing for urban childhoods***, we explain how we can create healthier and more inclusive, resilient and competitive cities for all of us to live, work and grow up in. To showcase our thinking we compiled 40 global case studies, 14 recommended interventions and 15 actions for city leaders, developers and investors and built environment professionals.

https://www.arup.com/perspectives/cities-alive-urban-childhood

Contact: Laurens Tait

3 Initiatives

Arup b.v. participates in a number of initiatives aiming to reduce CO2-emissions.

3.1 People's Pavillion

In collaboration with Dutch architects Overtreders W and Bureau SLA, Arup has delivered the structural design of the main pavilion for the Dutch Design Week 2017 in Eindhoven. The challenge of the project was to create a pavilion, with high architectural quality, from 100% borrowed materials. After the festival the building had to be dismantled and all materials returned to their suppliers in their original state.

Completely made from borrowed materials, our structural design implicated a circular design with a close to zero carbon footprint. We explored the possibilities of structuring a safe building without damaging the materials in any way. This meant that we had to devise a construction technique that didn't use glue, screws or nails. The frame is build up from standard off-the-shelve timber sections of different trade lengths tied together with steel straps to make longer and stronger

composite elements. The columns consist of 7 meter tall prefab concrete foundation piles. Steel rods from a demolished office building are reused as cross bracing. The composite timber beams, concrete columns and cross bracing were tied together using high capacity ratchet straps to create a save and sufficiently stiff structure to withstand strong wind conditions. This unconventional system required our calculations to be validated, which was done by executing several experiments in cooperation with the Technical University Eindhoven.

https://www.arup.com/projects/peoples-pavilion

Contact: Edwin Thie

3.2 Memberships

- Arup is a member of the Sustainability Committee TC1 of the Dutch Steel Association
- Participant of the Green Deal Duurzaam GWW
- Member of Madaster
- Member of Circle economy


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People's Pavilion, Credit Filip Dujardin