EU demands will affect our current commitments

- Final confirmation of EU climate demands Norway has committed to follow.
- EU`s climate demands
  - 40% national cuts before 2030
  - Yearly ambitions from 2020
  - If not met added 8% on yearly cuts
  - Considerable fine for not reaching demands
  - **30% cut in energyuse in buildings by 2030**

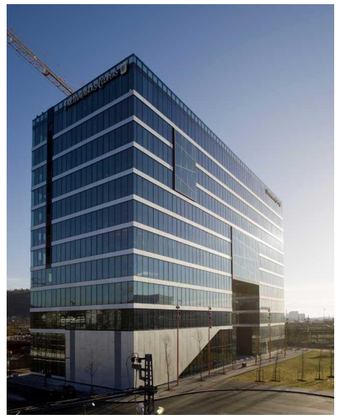
ChromoGenics

Different sectors are changing rapidly: Stating demands for new technology and sustainable decisions

- Transport sector is undergoing electrification

- Energy sector revolution. PV is cheaper than coal.

- Buildings are next



-This is the housing standard of the future,

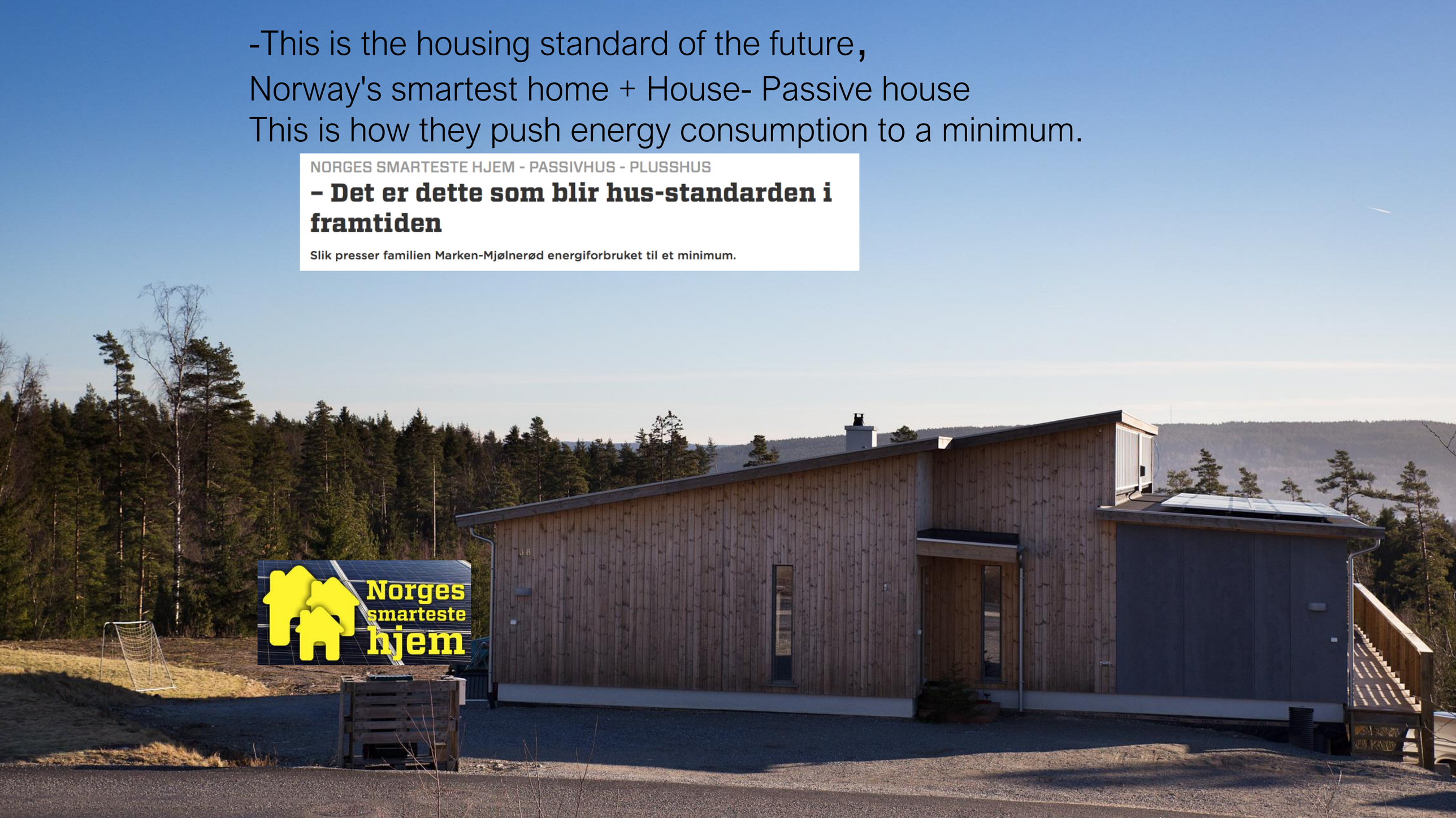
Norway's smartest home + House- Passive house

This is how they push energy consumption to a minimum.

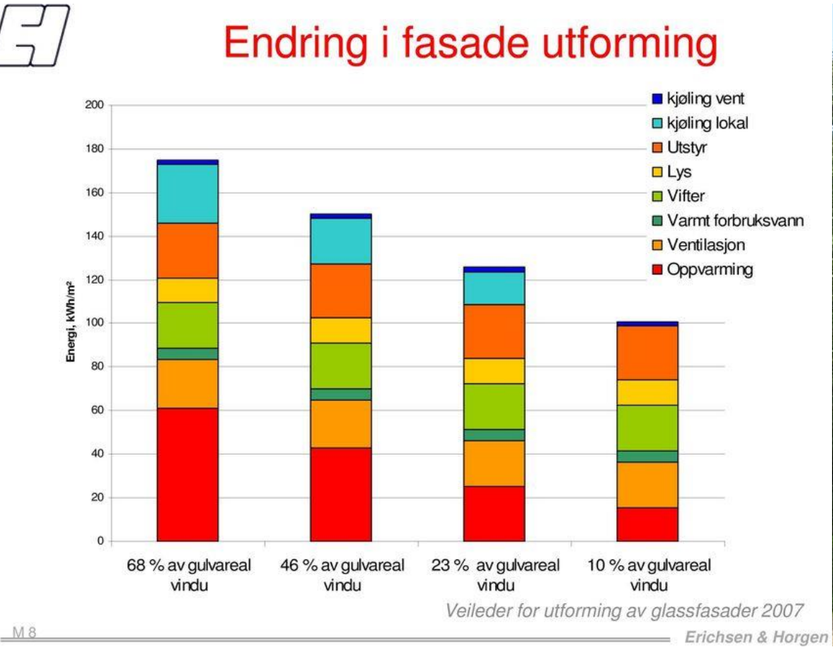
NORGES SMARTESTE HJEM - PASSIVHUS - PLUSSHUS

– Det er dette som blir hus-standarden i framtiden

Slik presser familien Marken-Mjølnerød energiforbruket til et minimum.



Architecture
is affected, **limits pushed with existing technology**

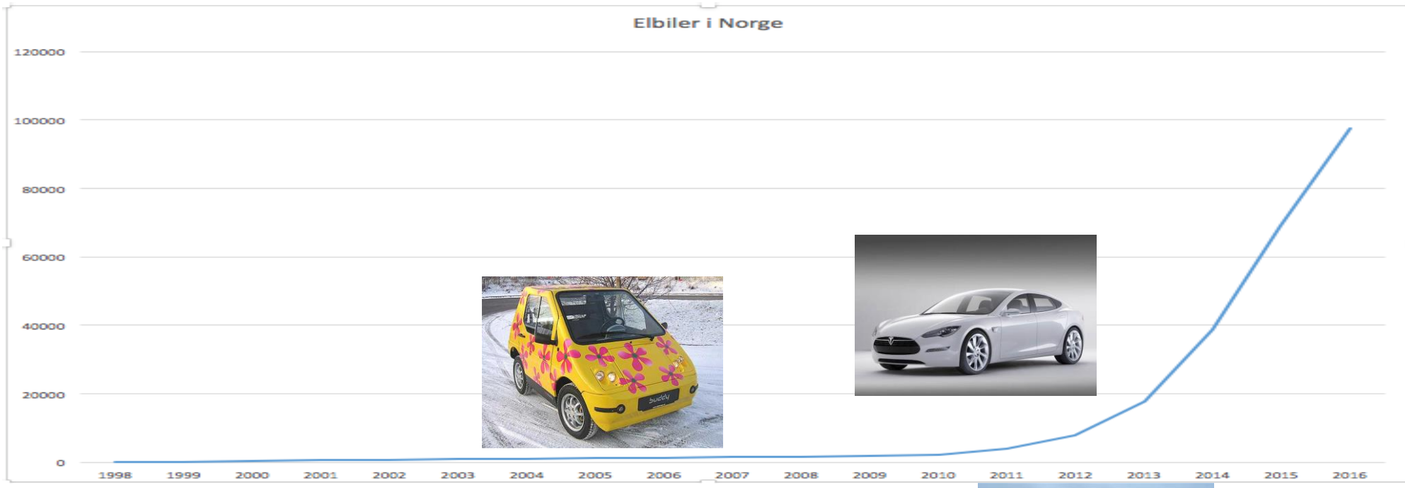


First Passive house Oslo 2009

Geir Grung 1964

- Society's needs enforces focus on change, to solve our needs creates **acceleration**

1. **Climate** changes and **regulations create needs**
2. **Strong political motivation** and will to move from old technology to the benefit of new solutions
3. **Technology** development Increased focus
4. **State market** power is used as a drive force for change.
5. **Technology development is** accelerating change, when providing us with **more of what we want, less of what we do not want, and meets our needs and use.**

