Importance of Sustainability within infrastructure projects

Development and implementation in COWI

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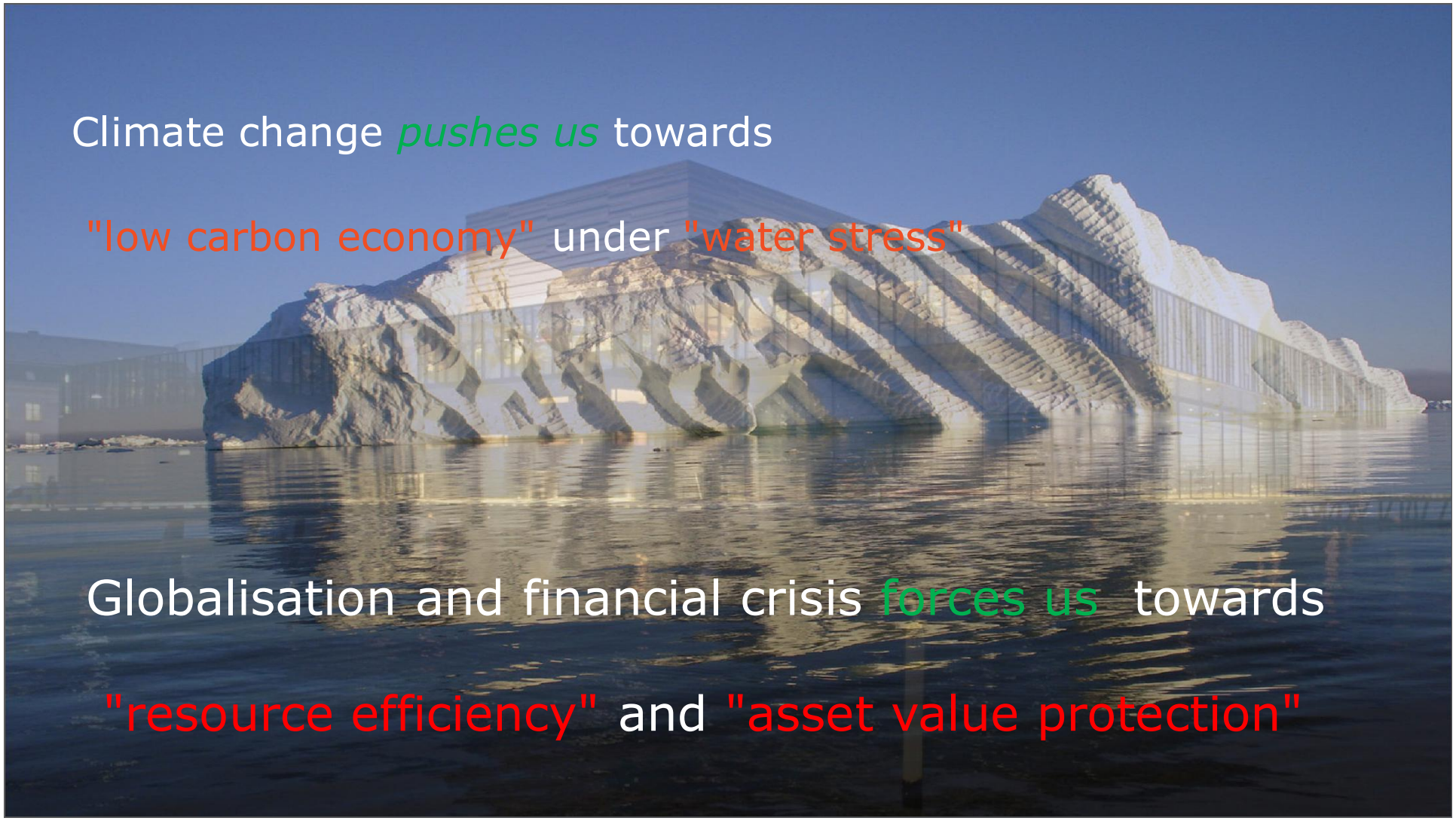
Climate change *pushes us* towards
"low carbon economy" under "water stress"


Climate change *pushes us* towards
"low carbon economy" under "water stress"
Globalisation and financial crisis forces us towards
"resource efficiency" and "asset value protection"

COWI POLICY

- In the **COWI Group we will take into account environmental and social aspects in connection with the tasks we perform for our customers**.
- The COWI Group considers the adherence to local legislation and international conventions a matter of course.
- **To meet our objectives, we will:**
- Further **contribute to sustainable development through constant improvement of our services**, **through our operation and through dialogue and co-operation with the world around us**.
- **Direct our employees' attention** to and enhance their knowledge about environmental and social conditions in order **to further the consideration for sustainable development in all of our activities**.

