



Lysaker Park
Intend Conference Oslo 24th September 2009
Energy consultant Arne Førland - Larsen
Esbensen Consultant Engineers

 storebrand



Hovedinngang / adkomst

18.06.2008

Step 1 Multi-disciplinary design team

- Building owner
- Quality coordinator
- Design - architect
- Energy - consultant engineer
- Daylight specialist
- Indoor climate specialist
- Acoustic specialist
- Consultant on air tightness
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Step 2 Analyse boundary conditions



- Committed building owner - Storebrand
- 1980 building, not fulfilling today's energy standard
 - Insulation
 - Air tightness
 - Building services systems
- Large building depth
- Noise from highway

STEP 3 Quality Assurance Program and Quality Control Plan



Central and crucial problems and objectives

- Program
 - Energy label B – 125 kWh/m² år
 - Low energy consumption service stage
 - Visible measurers
- Quality plan
 - Indoor climate objectives
 - Percentage of people present
 - Demand for IT equipment
 - Air tightness

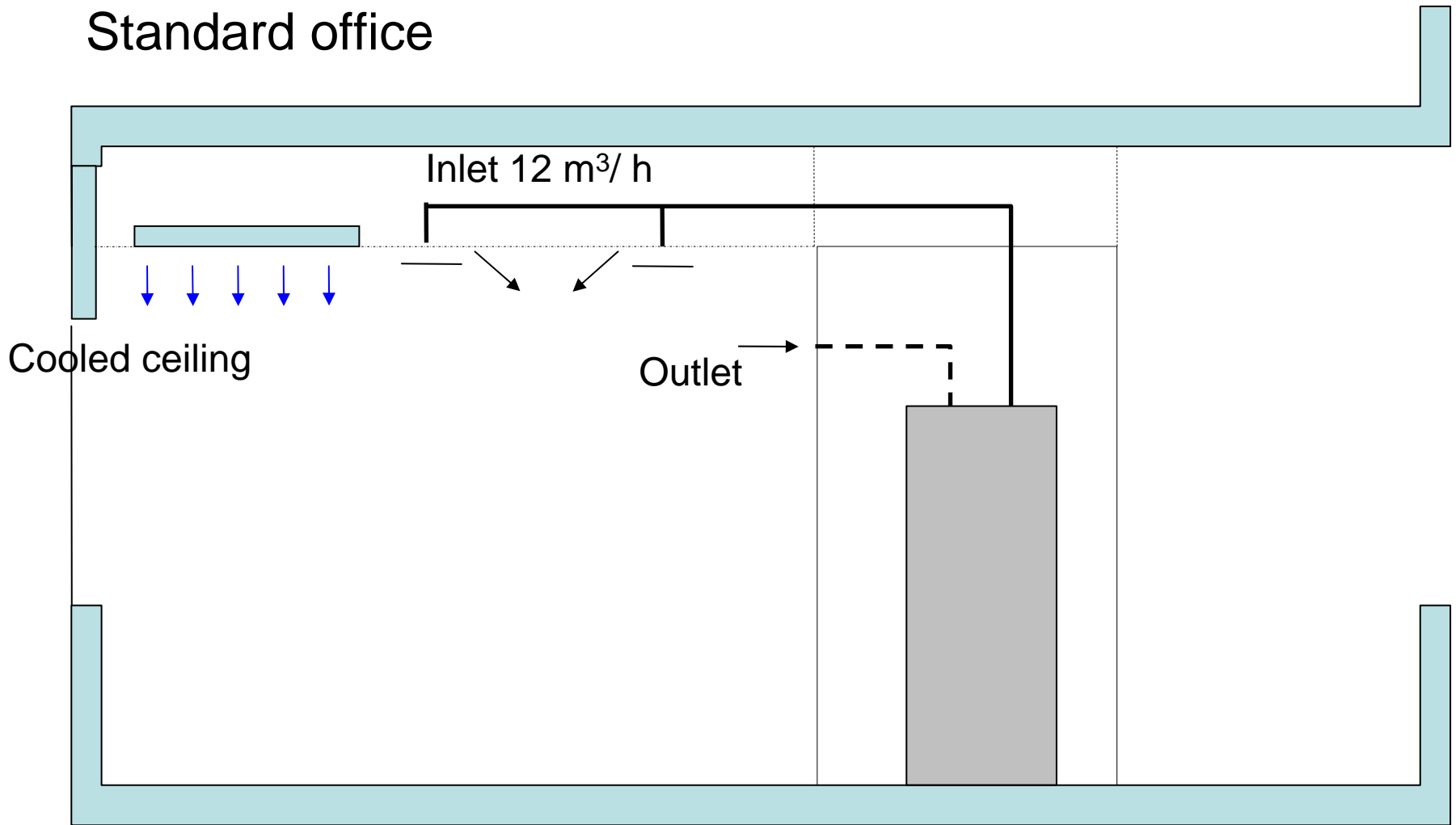
Standard indoor climate design criteria

Standard climate design criteria

- Operative temperature < 24 °C summer
- Operative temperature > 21 °C winter

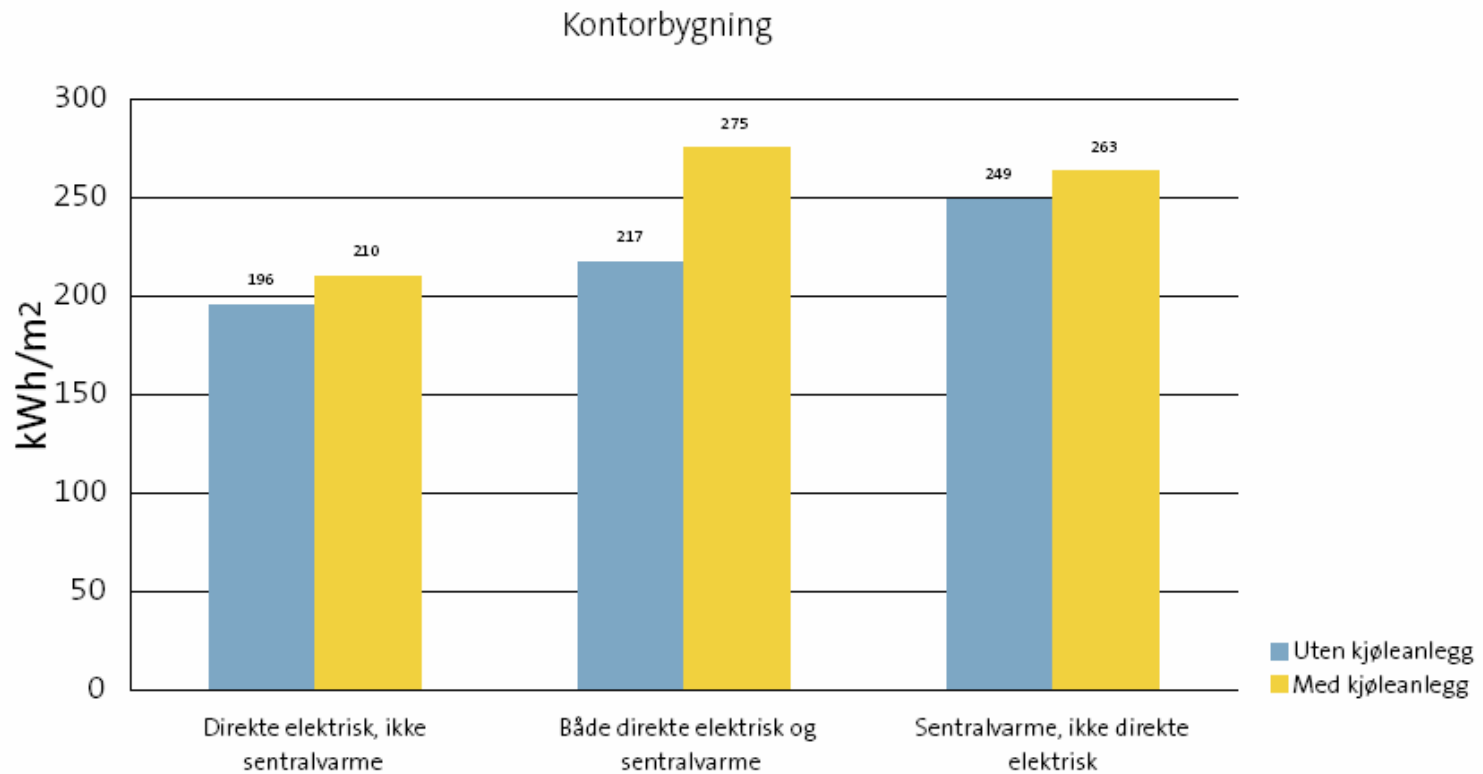


Standard office



Large capacity cause increased energy consumption?