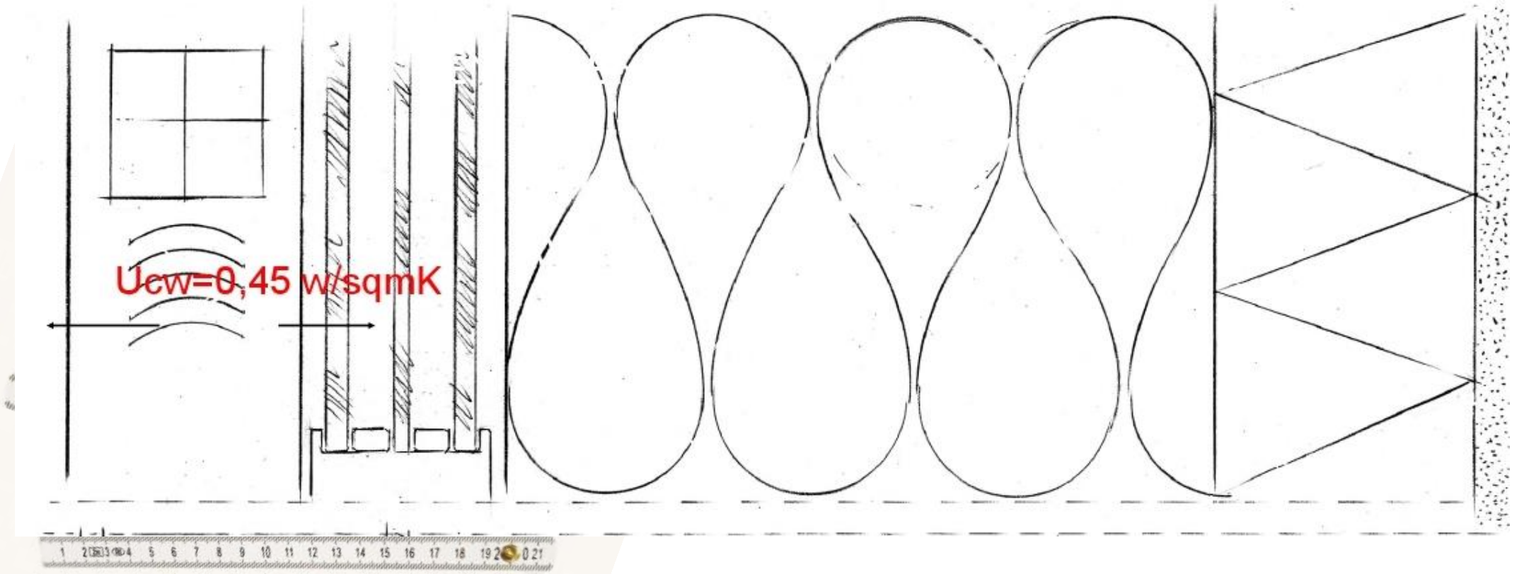


1959 Glava from Svartisen to Sahara

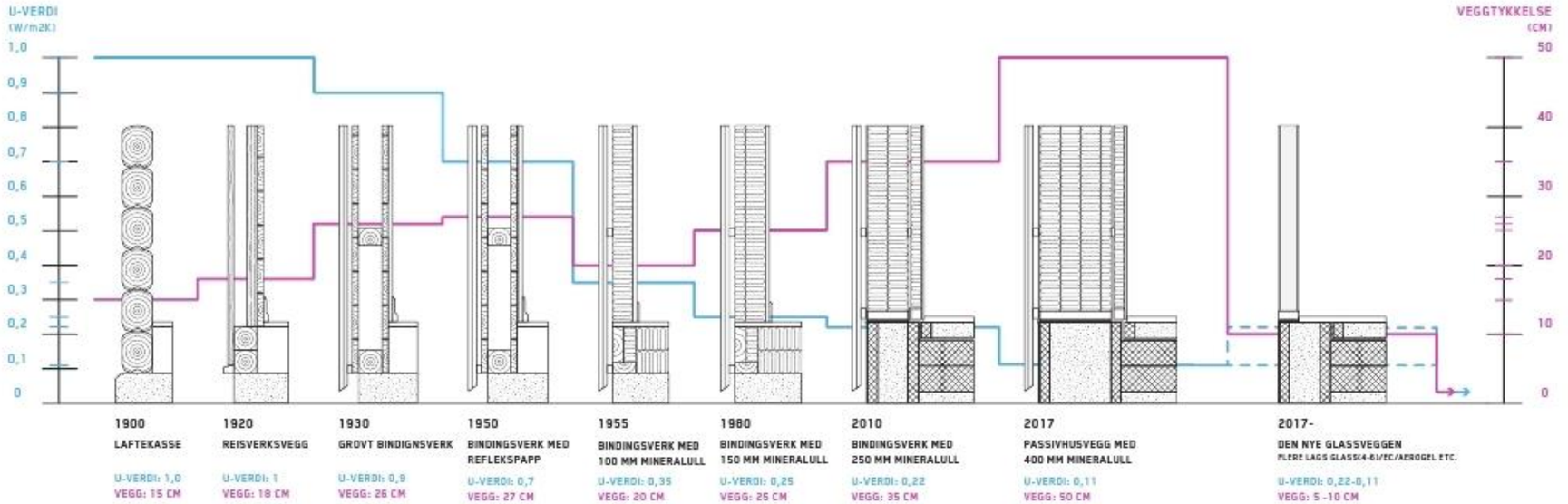
2009 Oslos first Passive house

Conventional construction has reached its limit,

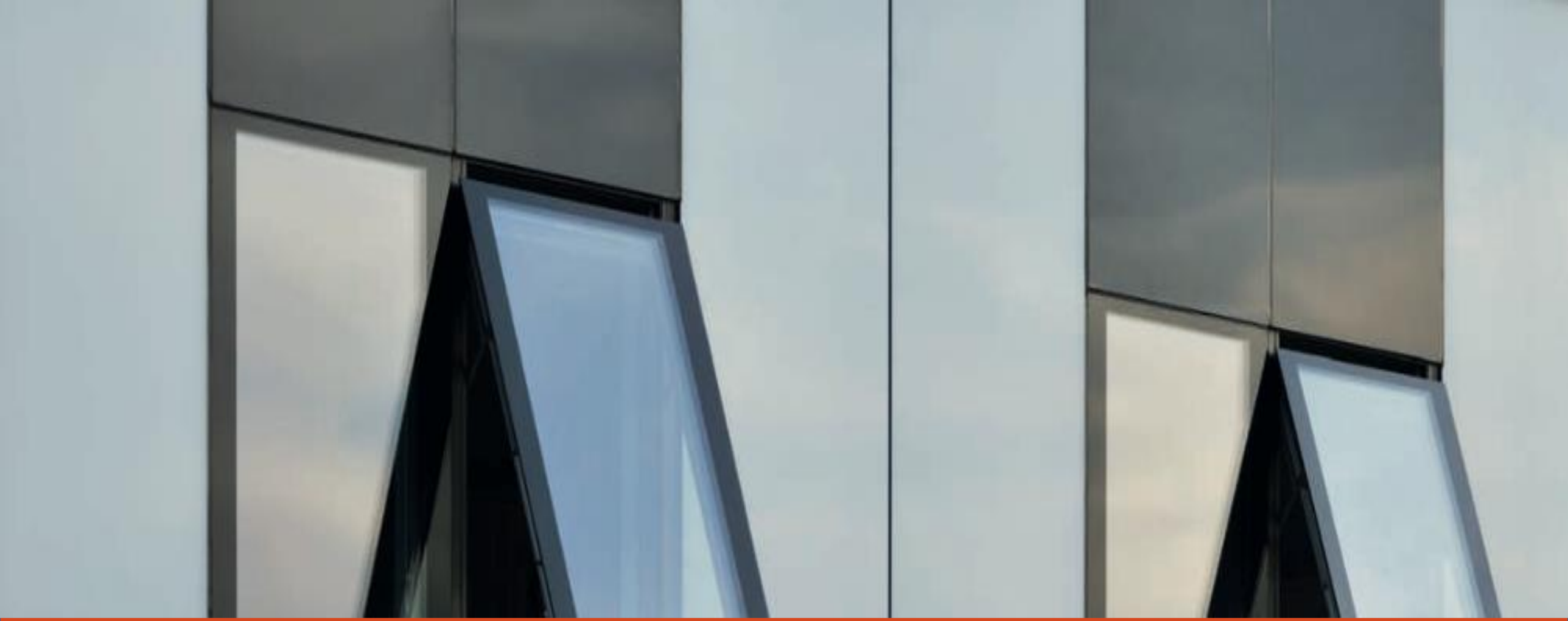
Energy and wall thickness



© 2017 Element Arkitekter AS



PÅSTAND: DYRT, HELSEFARLIG OG MILJØFIENTLIG BLINDSPOR.



Behind the facade

Current status: meeting ambitions with market technology

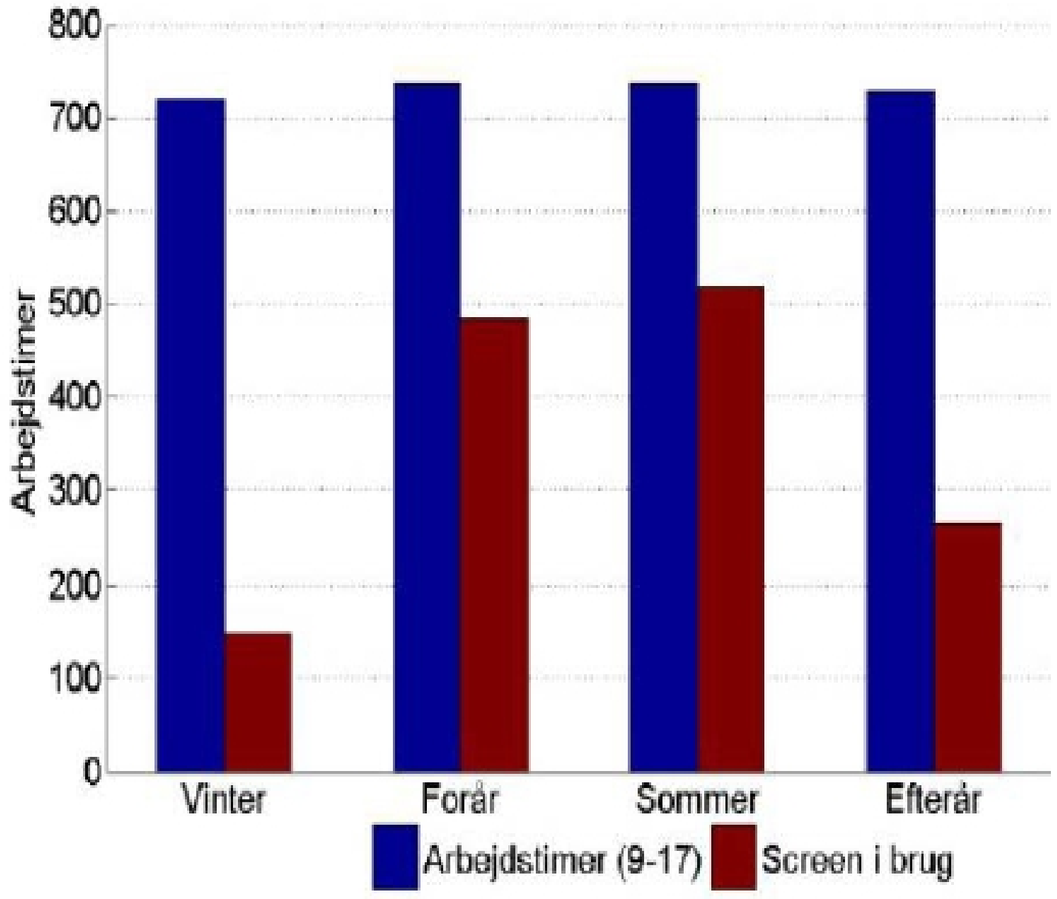
Energy focus impact onArchitecture

External Sun Shading


EKSPORTFINANS
ALIMAK

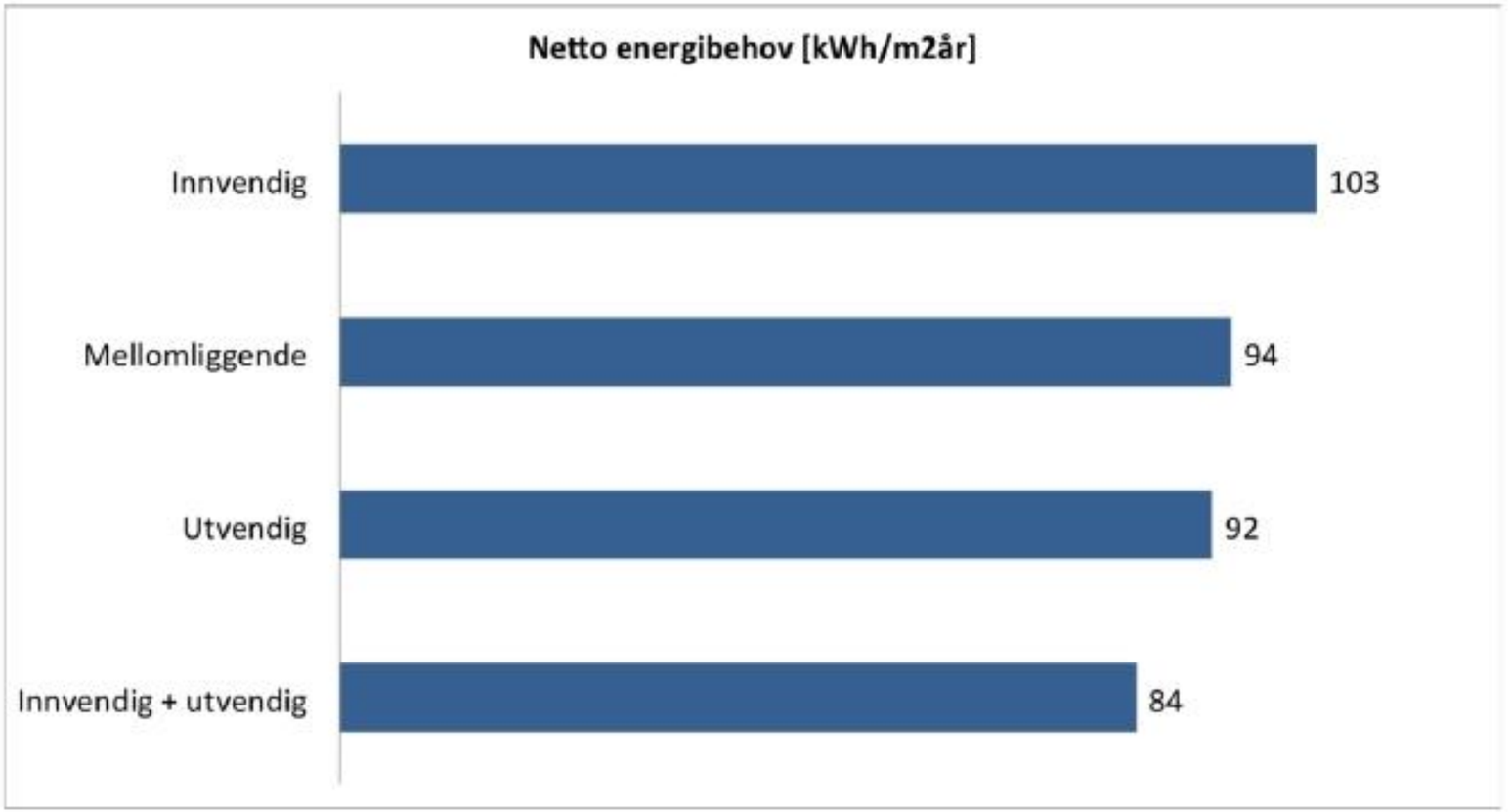
View blocked 60-70% of working hours, and increasing