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COWI sustainability on infrastructure projects

- **COWI aims to deliver holistic solutions in all our projects with sustainability as a core element of our way of working.**

- Sustainability aspects (esp. environmental) are already to some extent applied in our infrastructure projects, but
  - we need to be able to document the sustainability outputs and not at least to document the added value for our customers
  - we need to have a common language and understanding when talking about sustainability
  - we need to work after a uniform sustainability concept and a systematic approach

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Core idea of the project

- To take access in:
  - existing infrastructure projects =>
    - The output will therefore not be fluffy and theoretical
  - existing sustainability solutions =>
    - communicate that our starting point is not zero
      - we are already working with sustainability
  - existing project teams
    - build up knowledge and experience in project organisations that have no previous experience with sustainability
      - if they can do it and see the value everybody in COWI should be able to follow
- To develop:
  - an easy value creating and systematic sustainability process and tool
  - sustainability cases and calculate the value

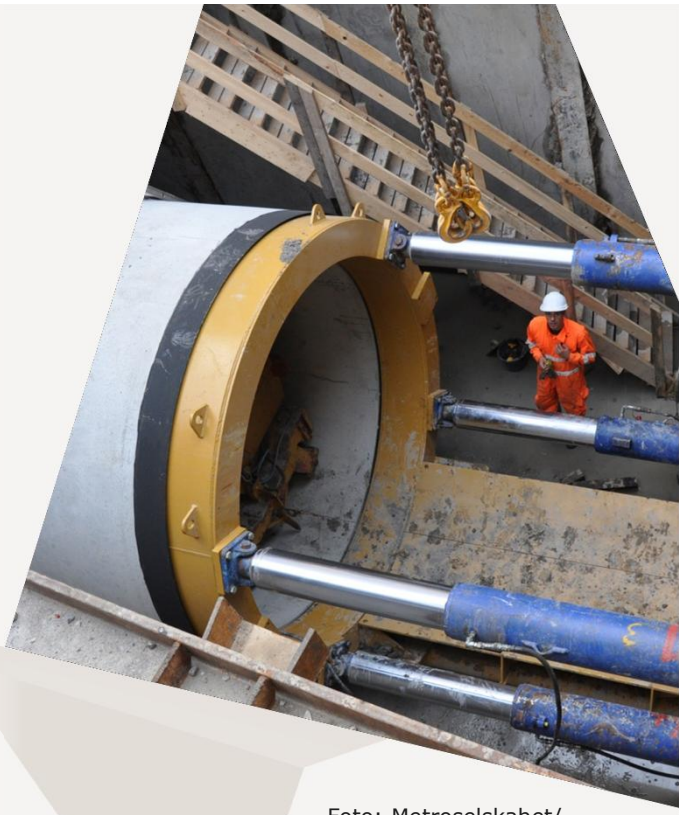

Foto: Metroselskabet/
Lene Skytthe

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Outputs

We want to calculate the sustainability value in economic terms and also CO_2 emissions

- Survey on existing sustainability calculation tools on infrastructure:
  - No existing single tool can cover COWI's need regarding easy calculation of CO_2 and the economic value of all types of infrastructure projects
- **The ETSI is expected to deliver a CO_2, LCA and life cycle costs calculator**
- And we focused on developing a systematic sustainability dialogue tool
- and documentation of the sustainability value on ongoing infrastructure projects

