



Climate adaptation of public buildings through MOM

- A case study

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A changing climate

The impending climate changes in Norway is likely to have a significant impact on the entire Norwegian built environment

- Higher temperatures,
- more extreme weather
- increase of intense precipitation
- increased demands of the climate screen of the building





A changing climate

Rain leakages

**Stormwater
management**

Mould growth

Water pressure on
basement walls

**Ice
formation**

Freeze-thaw cycles

**Driving
rain**

**Wet
snow**

Rot decay

**Cooling
demands**

Standing water

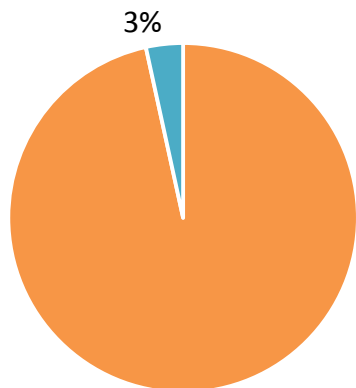
Drain capacity

Drying-out capabilities

Service life
of surface
treatments

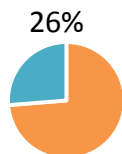
Why climate adaptation?

Repair cost compared to annual turnover



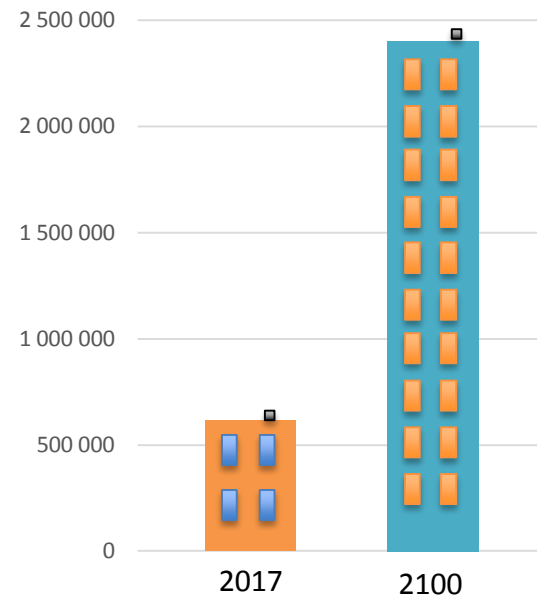
Estimated annual cost related to repairs of buildings in Norway is **1.65 billion Euros**.

Repair cost compared to annual profits



- 75% caused by moisture
- 65% related to building envelope
- 25% caused by precipitation
- 35% of facade defects caused by moisture
- 50% of roof- and terrace defects caused by moisture

Types of **damages and defects** found in the Norwegian building stock




Estimated number of buildings situated in areas with **high risk of rot decay**.


Climate adaptation through MOM

- 80% of the building mass of 2050 is **already built**. **Maintenance Operation and Management** and upgrades is important for future climate adaptation.
- A mapping of research projects concerning climate adaptation with Norwegian partners within the field of MOM was carried out.



The research gap



Level	Main actor of interest	Research theme		
		1. Climate adaptation	2. Energy efficiency	3. Economy
A. Law and legislative	Ministry/ Directorate			
B. Legislative / planning / strategy	Municipality/ Local authority			
C. Strategy / system	Managers/ MOM operators			
D. System / solution	Consultant/ Contractor			
E. Solution / component	Product manufacturer			



Results from the mapping

Strategies ensuring climate adaptation through MOM and upgrade plans should be further developed

Checklists with key climate adaptation factors should be developed based on a systems, solution and component review

Systems, solutions and components that are key factors in ensuring climate adaptation should be refined and further developed

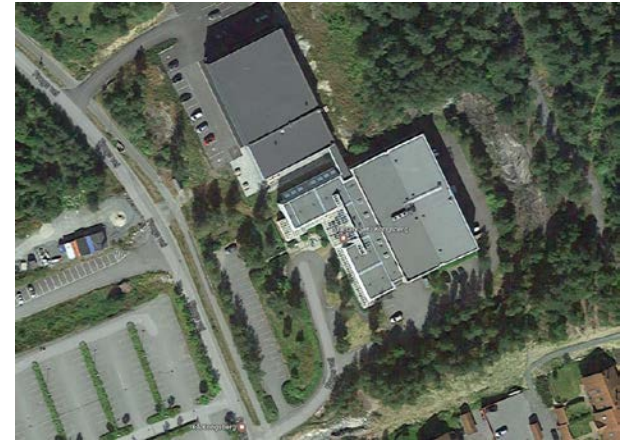
This must be done in close collaboration with the building industry to ensure that new developments are market-ready, useable and applicable for the entire building sector