Årstid	% af arb-ejdstiden
Vinter	21%
Forår	66%
Sommer	70%
Efterår	37%



EXTERNAL SUNSHADING AESTETHIC

20%less energy consumption, with optimal operation



Inner blinds

In between blinds

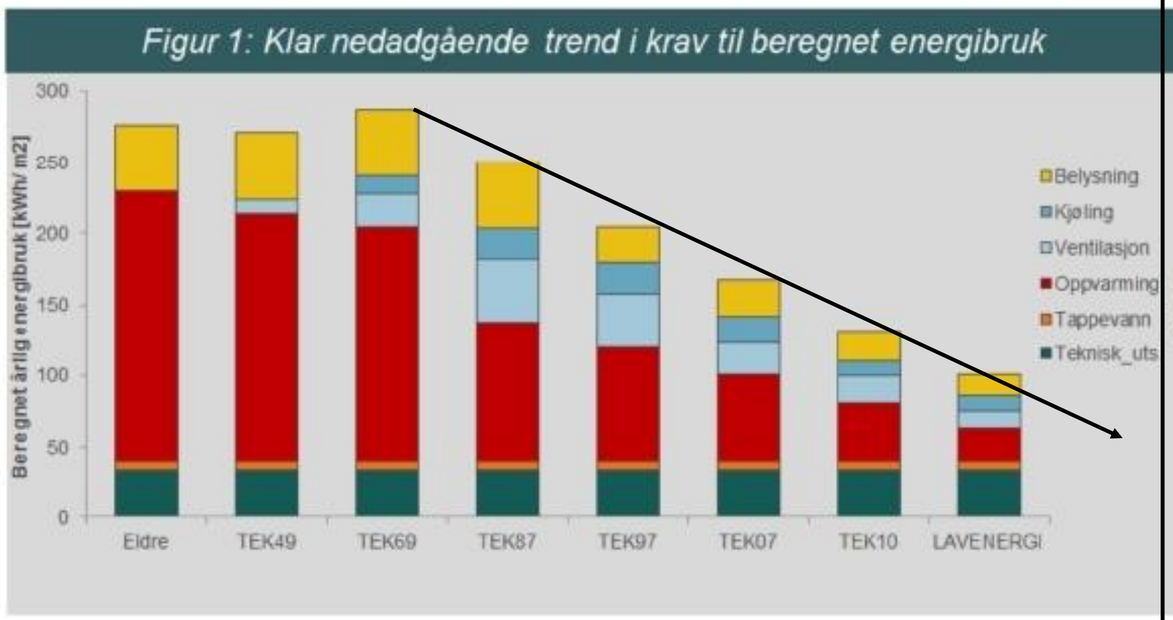
Outer sun shading

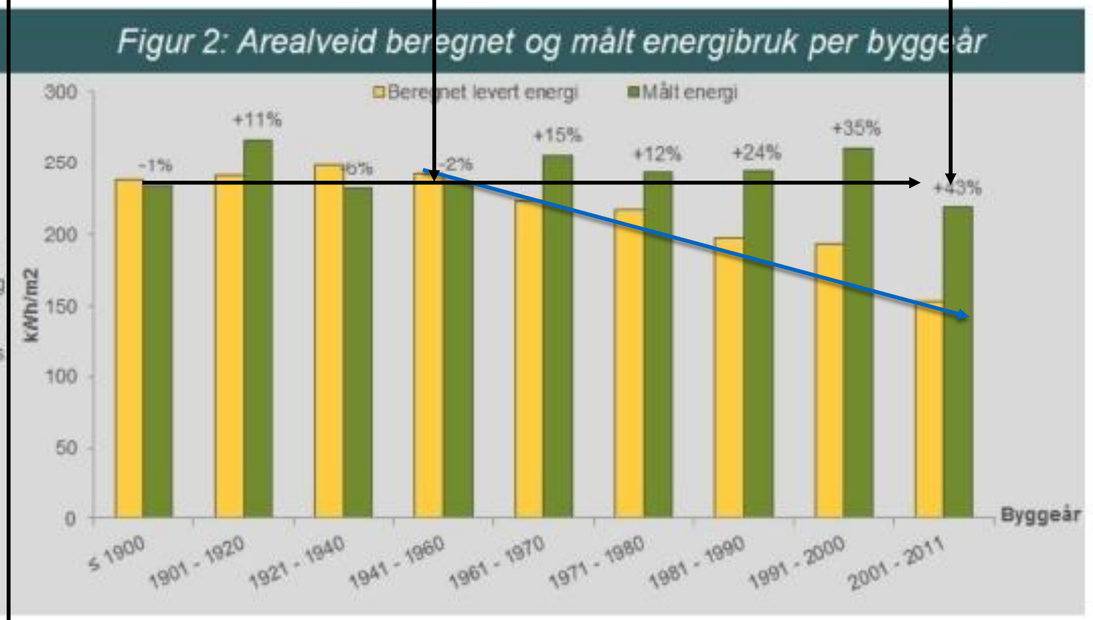
Outer + inner blinds

Beregnet netto spesifikt energibehov for cellekontor i et passivhus, med ulike former for solskjerming. Alternativet innvendig + utvendig er en enkel sesongregulering: Innvendig solskjerming om vinteren (fra november til mars), og utvendig om sommeren. (Fra april til oktober). KILDE: Glass i fasader og solskjerming/ Erichsen & Horgen.

Are we going in the right direction?
Are we meeting ambitions and needs

NVE Report 2013





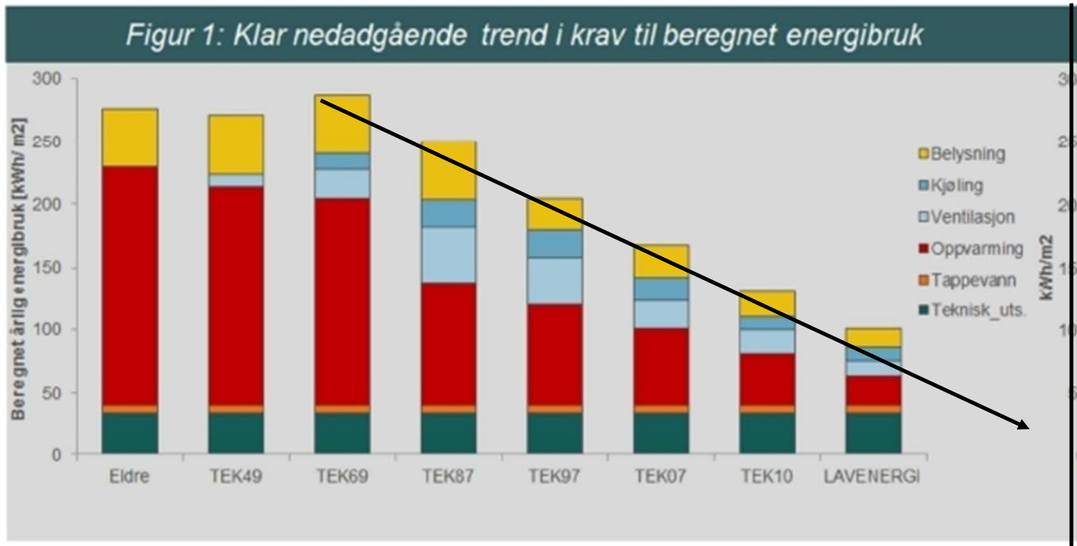
State ambitions and requirements

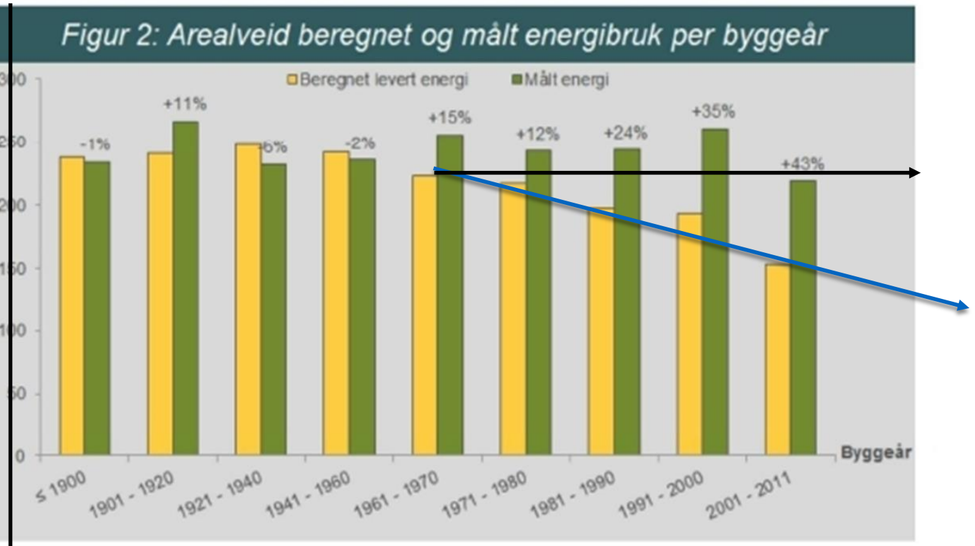
Reality 1:calculated energy consumption

Reality 2 Real energy consumption

TRI MO Q·Air

AS LONG AS CALCULATIONS AD UP, INNOVATION SUFFERS



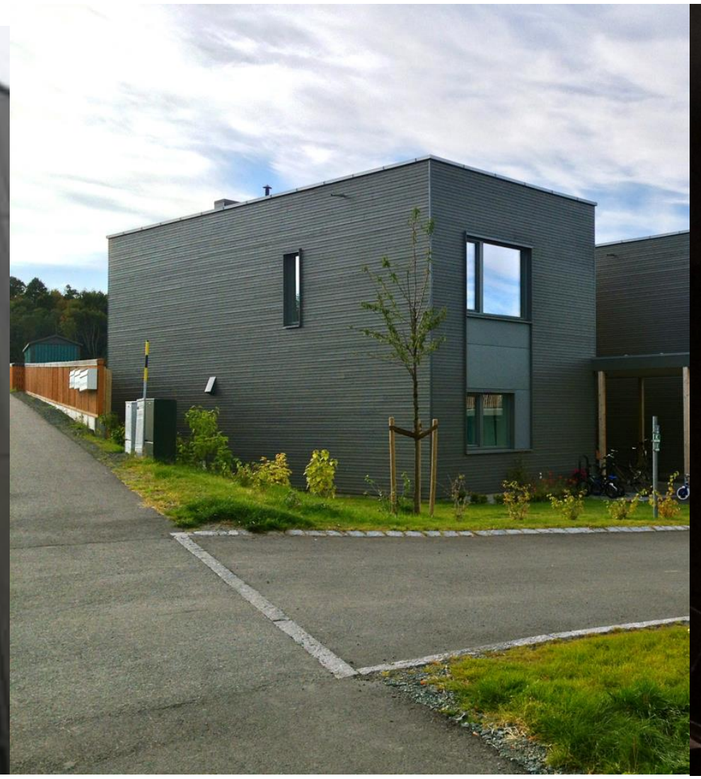


Better performing solutions **was needed yesterday**
Is needed today
And **will be needed to meet future demands** and regulations

TRI MO Q·Air

To reduce energy consumption . Do we sacrifice?:

.



Daylight View Space Design ..and change our behavior


To take short cuts is a part of human nature
WE ACCEPT NO COMPREMISE ON VIEW, THERMAL COMFORT AND DAYLIGTCONDITIONS
and it will effect energy consumption
Until we have technology that meets our use and needs and energy ambitions, not the opposite.

- The first important Step(Arcitecture 2030 - Edward Mazria)

- Over the next twenty years, an area equal to a *staggering 3.5 times* the entire built environment of the U.S. will be redesigned, reshaped, and rebuilt globally. If all these buildings are designed and constructed using traditional inefficient approaches, and are powered by electricity produced by burning fossil fuels, there is no way to avoid irreparably damaging the planet's climate.

- The first step is design; to integrate **sustainable and passive design strategies** that are low-cost or no-cost. This can get you 70-80% of the way there. For example, **how you orient the building, shade the glass, incorporate daylighting and passive heating and cooling strategies**, and the materials and systems you specify. These approaches dramatically reduce the energy the building requires.

- The second step is to provide fossil-fuel-free energy; ideally from on-site renewables, or from accessing district or utility-scale renewable energy produced off-site.

FREMTIDEN VINDU MÅLSETTING: Muligheter

- Økt utsyn ved fjerning av utvendig solskjerming
- Arkitektonisk frihet, ikke begrensninger i glassarea
- Redusert energiforbruk
- Økt komfort
- Tynnere vegger

Hvordan?

Angripe det svakeste leddet glass
og utnytte det største potensialet,
varmetilskuddet fra solen.