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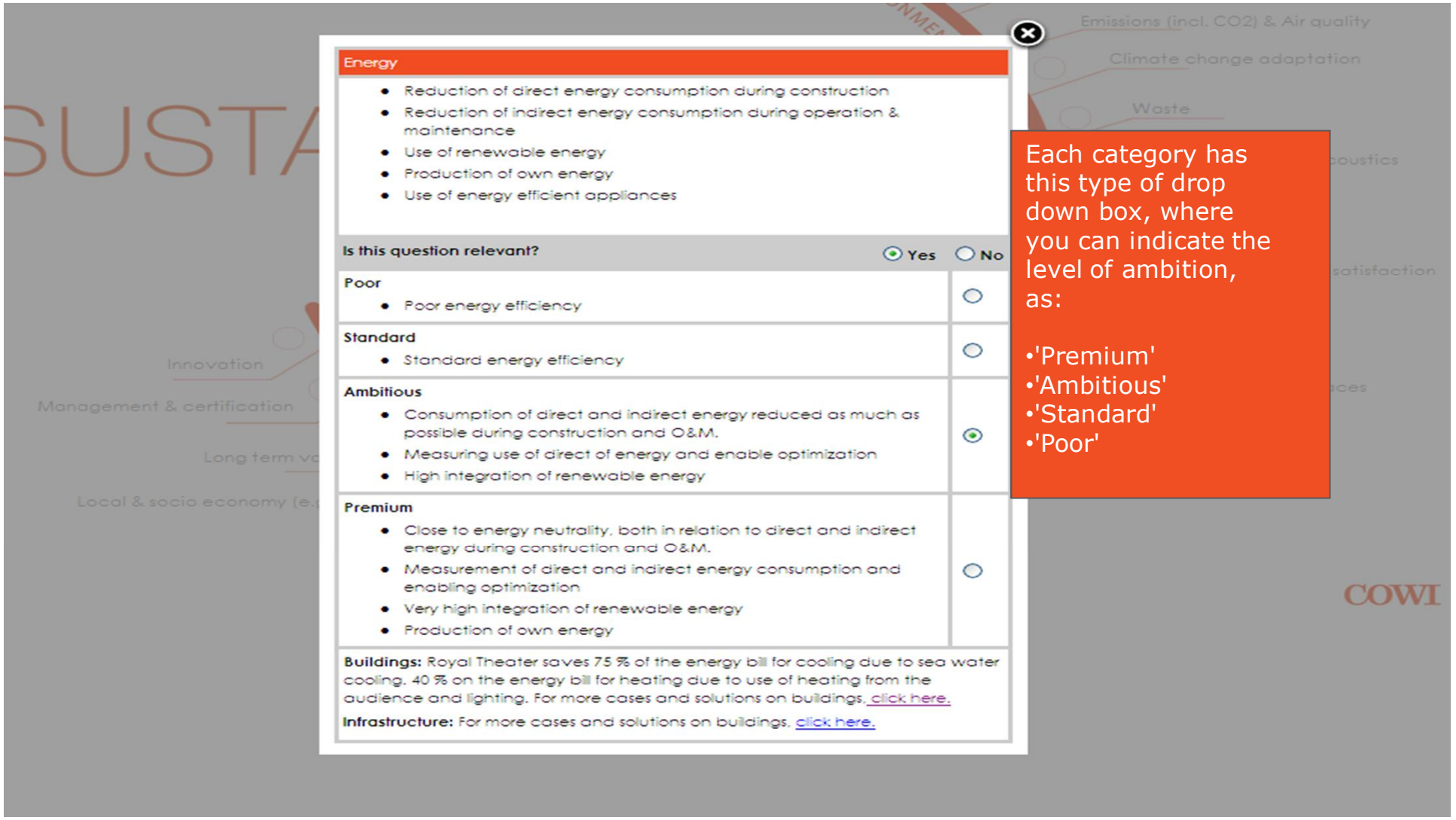
On-line Sustainability Dialogue Tool


PREMIUM
Aim for zero impact or beyond
AMBITIOUS
Aim to reduce negative impact as much as possible
STANDARD
Standard practice or legal compliance
POOR
Below standard practice
SUSTAINABILITY
INDICATE THE SUSTAINABILITY PRIORITIES
BY FILLING OUT THE CIRCLES
ENVIRONMENT
MATERIALS & CHEMICALS
ENERGY
AIR QUALITY
CLIMATE CHANGE ADAPTATION
WASTE
NOISE & VIBRATION
BIODIVERSITY
TRANSPORTATION
SOCIAL
USER & COMMUNITY SATISFACTION
HEALTH & SAFETY
AESHTETICS, GREEN & BLUE SPACES
CULTURAL HERITAGE
DIVERSITY
SUPPLY CHAIN
ECONOMY
PROJECT ECONOMY (LCC)
LOCAL & SOCIO-ECONOMY
LONG TERM VALUE
MANAGEMENT & CERTIFICATION
INNOVATION
Click on the categories and a drop down box will appear