Cooling increase energy consumption with
in average ~10 - 15 % pr. year

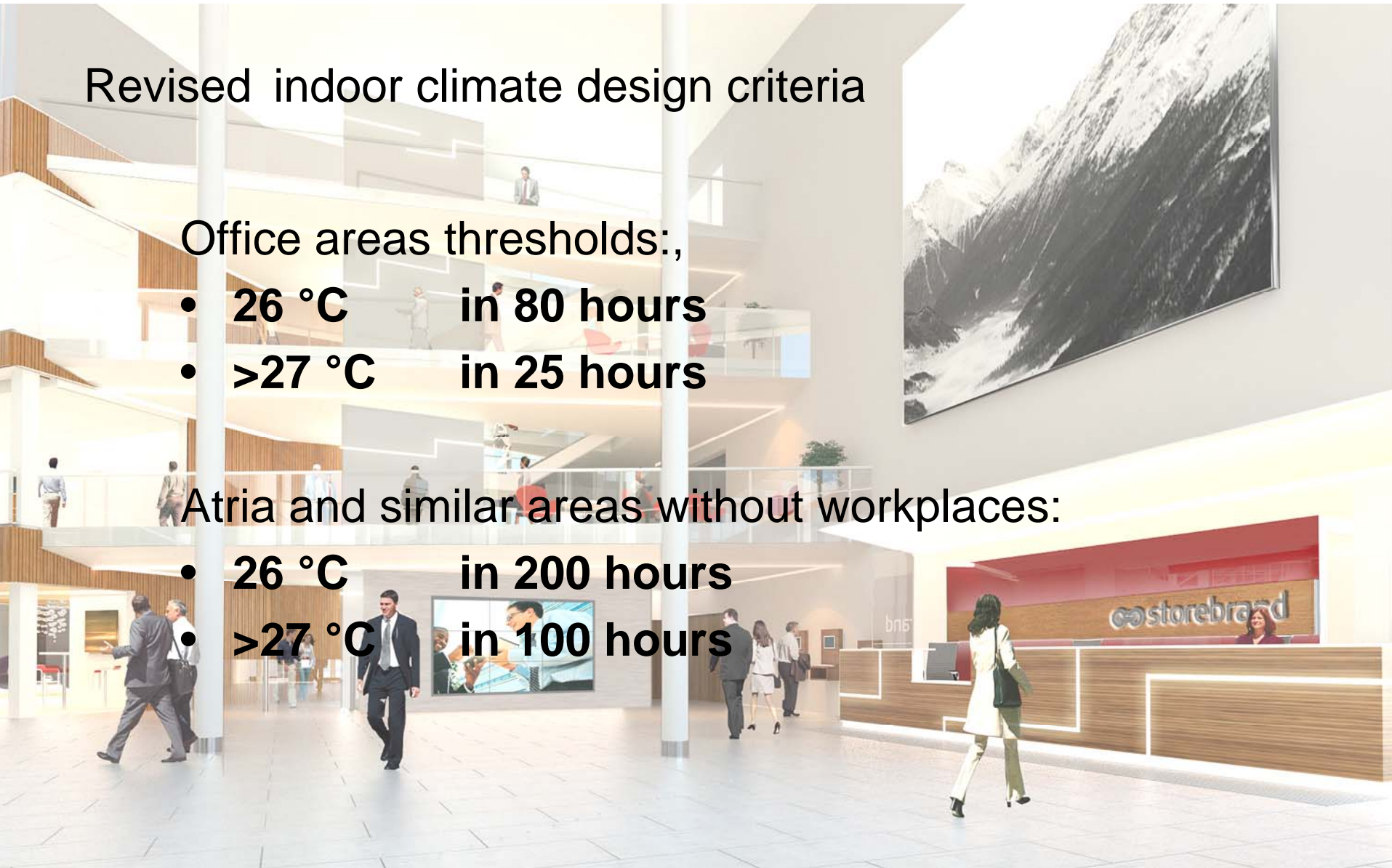
Revised indoor climate design criteria

Office areas thresholds:

- **26 °C** in 80 hours
- **>27 °C** in 25 hours

Atria and similar areas without workplaces:

- **26 °C** in 200 hours
- **>27 °C** in 100 hours



40 % of hot hours outside working period

Time period	Roomtemp. > 26 °C	Roomtemp. > 27 °C
07.00 – 19.00	94	14
07.00 – 18.00	79	8
08.00 – 16.00	66	2
08.00 – 16.00 (exclusive July, holiday month)	51	0
Hot hours in work period	51	0