Ballancing heat gain and heat loss

Solvarmegevinst (g-verdi)

Varmetap (U-verdi)

Energi-balanse

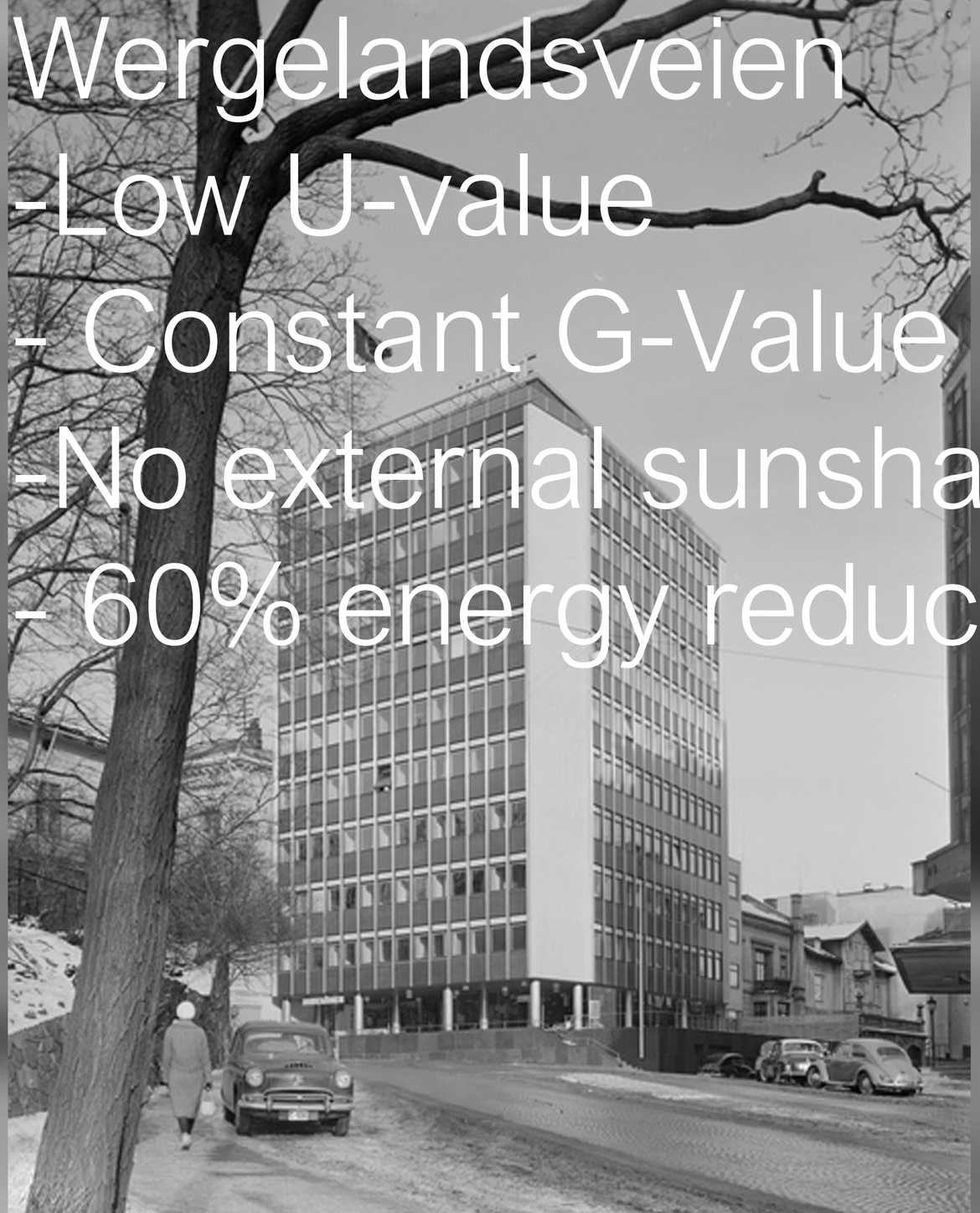
Wergelandsveien

-Low U-value

- Constant G-Value

-No external sunshading

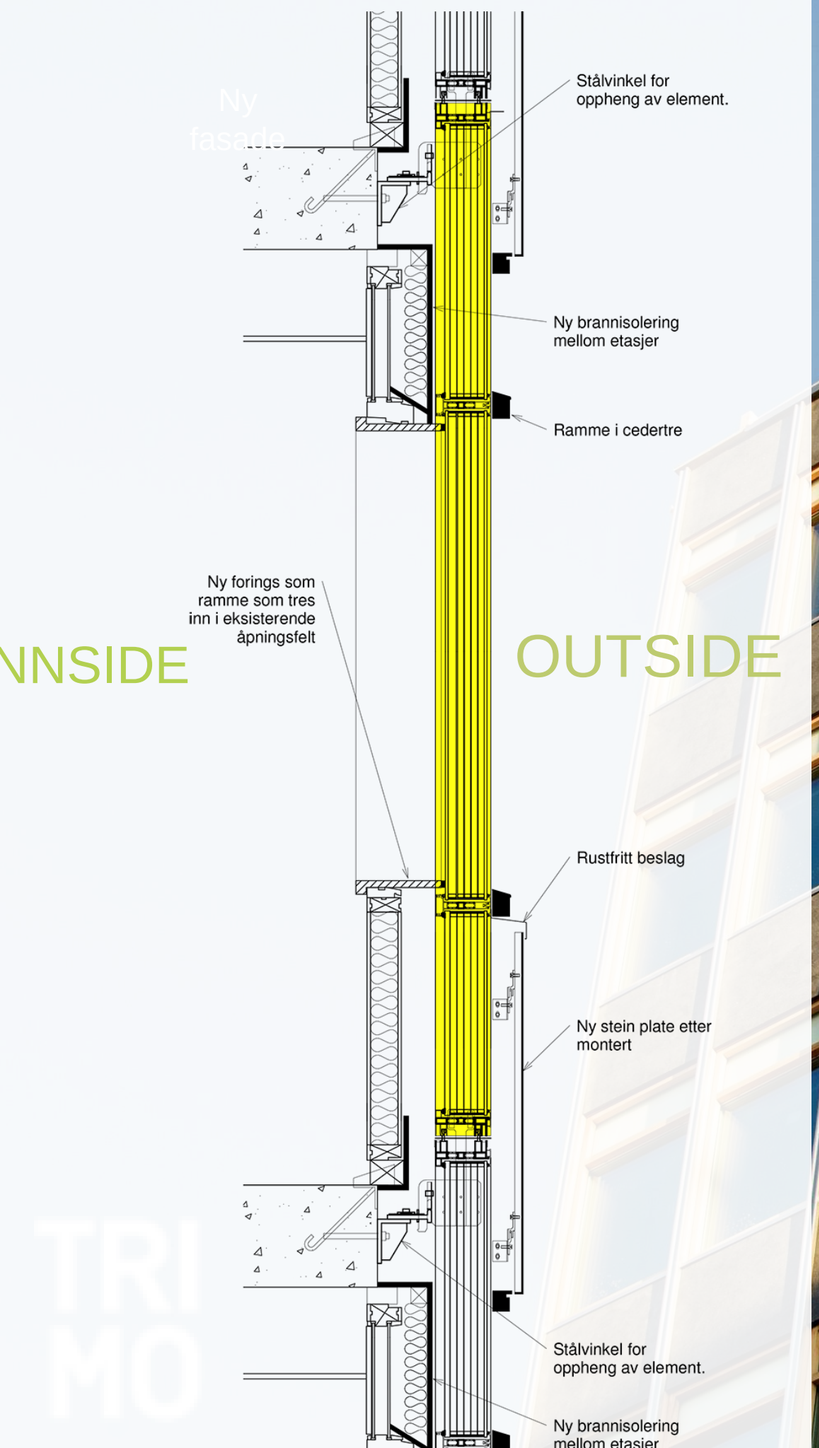
- 60% energy reduction



HÖEGH EIENDOM

External sunshading from 1980

STARTING POINT



FERDIG BYGG

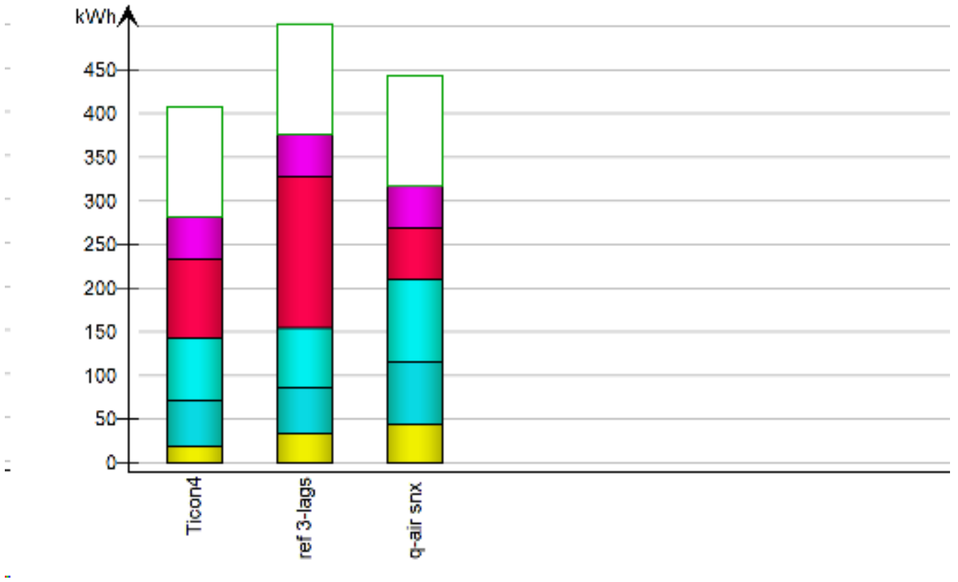
HÖEGH EIENDOM

1958
2016

Energireduksjon

	Ticon4		ref 3-lags		q-air snx	
	kWh	kWh/m²	kWh	kWh/m²	kWh	kWh/m²
Lighting, facility	18	1.9	33	3.4	43	4.5
Electric cooling	53	5.5	54	5.6	72	7.5
HVAC aux	71	7.4	68	7.1	94	9.8
Total, Facility electric	142	14.8	155	16.2	209	21.8
Fuel heating	90	9.4	173	18.0	59	6.2
Domestic hot water	48	5.0	48	5.0	48	5.0
Total, Facility fuel*	138	14.4	221	23.0	107	11.2
Total	280	29.2	376	39.2	316	32.9
Equipment, tenant	127	13.2	127	13.2	127	13.2
Total, Tenant electric	127	13.2	127	13.2	127	13.2
Grand total	407	42.4	503	52.4	443	46.2

*heating value



arc sys
architectural systems

Energireduksjon

	Ticon4		ref 3-lags		q-air snx	
	kWh	kWh/m²	kWh	kWh/m²	kWh	kWh/m²
Lighting, facility	18	1.9	33	3.4	43	4.5
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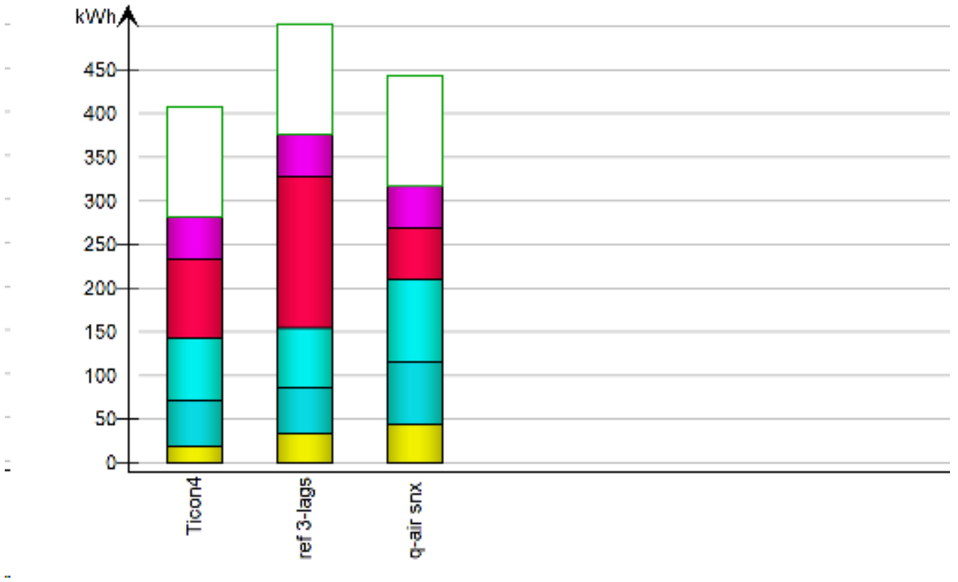
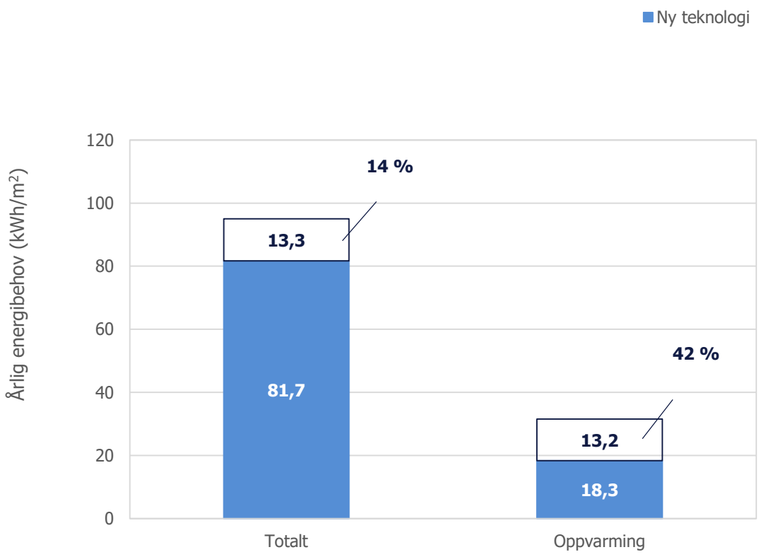
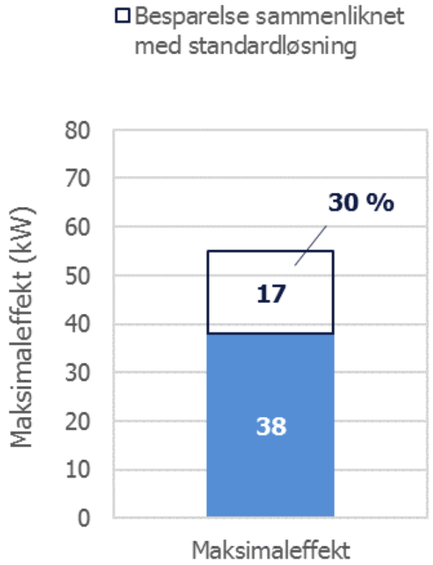