Emissions (incl. CO2) & Air quality
Climate change adaptation
Waste
Innovation
Management & certification
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Energy
Reduction of direct energy consumption during construction
Reduction of indirect energy consumption during operation & maintenance
Use of renewable energy
Production of own energy
Use of energy efficient appliances
Is this question relevant?
Yes
No
Poor
Poor energy efficiency
Standard
Standard energy efficiency
Ambitious
Consumption of direct and indirect energy reduced as much as possible during construction and O&M.
Measuring use of direct of energy and enable optimization
High integration of renewable energy
Premium
Close to energy neutrality, both in relation to direct and indirect energy during construction and O&M.
Measurement of direct and indirect energy consumption and enabling optimization
Very high integration of renewable energy
Production of own energy
Buildings: Royal Theater saves 75 % of the energy bill for cooling due to sea water cooling. 40 % on the energy bill for heating due to use of heating from the audience and lighting. For more cases and solutions on buildings, click here.
Infrastructure: For more cases and solutions on buildings, click here.
Each category has this type of drop down box, where you can indicate the level of ambition, as:
•'Premium'
•'Ambitious'
•'Standard'
•'Poor'


NOT RELEVANT
Category not relevant
POOR
Below standard practice
STANDARD
Standard practice or legal compliance
AMBITIOUS
Aim for minimal negative impact
PREMIUM
Aim for positive or zero impact
This is an example of how the tool will look, when you have been through all the areas.
SUSTAINABILITY
INDICATE THE SUSTAINABILITY PRIORITIES
BY FILLING OUT THE CIRCLES
ENVIRONMENT
Materials & ch
Energ
Land & site
Emissions (incl. CO2) & Air qu
Climate change adaptation
Waste
Noise, vibrations &
Biodiversity
User and community sati
SOCIAL
Health and safety
Aesthetics, green & blue
Cultural heritage
Diversity & inclusion
Supply chain
Transportation
ECONOMY
Innovation
Management & certification
Long term value
Local & socio economy (e.g. job creation)
Project economy (LCC)

Outputs

Sustainability Process

One circle per project phase

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Outputs

Sustainability cases - Cityringen

- Bored tunnel segments and CO_2 requirement
- Sustainable granite and natural stone
- Climate change adaptation
- Substitution of PVC cables to reduce risk of fire and CO_2 emission
- Conservation of groundwater resources
- Safeguarding cultural heritage
- Substitution of green house gasses as refrigerants
- Sustainable electromechanical planning and design
- Integration of station design for flooding into landscape.

Foto: Metroselskabet/
Søren Wesseltoft

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SUSTAINABILITY IN THE CITYRINGEN PROJECT

CASE: SUBSTITUTION OF PVC CABLES TO REDUCE RISK OF FIRE AND CO_2 EMISSION

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360° SUSTAINABILITY

MATERIALS & CHEMICALS

"COWI aims to deliver holistic solutions in all our projects with sustainability as a core element of our way of working."

SUBSTITUTION OF PVC CABLES TO REDUCE RISK OF FIRE AND CO_2 EMISSION

PRODUCTION, USE AND DISPOSAL OF PVC IMPOSE A RISK TO THE ENVIRONMENT AND PEOPLE. PVC IS ALSO UNWANTED AS A BUILDING MATERIAL AS THE FUMES CREATED IN CASE OF A FIRE DEVELOP BOTH TOXIC DIOXINS AND HYDROCHLORIC ACID.

Smoke from fire in PVC materials is dangerous to inhale. PVC is used in carpets and several building fires have over the years caused many fatalities. Decomposed PVC components also cause extensive damage to all material surfaces beyond the damages caused by the fire itself.

Consequently, Metroselskabet I/S has decided that buildings, trains and installations must be free of PVC materials. Instead, PE materials are to be used, giving the following advantages: reduced risk in case of fire, reduced CO_2 emission from recycling and reduced disposal cost.

PVC has for many years been the dominant cable insulation material.

It is expected that about 510 tonnes of cables will be installed in the Cityringen metro tunnels and stations for the installations alone. Out of the 510 tonnes, approximately 285 tonnes concern insulation.

ENVIRONMENT

By substituting PVC (polyvinylchloride) cables with PE insulated cables, the environmental impact of producing and disposing cables at the end of their lifetime is significantly reduced. PE-LD (polyethylene – low density) that is to be used for the cables is easy to recycle, especially in an isolated waste stream. In comparison, the soft PVC is very difficult to recycle as no large-scale recycling facilities are currently available. This leaves a large volume of PVC waste that either has to be sent to a landfill for several hundred of years due to its long degradation time, or has to undergo a complicated and costly recycling process.