Cooled ceilings area reduced to 35 %



80 kWh/m² year saved by changing facilitation on IT equipment and more energy efficient equipment

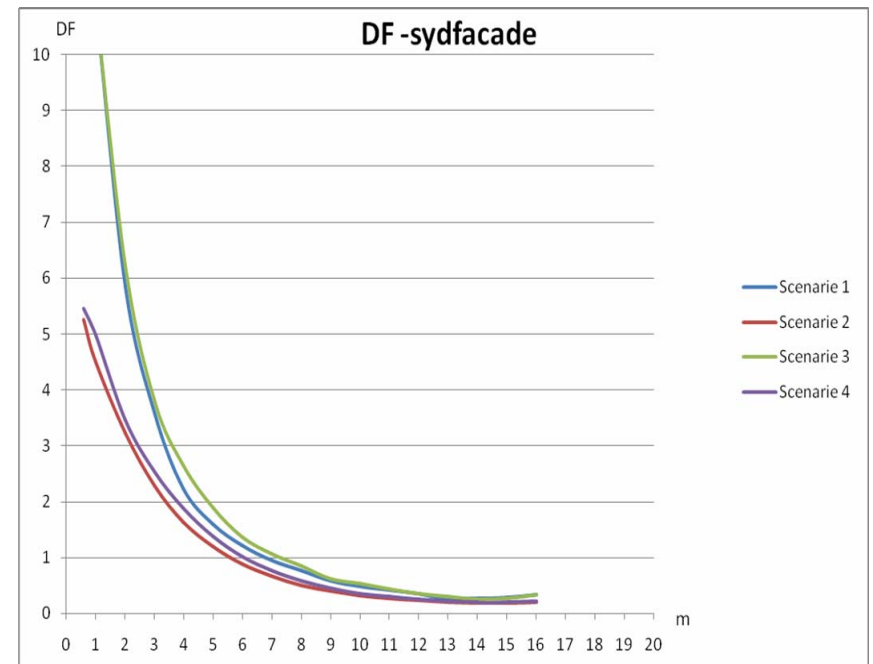
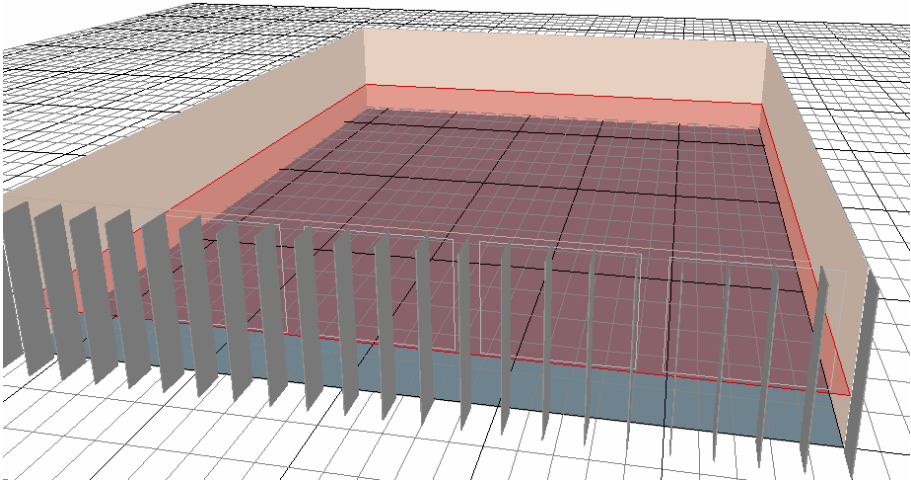


STEP 4 arrange a **kick-off** workshop

Kick off meeting where carried true at the beginning of the project period:

- Attendant:
 - Client Storebrand
 - Storebrand operation & maintenance
 - Quality coordinator
 - Architect
 - Energy consultant
 - Electric consultant

Daylight studies



STEP 5 facilitate **close cooperation** within the design team

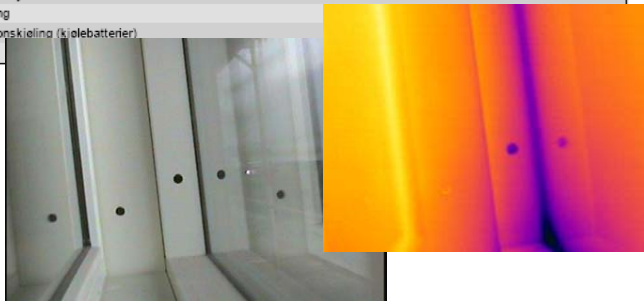
Quality coordinator facilitate close cooperation –
supported by energy engineer