arc sys
architectural systems





14 % for totalt årlig energibehov

42 % for årlig energibehov til rom- og ventilasjonsoppvarming

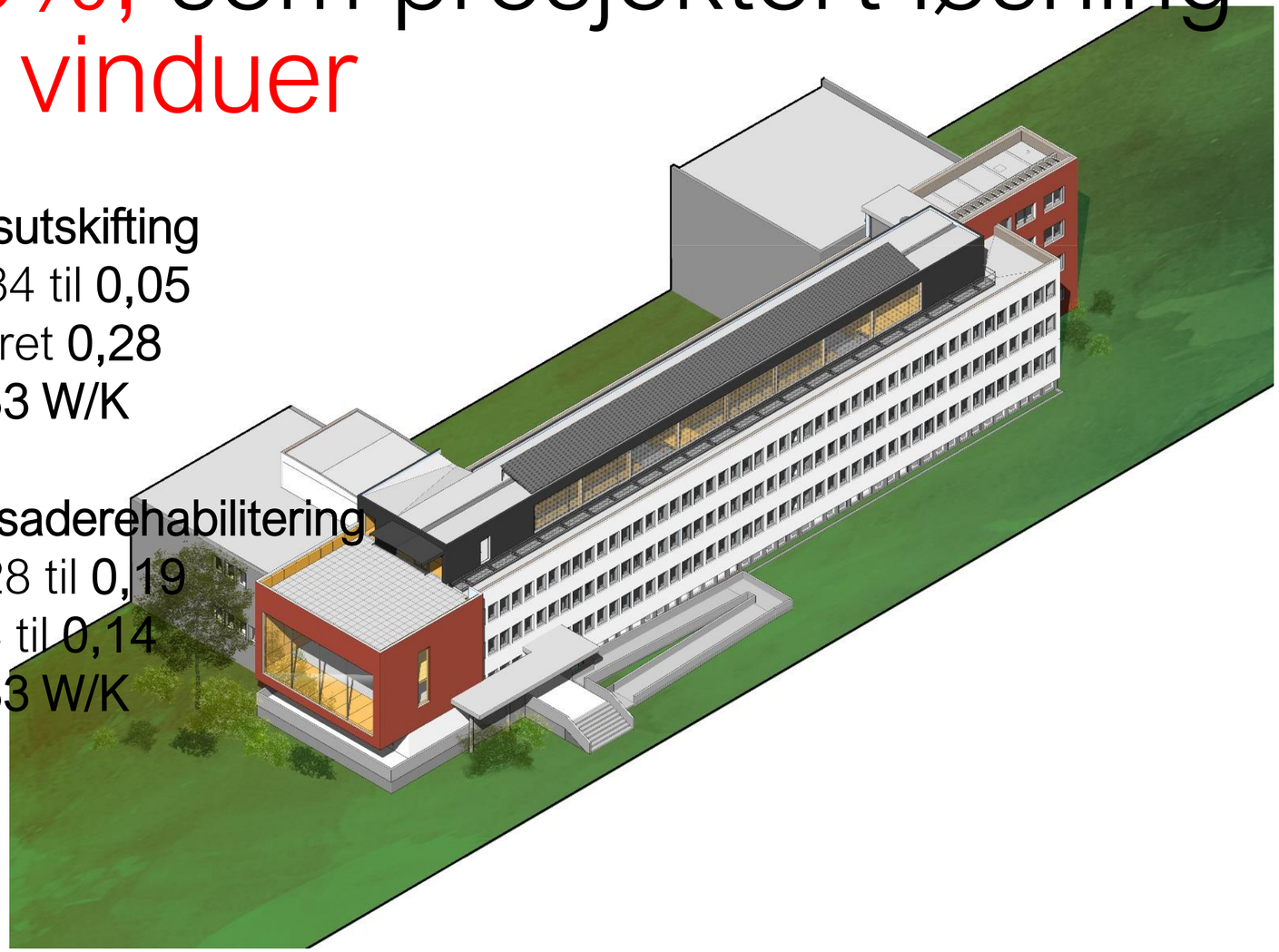
30 % for maksimalt effekbehov til romoppvarming

TF Bygget NMBU 2018

Samme varmetap 50%, som prosjektert løsning ved kun utskifting av vinduer

- Ug 0,27 løsning kun Vindusutskifting
  - Varmetapstall vindu fra 0,34 til **0,05**
  - Varmetapstall vegg uendret **0,28**
  - **Totalt varmetapstall 0,33 W/K**

- Prosjektert Ug 0,55 løsning total fasaderehabilitering
  - Varmetapstall vegg fra 0,28 til **0,19**
  - Varmetapstall vindu 0,34 til **0,14**
  - **Totalt varmetapstall 0,33 W/K**



TF Bygget
NMBU

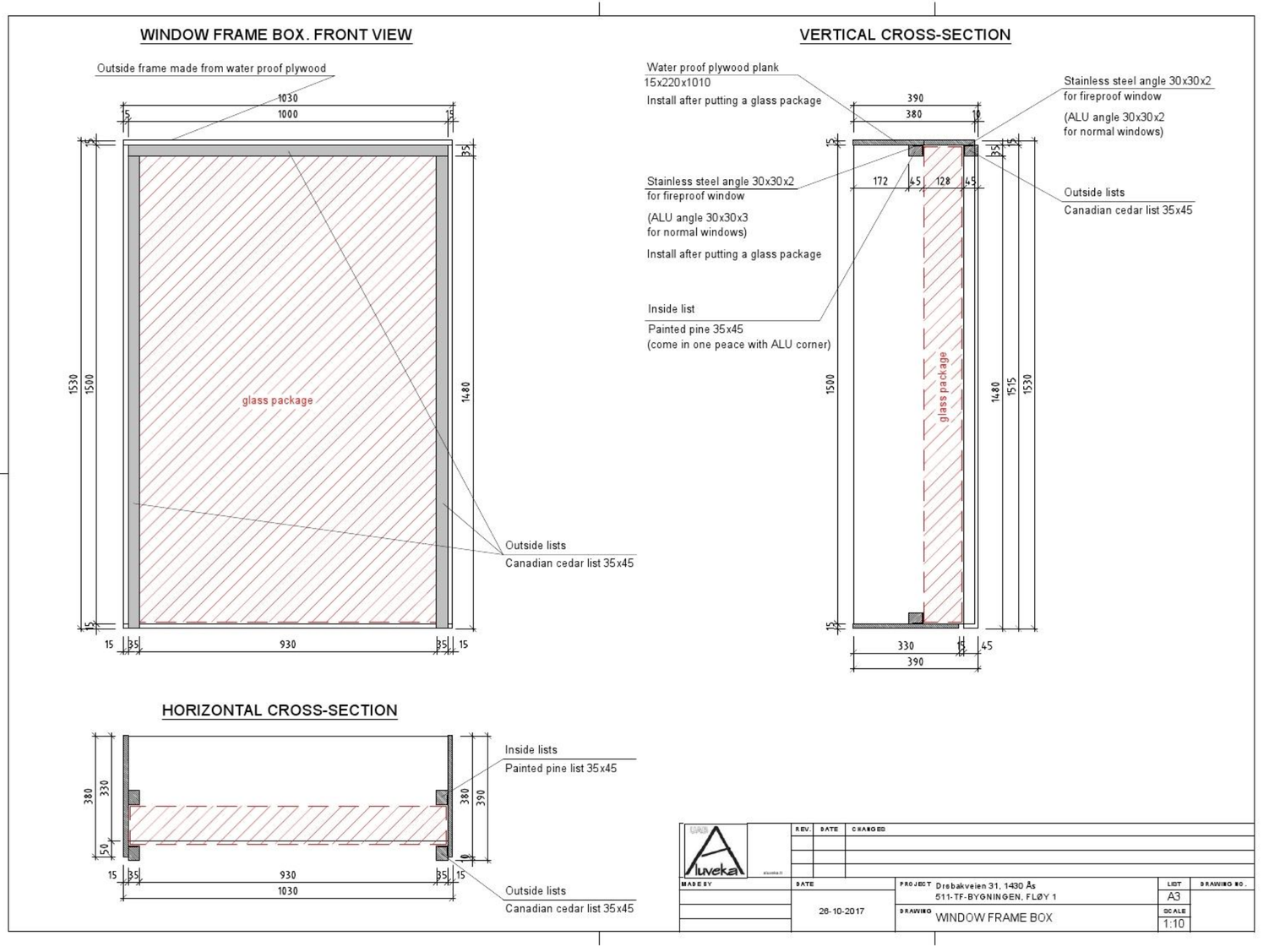
58% lavere varmetap med 6 lags vinduer

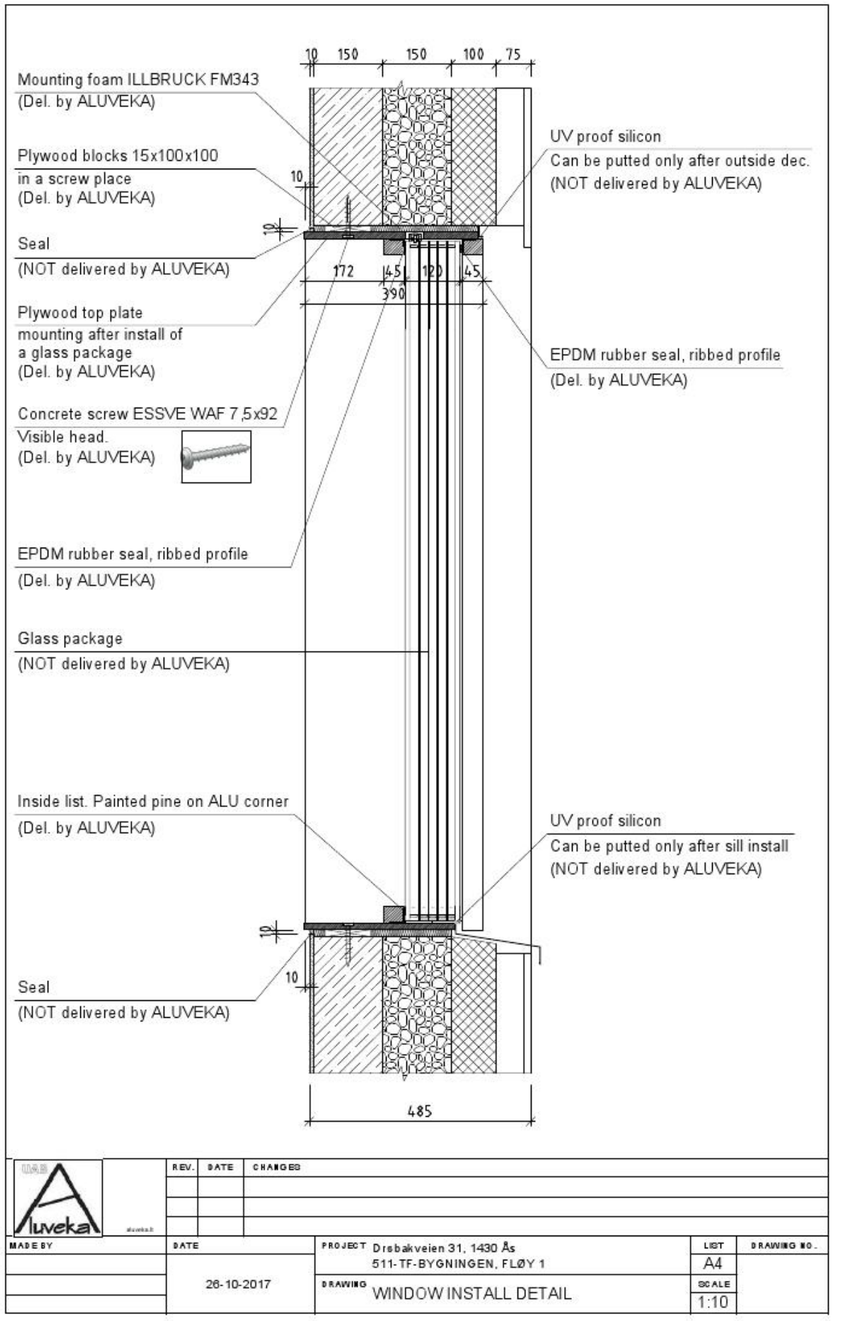
Eksisterende varmetapstall 0,62

- **Prosjektert løsning**
- Varmetapstall vegg fra 0,28 til 0,19
- Varmetapstall vindu 0,34 til 0,14
- **Samlet varmetapstall** fra 0,62 til **0,33 W/K**