It costs around 0.6 kg of CO_2 to produce 1 kg of PE-LD through recycling. This saves the environment around 1.5 CO_2/kg PE-LD, compared to the 2.1 kg CO_2/kg it costs to produce virgin PE-LD. This gives a net emission of approximately 190 tonnes of CO_2 for the 285 tonnes of PE-LD needed for the cables.

Production of PVC without any recycling at the end of lifetime emits 2.5 kg CO_2/kg or 712 tonnes in total for the 285 tonnes of insulation material.

Using PE-LD instead of PCV for cable insulation leads to a total CO_2 reduction of 532 tonnes.

HEALTH AND SOCIETY

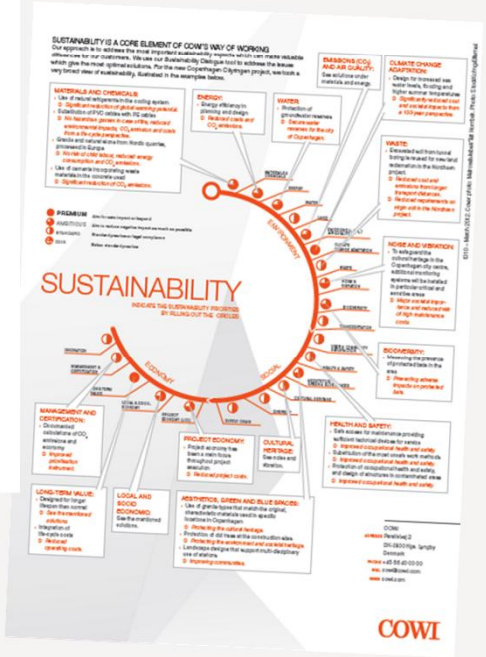
Using PVC-free materials reduces the risk to the public of exposure to hazardous smoke from a potential fire in a station, shaft or tunnel.

The material damage from a fire is reduced to the effects from the fire and heat, thereby reducing the time needed to repair the installation and the loss of income and inconvenience to the public in general.

ECONOMICS

Disposal of PVC cables and wires will follow the "PVC-Afgiftsloven". The disposal cost is DKK 2.48 per kg in case phthalates are present (soft plastic) and DKK 0.91 per kg if other plasticizers than phthalates are used (2011 prices). The disposal cost of PVC-free cables and wires (like PE-LD) is DKK 0 per kg.

The disposal cost of the 285 tonnes of insulation material is reduced by DKK 707,000 in the current worse-case scenario.



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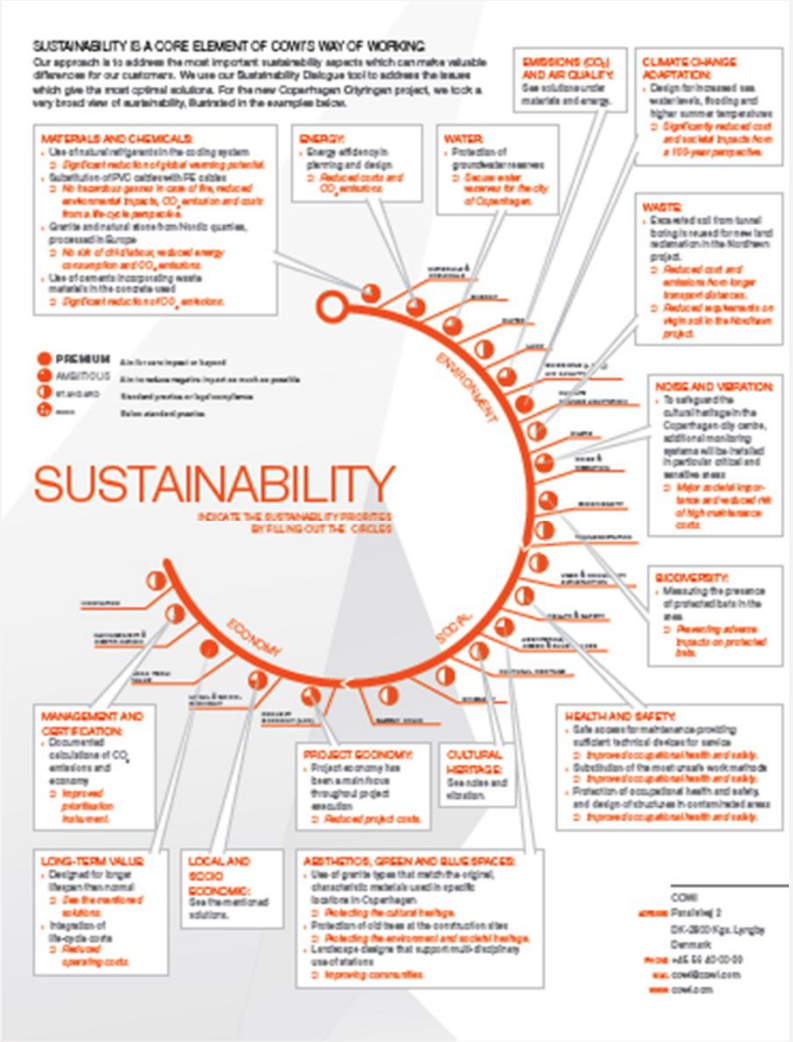
Cityringen