STEP 6 **update** the control plan and **document** the energy performance

- Updated energy calculations
- Running air tightness test
- Control energy solutions
 - Design photocopy rooms
 - Lighting
 - Cooled ceilings
 - Efficiency tech. equipment
 -

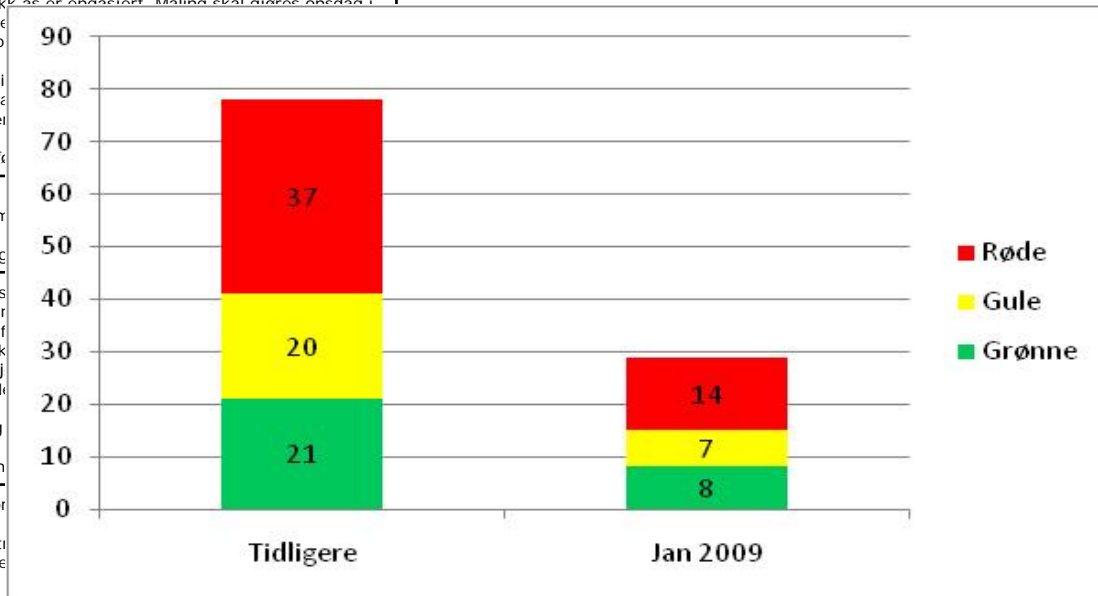
Energiramme (§8-21 b, samlet netto energibehov)		Verdi
Beskrivelse		
Beregnet energibehov romoppvarming	32.0 kWh/m ²	
Beregnet energibehov ventilasjonsvarme (varmebatterier)	5.6 kWh/m ²	
Beregnet energibehov oppvarming av tappevann	5.0 kWh/m ²	
Beregnet energibehov vifter (ventilasjon)	12.2 kWh/m ²	
Beregnet energibehov pumper	2.4 kWh/m ²	
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Beregnet energibehov pumper	2.4 kWh/m ²	
Beregnet energibehov belysning	20.0 kWh/m ²	
Beregnet energibehov teknisk utstyr	34.5 kWh/m ²	
Beregnet energibehov romkjøling	2.6 kWh/m ²	
Beregnet energibehov ventilasjonskjøling (kjølebatterier)	8.2 kWh/m ²	
Totalt beregnet energibehov	122.9 kWh/m ²	
Rov Forskiftskrav netto energibudsjet	165.0 kWh/m ²	
Ventilasjonsvarme (varmebatterier)	20378 kWh	8.5 kWh/m ²
Oppvarming av tappevann	12027 kWh	5.0 kWh/m ²
Vifter (ventilasjon)	24445 kWh	10.2 kWh/m ²
Pumper	9500 kWh	4.0 kWh/m ²
Belysning	38130 kWh	15.1 kWh/m ²
Teknisk utstyr	72254 kWh	30.1 kWh/m ²
Romkjøling		
Ventilasjonskjøling (kjølebatterier)		
Total		