- **Q-Air løsning total fasade rehabilitering**
- Varmetapstall vindu fra 0,34 til 0,14 til 0,05 W/K
- Varmetapstall vegg fra 0,28 til 0,19 W/K
- **Samlett varmetapostall** fra 0,62 til 0,33 til **0,24 W/K**

TF Bygget NMBU



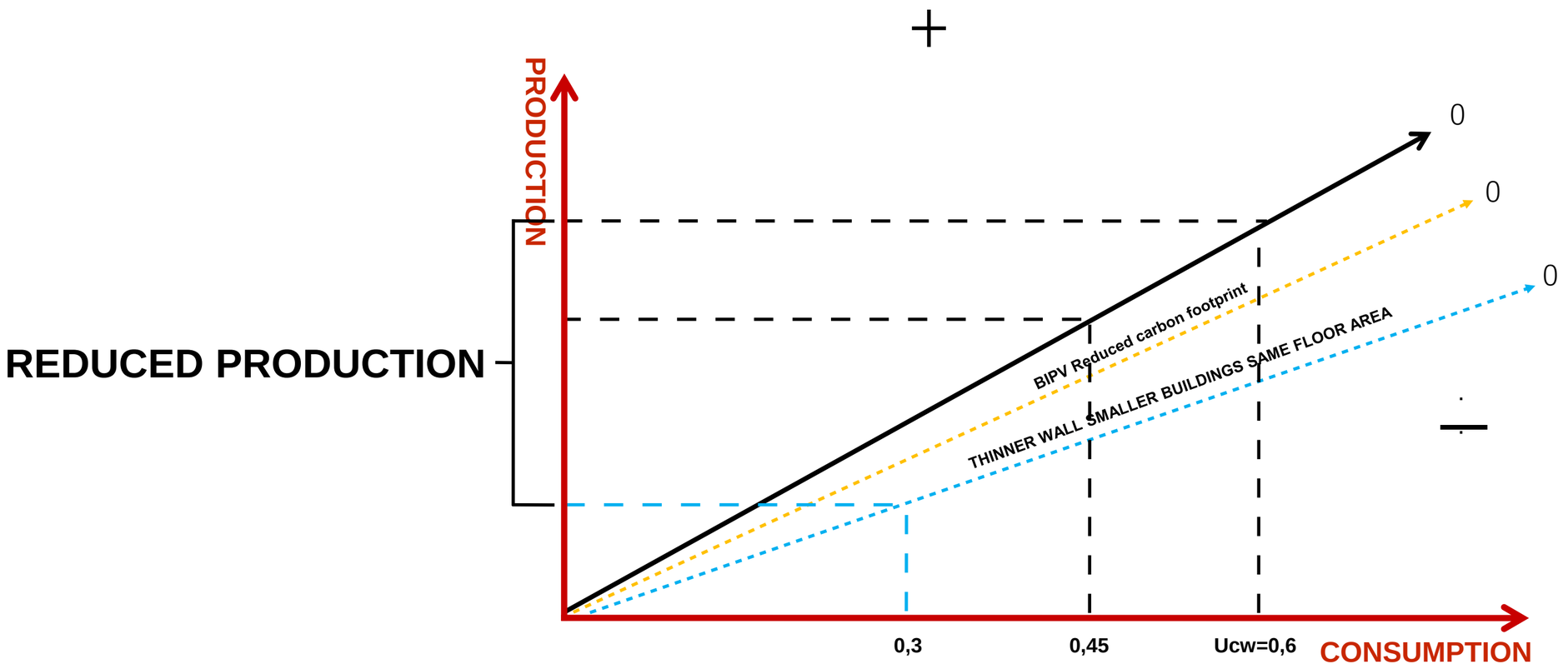


Ucw= 0,3 W/m2K

arc sys
architectural systems

The building as an entity?

Production BIPV and heat loss (consumption)



Balancing heat gain and heat loss adding production and dynamisk G-verdi Elektrokromt glass

Solvarmegevinst (g-verdi)

Varmetap (U-verdi)

Energi-balanse

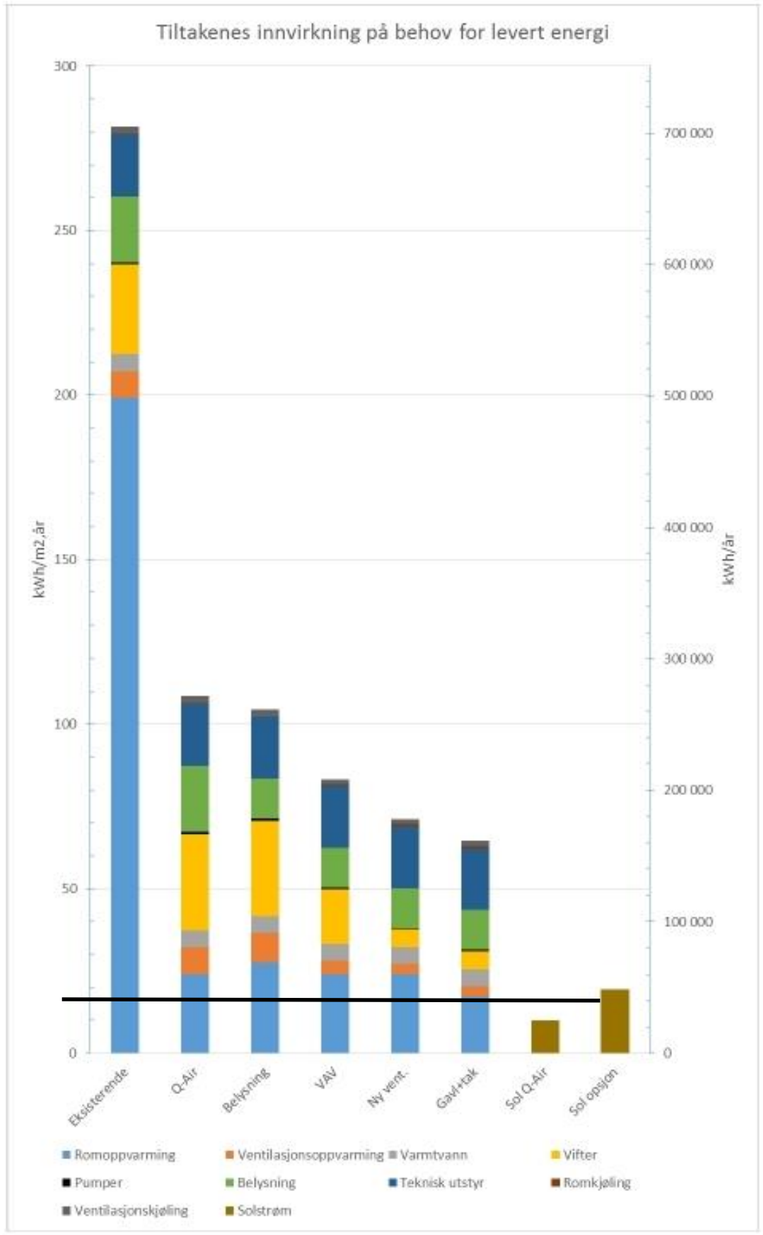
+ BIPV production

Ticon Bygget
DRAMMEN, NORGE

Wergelandsveien
-Low U-value
- Constant G-Value
-No external sunshading
- 60% energy reduction

ConverLight® Paragon
ConverLight® Energy

-Low U-value
- Dynamic G-Value
-100% View
- BIPV
- 85% reduced energy consumption



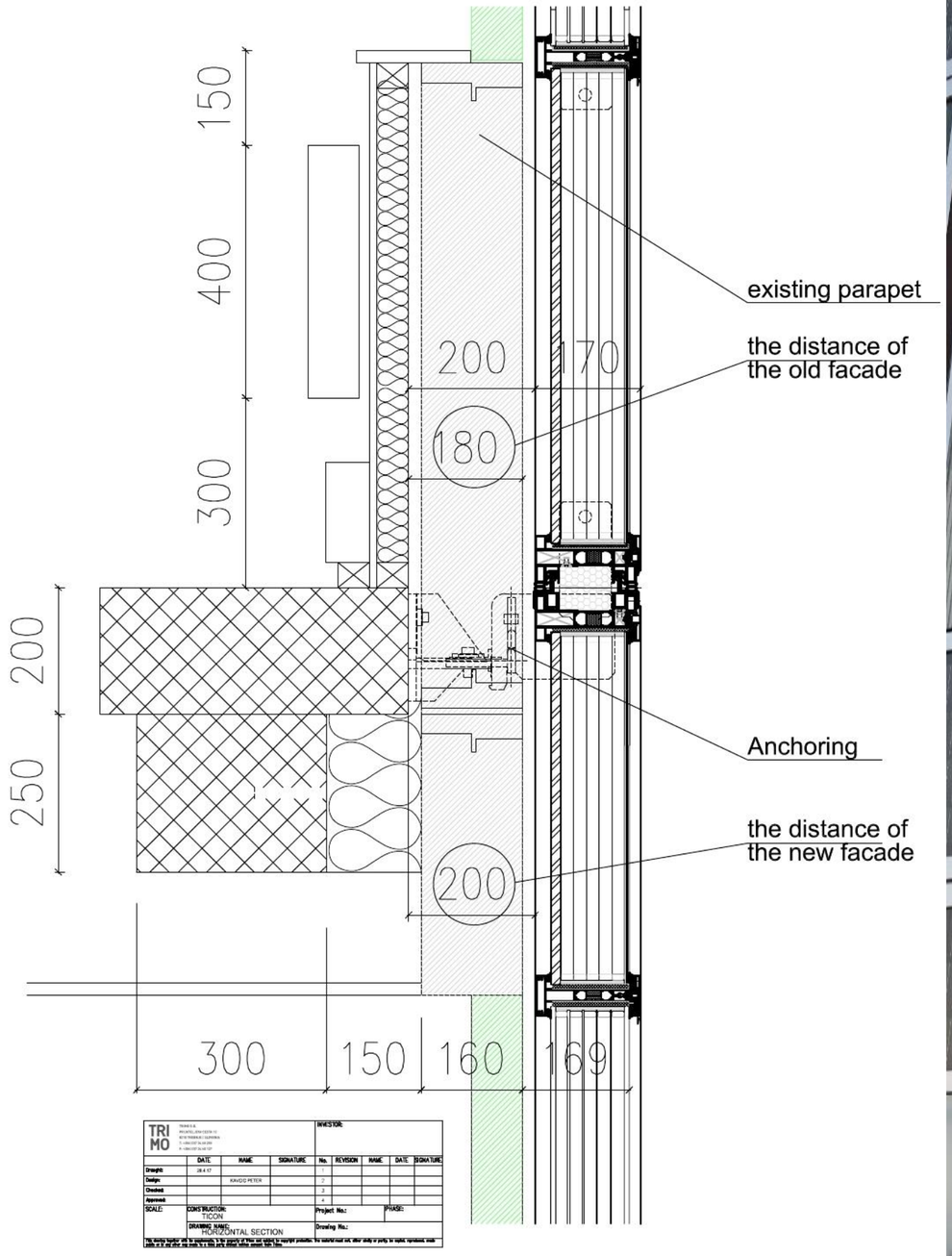
Figur 6 Diagram med levert energi før og etter tiltak

Tabell 4 og 5 under viser verdiene som ligger til grunn for diagrammet (figur 6). Tabell 4 viser totalt levert energi, mens tabell 5 viser spesifikt levert energi.