› Using the sustainability dialogue tool



Outputs

Sustainability cases - Brande Bypass

- Cement stabilization reduces asphalt consumption and costs
- Using waste materials in road embankment
- Use of local gravel pits improved biodiversity, CO_2 emissions and costs
- Recycling asphalt reduced asphalt consumption, transport, CO_2 emission and costs
- Road design supported expansion of local business

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SUSTAINABILITY IN THE BRANDE C-PASS PROJECT

CASE: USING WASTE MATERIALS IN ROAD EMBANKMENT

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360° SUSTAINABILITY

MATERIALS & CHEMICALS

WASTE

"COWI aims to deliver holistic solutions in all our projects with sustainability as a core element of our way of working."

USING WASTE MATERIALS IN ROAD EMBANKMENT

IN THE NEW EXPRESSWAY DOUBLE-TRACK IN BRANDE, RESIDUAL AND WASTE PRODUCTS WERE USED TO CONSTRUCT THE ROAD EMBANKMENT.

The residual products filled in the new road embankment consist of more than 1 m³ of lightly contaminated soil delivered from a local company through the Municipality of Ikast-Brande. Moreover, 1,400 m³ of base gravel from the existing asphalt layer and road embankment removed during construction were also reused in the road embankment. This solution displaced more than some 7,400 m³ of new materials such as base gravel and coarse sands.

When constructing the road embankment of the new double-track berm, soil from the existing road embankment had to be removed. This berm soil was considered as contaminated soil, but was reused when establishing a berm soil layer on the new embankment. Otherwise, it would have had to be sent to a controlled waste site. In total, this solution saved the transport of 6,000 m³ berm soil to a controlled contaminated soil site.

ENVIRONMENT

Reduced consumption of natural raw materials contributed to reducing the pressure on the environment imposed by excavation in gravel pits.

Filling of residual products in new road embankments under an membrane and an asphalt cover contributed to an environmentally safe storage of the contaminated soil, while utilizing this otherwise unusable materials instead of virgin materials. The reuse thus reduced the pressure on the natural environment.

The storage of residual products containing environmentally harmful substances does not, while stored under Danish legislative guidelines, pose a potential threat to the local environment. Danish legislation considers the storage of residual products in road embankments to be environmentally safe under certain conditions which were met in this project.

By eliminating excavation and transport of 7,400 m³ base gravel and coarse sand from quarries and reusing the excavated berm soil, this CO_2 emissions were reduced by 32.2 tonnes corresponding to a reduction of 1.9 per cent, compared to using strictly virgin materials.

HEALTH AND SOCIETY

Using the excavated berm soil and the lightly contaminated soil in the new road embankment did not significantly alter health and safety impacts during the construction work, as long as the soil was handled correctly.

This case is a good example of how to transform waste into new raw material - a necessity, seeing how the demand for resources worldwide continues to increase.

ECONOMICS

The material reuse resulted in a total saving to society of DKK 2 million compared to using new gravel. Considering only the road project, the reused gravel was slightly more expensive than new gravel, an estimated DKK 21,000.

But taking a broader perspective on the project, it achieved a huge saving by this alternative disposal of the waste materials of DKK 1.86 million, as well as a benefit for society in terms of less air pollution, less CO_2 emissions, less noise, fewer accidents, less congestion and road deterioration, amounting to DKK 97,000.

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Brande Bypass

- Using the sustainability dialogue tool

Conclusion

- Working with most sustainability aspects is already common practice on COWI infrastructure projects
  - but **we did not** systematically document the added value for our customers and ourselves.
- Now, we have:
  - a systematic sustainability process and dialogue tool
  - cases which document the sustainability value on all aspect within environmental, social and economic
  - sustainability specialists who can lead the process
- And, we should be ready to create added value for our customers and develop a better market position regarding sustainability on infrastructure projects for ourselves!

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