Status report to building owner

Energy issues part of the overall risk plan

N R	Risiko - gjeldende	Forklaring
5	Dårlig utebelysning på ferdig bygg	<ul style="list-style-type: none"> •Det benyttes egen lysdesigner. Arbeidet med armaturer i gangarealer pågår fortsatt. •Fasadebelysningen problematiseres noe pga behov for tilførsel gjennom vegger (samarbeid med ARK). Beslutning om belysningskrav til fasaden må tas snarest. •Øvrig utebelysning har god tid. Viktig at dette henger sammen med landskapsarkitektens plan (ikke detaljert ennå).
7	Vanskelig tilgang til tekniske rom	<ul style="list-style-type: none"> •Planlegge funksjonelle traseer inn mot tekniske rom. Prosessen er pågående gjennom hele byggeperioden (gjøres rom for rom). •Driftsansvarlig må gå gjennom dette og gi innspill. •Det er ingen risiko knyttet til taket lenger. •Installasjon av brede dører inn til tekniske rom ivaretas.
8	Oppnår ikke tetthetskravet	<ul style="list-style-type: none"> •Bygningsfysisk rådgiver er engasjert. •Engasjert firma for stikk kontroll av utvendige konstruksjoner. Termografi og Måleteknikk er engasjert. Måling skal gjøres onsdag i uke 3 2009. Hvis resultatet er dårlig fortsetter arbeidet som på tidligere tiltak iverksettes. •Fukt/klimatiske forhold i rom •Termografering er planlagt •Besluttet å legge på mer isolasjon. •Utarbeidet liste for oppfølging
13	Forsinket prosjekteringsunderlag	<ul style="list-style-type: none"> •Risikoen er åpnet igjen. •Veldig press på tid/ frem tegnet/ prosjektert. •Fremdriftsplaner foreliggende
14/15	Fukt i ferdig bygg Fukt/feil som medfører fuktskade og som oppdages i byggeperioden	<ul style="list-style-type: none"> •Bygningsfysiker benyttes •Planlagt byggørk ved br •Mycoteam er engasjert for Termografi og Måleteknikk luftgjennomgang (skal gj •Detaljering av klimaskille alle bygg. •Rutiner for riktig lagring de ulike entreprenørene. •Det vil ikke foretas term
17	Ikke nok ressurser hos aktører som kommer inn	<ul style="list-style-type: none"> •Dette er en pågående problemstilling i byggebransjen. •Før kontrahering får entilgang til ressurser, både arbeidskraft, HMS etc.



STEP 7 make **contracts** that encourage energy efficiency

- Energy demands are worked into the tender documents
 - Efficiency heat recovery
 - Air tightness
 - Insulation standards
 - Etc...

STEP 8 motivate and educate construction workers and apply quality tests

- Quality coordinator and energy consultant offer seminars and information
 - Project group
 - Construction workers
 - ..

STEP 9 make a **user manual** of operation and maintenance

- After completion of construction, the design data will be updated in order to provide concrete information for future facility management.
- Building Management Systems will be used to decrease energy consumption in maintenance stage

Energy measures building envelope

- Insulation
- Facade optimization - external sun shading and glazing with high daylight performance
- Natural ventilation in atrium
- Double skin facade

		Refurbish. Buildings	Existing Building	Building codes
U-values exterior wall	W/m ² K	0,18 - 0,24	0,3	0,18
U-values roof	W/m ² K	0,13 - 0,18	0,18	0,13
U-values floor	W/m ² K	0,24	0,35	0,15
U-values windows	W/m ² K	0,9	1,9	1,2
Air Tightness	n ₅₀	0,5 - 1,5	0,5 - 1,5	1,5

Colt facade





Natural ventilation in atria



Doble skin facade



Energy measurers building services

- Daylight control system
- Efficient heat recovery in ventilations plants ~0,83
- Efficient ventilation fans ~ 1,8 – 2,0 (3,0 old building)
- Variable air volume ventilation
- Reduced area of cooled ceilings
- Passive cooling through night ventilation
- Natural ventilation
- Solar plans for hot water building B

Energy performance



Energy
performance
139 kWh/m² år

Energy
performance
106 kWh/m² år

Overall energy performance 115 kWh/m² år
B - classification according to Norwegian Energy performance codes

Lesson learnt

- Commitment from building owner has a large impact on the process and results
- Look for opportunities not for constraints
- Environmental- and energy facilitator should be placed central in the project
- IED can be applied in refurbishment projects
- Carry through energy assessment during the project- and construction stages
- Ask questions – challenge “use to do” / “common practice”
- Carry through instructions and seminars for project group and construction workers
- Energy efficient refurbishment is possible



Tænk forebyggelse frem for behandling

Byggeteknisk regulering



Installationsteknisk regulering



Forebyggelse

Behandling