Report Multiconsult for energy savings Ticon Bygget

- **61%** Energy reduction Q-Air
- All other measures additional **16%**

No sunshading, 48% energy saved on lighting compared with automatic external sunshading



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Checked:				3				
Approved:				4				
SCALE:	CONSTRUCTION: TICON			Project No.:			PHASE:	
	DRAWING NAME: HORIZONTAL SECTION			Drawing No.:				

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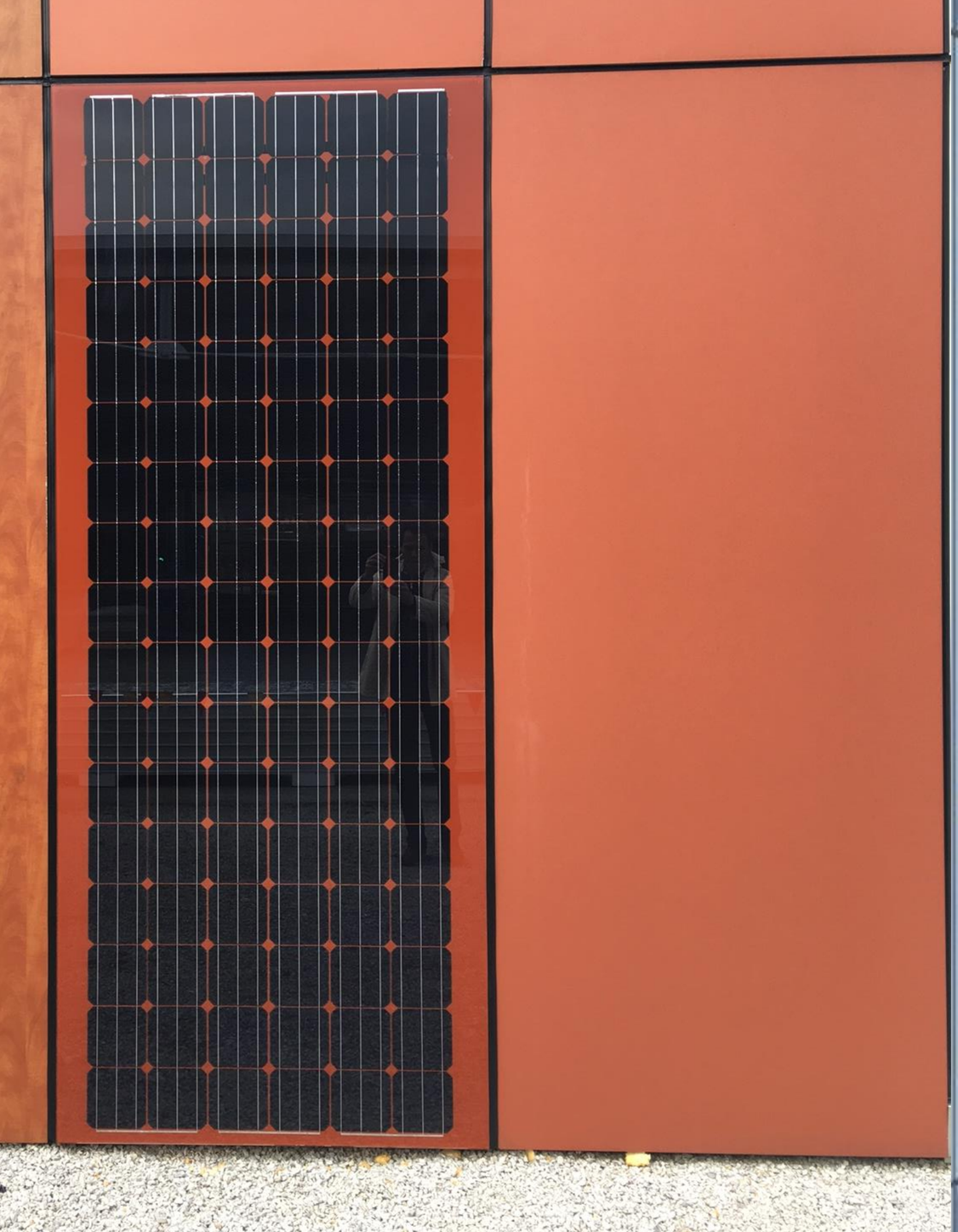
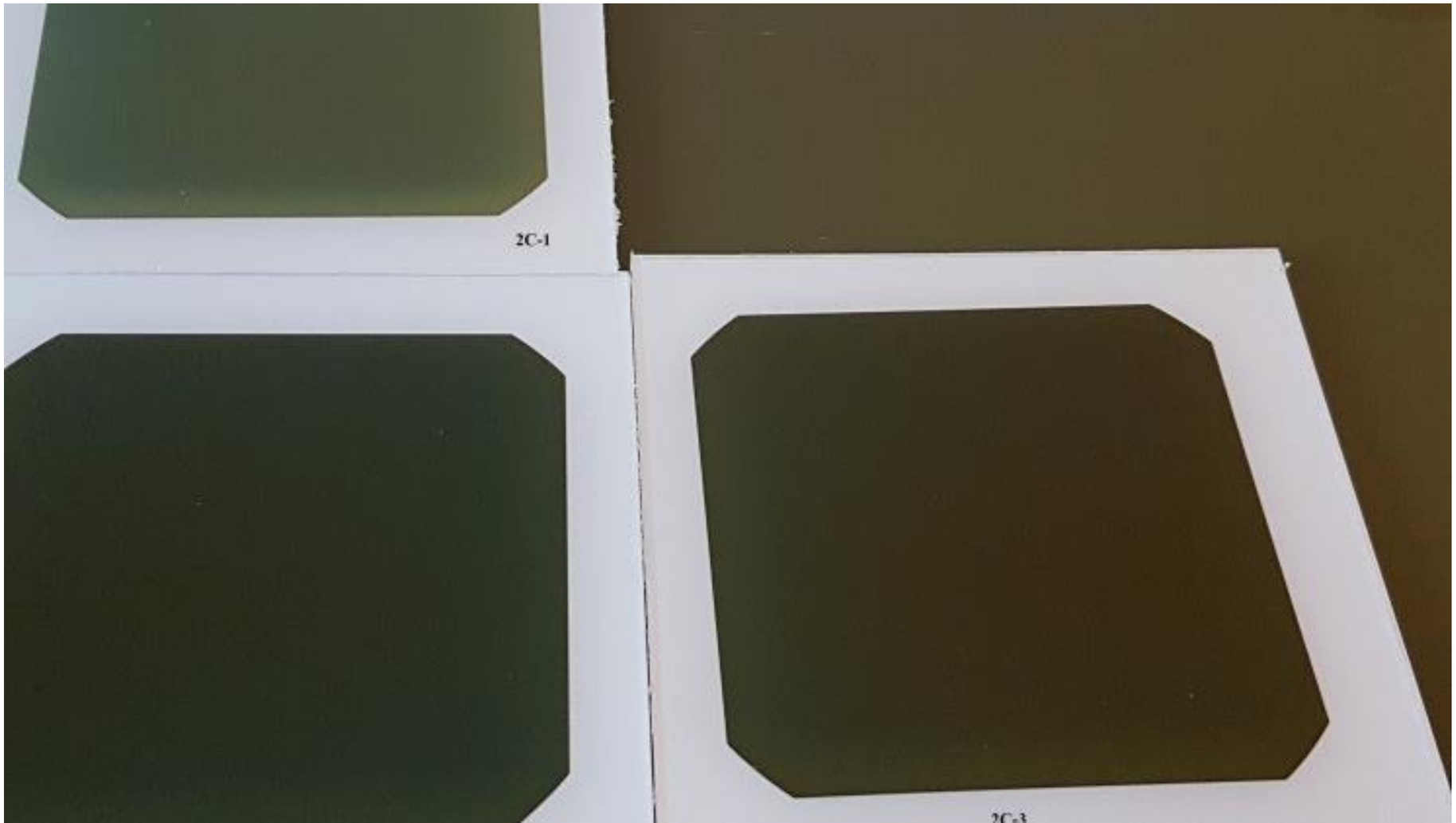


Q-Energy

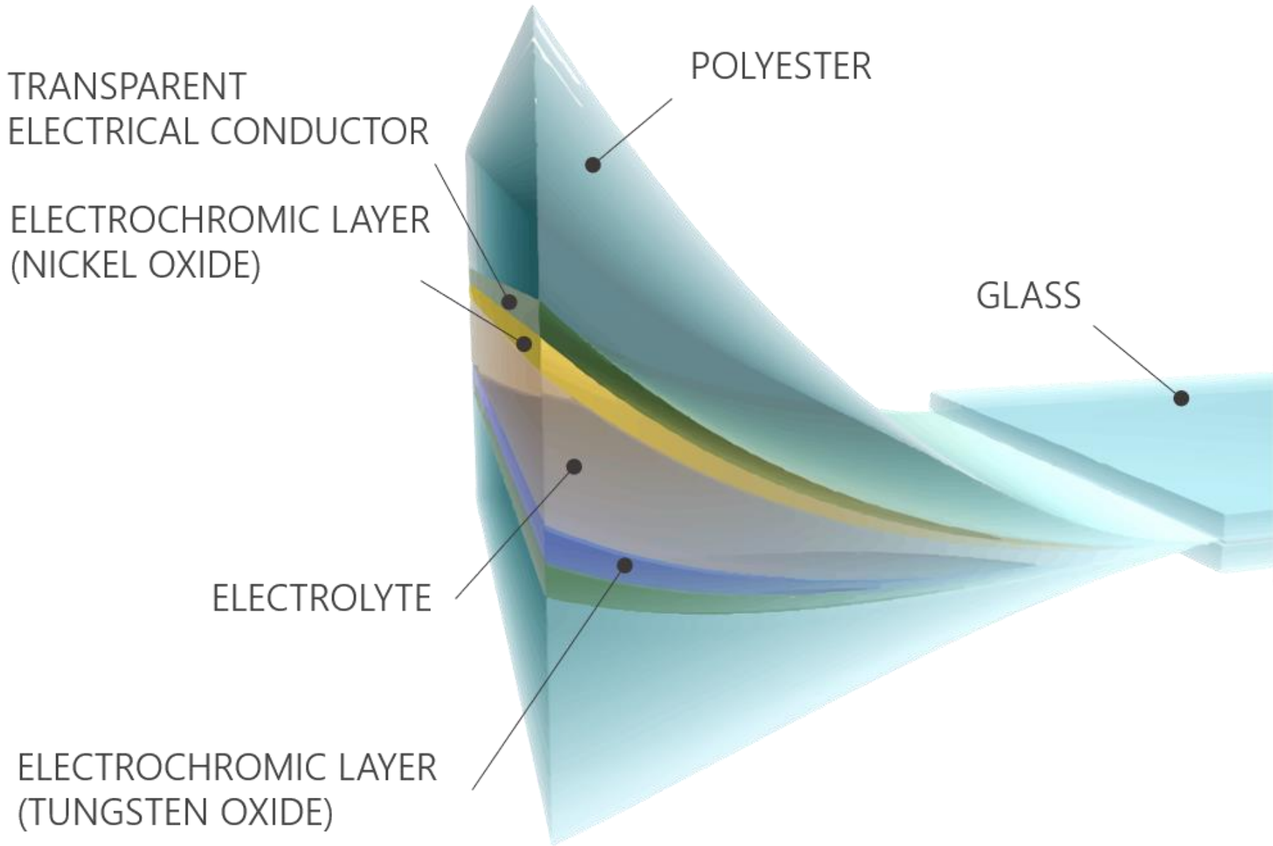
-15 cm wall,
Integrated PV

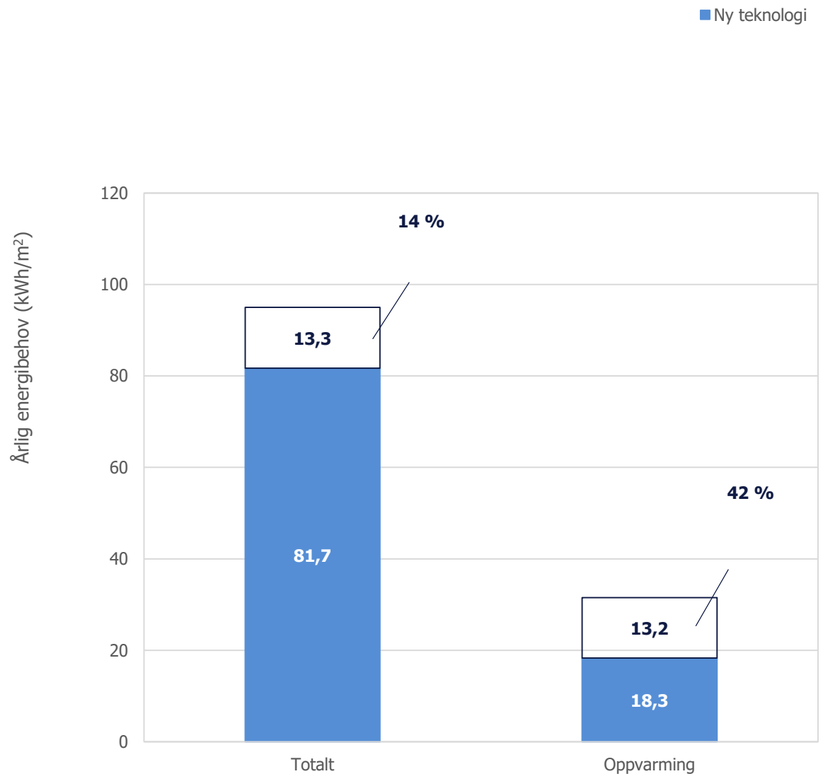
Developing mono wafers with correct colour