Case Study: Large public building owners

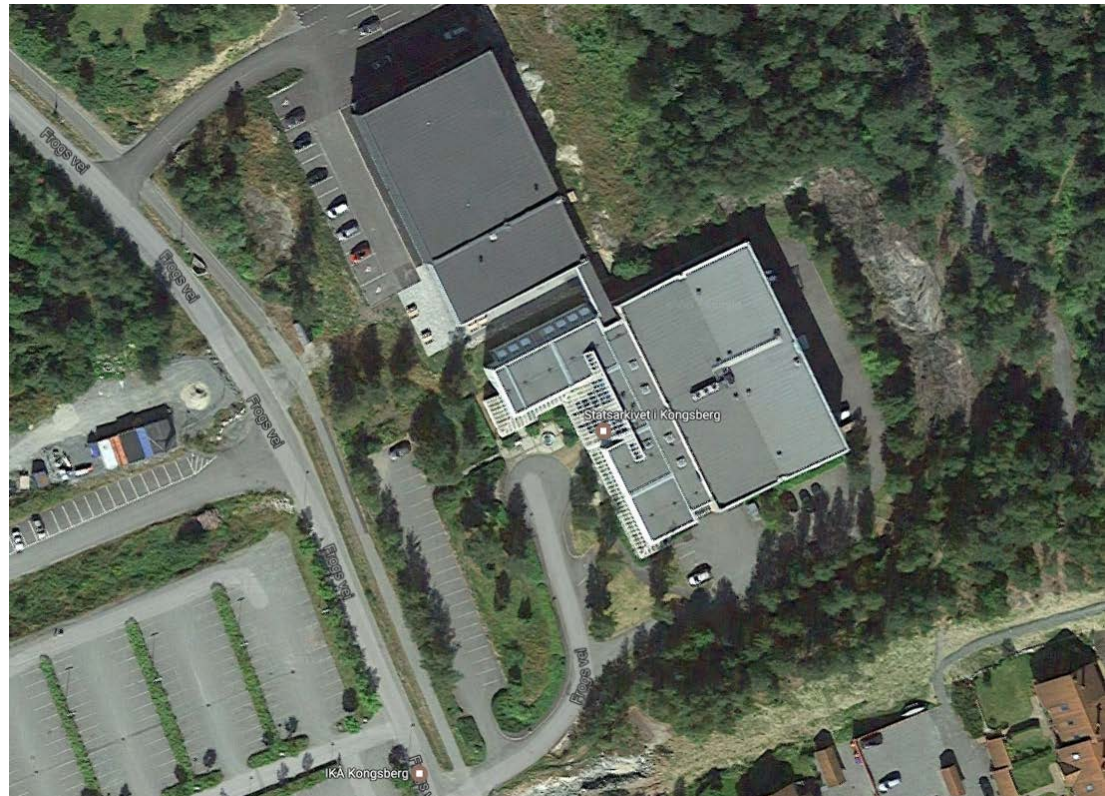
Map routines and planning tools based on analysis of **case buildings** to assess the strategy and main challenges of MOM at large public building owners, trying to answer:

- What are the characteristics of present day MOM-system for **climate adaptation**?
- What are the **challenges** to these systems?
- How can these systems be **improved**?



Case Study: The Regional State Archive, Kongsberg Norway

- Built in 1994
- Total area 5180 m² divided between:
 - Offices
 - Archive
- **Owner; Statsbygg** - The largest property owner in Norway





Case Study: Findings from the condition analysis

- Water leaks observed in multiple locations
 - *Temporary* measures taken
- Poor detailing...
- Water-induced damages in exterior constructions
- Damages to adjacent building





Case Study: Findings from the MOM-system

- Climate adaptation focus in property owner strategy from 2014 (at a more strategic level...)
- No operational plans or concrete suggestions outlined in the management system.
- A common platform for all MOM-planning

- Distinction between:
 - *Management*; Tasks planned with cyclic intervals
 - *Maintenance*; Necessary repairs/renovations based on *mappings*

The MOM system

Step 1 Maintenance needs	Step 2 Long-time plans	Step 3 Yearly plans	Step 4 Activities and follow-ups
<p>Task:</p> <ul style="list-style-type: none"> • define maintenance needs <p>Responsible Maintenance officers or administrators</p> <p>Actions:</p> <ul style="list-style-type: none"> - Register need - Transfer to long-time plans 	<p>Task:</p> <ul style="list-style-type: none"> • Define 5-year maintenance plans • Maintenance needs • Transfer needs to yearly plans <p>Responsible Building- and head-administrator</p> <p>Actions:</p> <ul style="list-style-type: none"> - Edit actions - Budget approval - Periodize actions 	<p>Task:</p> <ul style="list-style-type: none"> • Access to yearly budgets • carry out actions • define of working-orders <p>Responsible Building administrator</p> <p>Actions:</p> <ul style="list-style-type: none"> - Edit actions - Make working-orders - Close actions 	<p>Task: Working-orders to be carried out</p> <p>Responsible Maintenance officer</p> <p>Actions:</p> <ul style="list-style-type: none"> - Edit working-orders - Orders for external assistance - Close working-orders



Conclusions

- Strong links between the operations and project management levels in the organization needed to fulfil the corporate strategy and goals
- Some challenges in day-to-day implementation of the system (on-going water leakages)
- Need for strategies to bridge inter-corporate communication gaps



Further work

- Compare the MOM-systems of several large public building owners, to **map the characteristics** of present day climate adaptation work.
- **Find crucial focus points** to reduce the amount of damages, and increase the life span of the buildings.
- **Suggest specific improvements** to technical solutions and MOM-routines.

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MOM