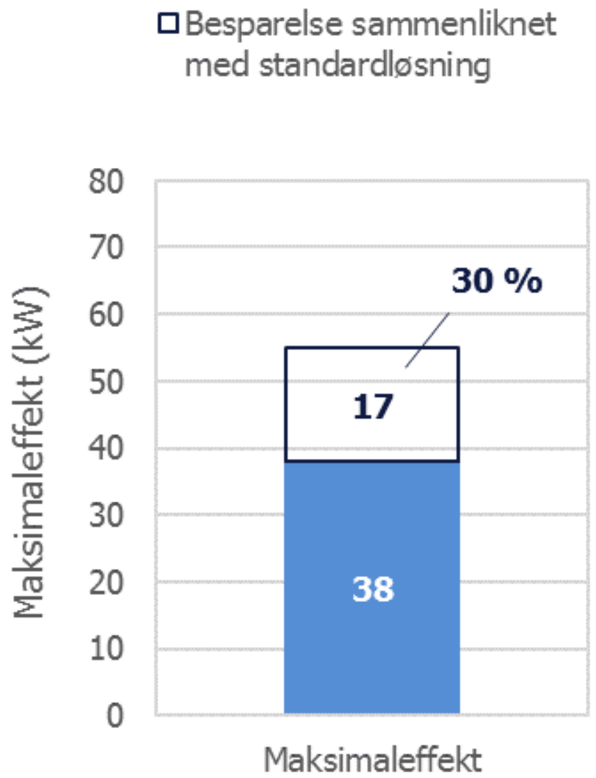


Electrochromatic glasses from Chromogenics

- Patented laminerad between glasses Charged darker, uncharged lighter
- Energyconsumption only when switched (c:a 0.25kWh/m2,år)
- Switch same tinme and sequence as eysr app 20 min. Reduced glareTydlig effekt redan efter ett par minuter







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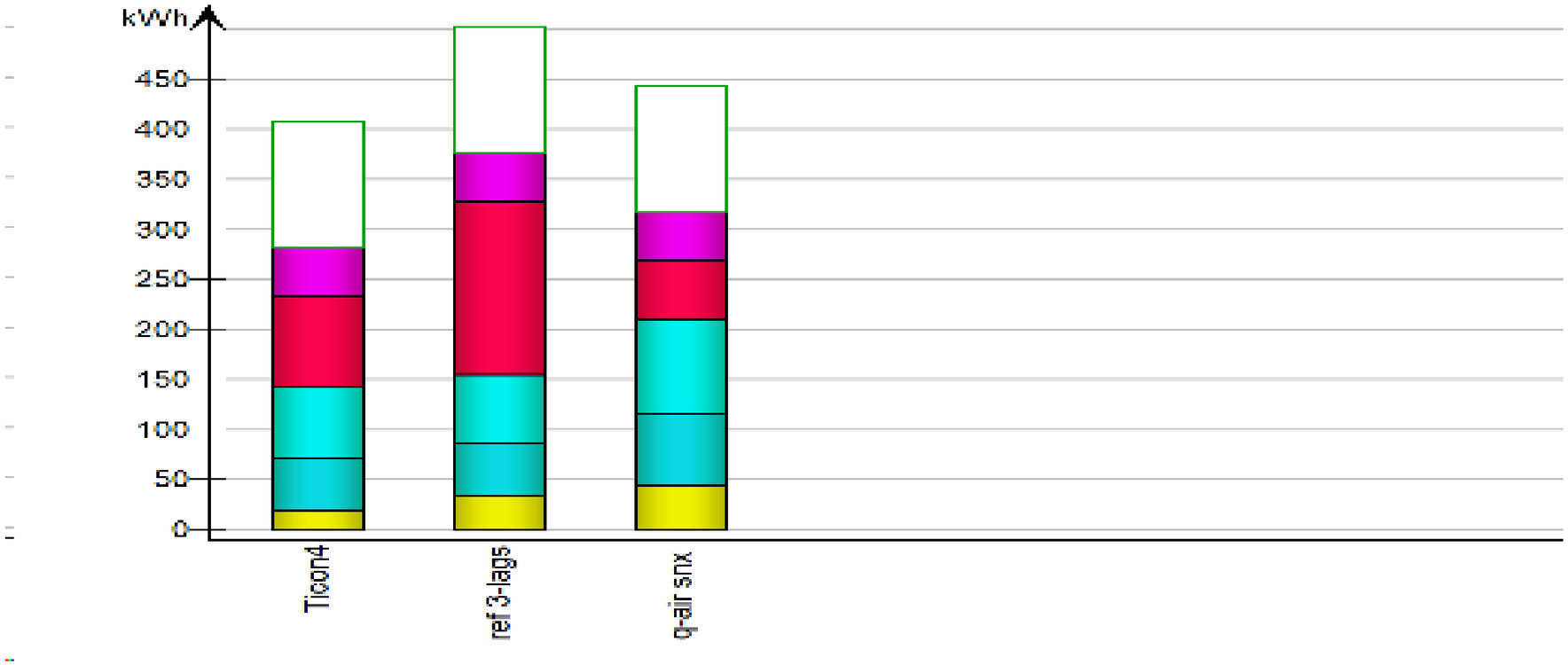


ColorBlast™
1. What is it?

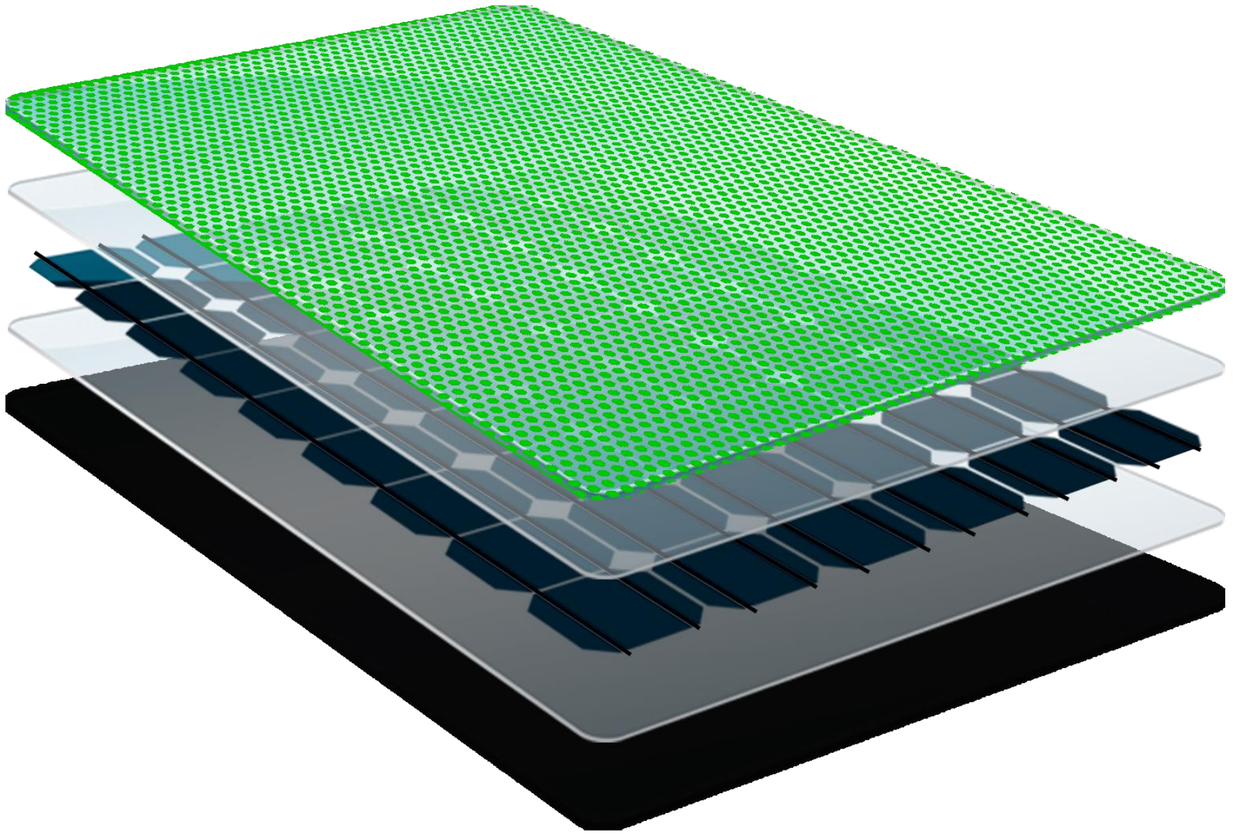
Glass/glass PV module build-up

- Top layer: 4mm solar glass with ceramic pixel print
- Encapsulant layer(s)
- PV cells and interconnects
- Encapsulant layer(s)
- Bottom layer: 4 - 8mm enameled black glass (opaque)

Simply: layered glass with cells between the two panes.

Weight: ~22.5 kg per m^2

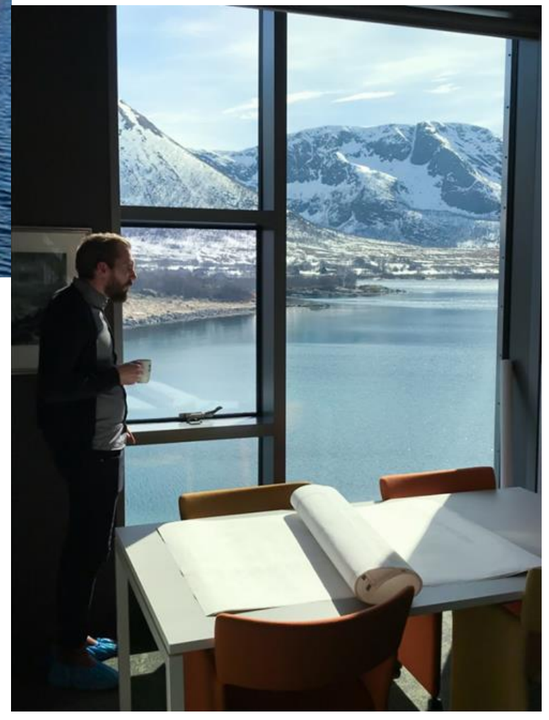
Power: up to 150 Wp per m^2 (Dependent on color, dimensions, and coverage)

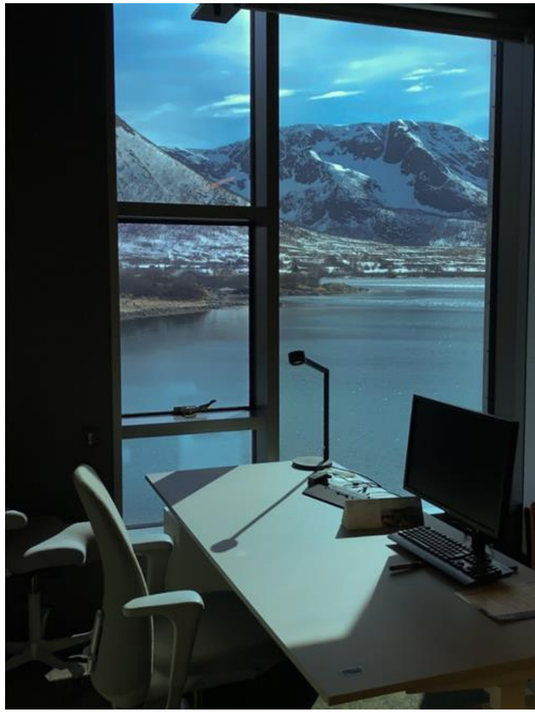


KONTOR
SORTLAND,
NORGE (2016)

Holmøy Maritime
AS

ConverLight®

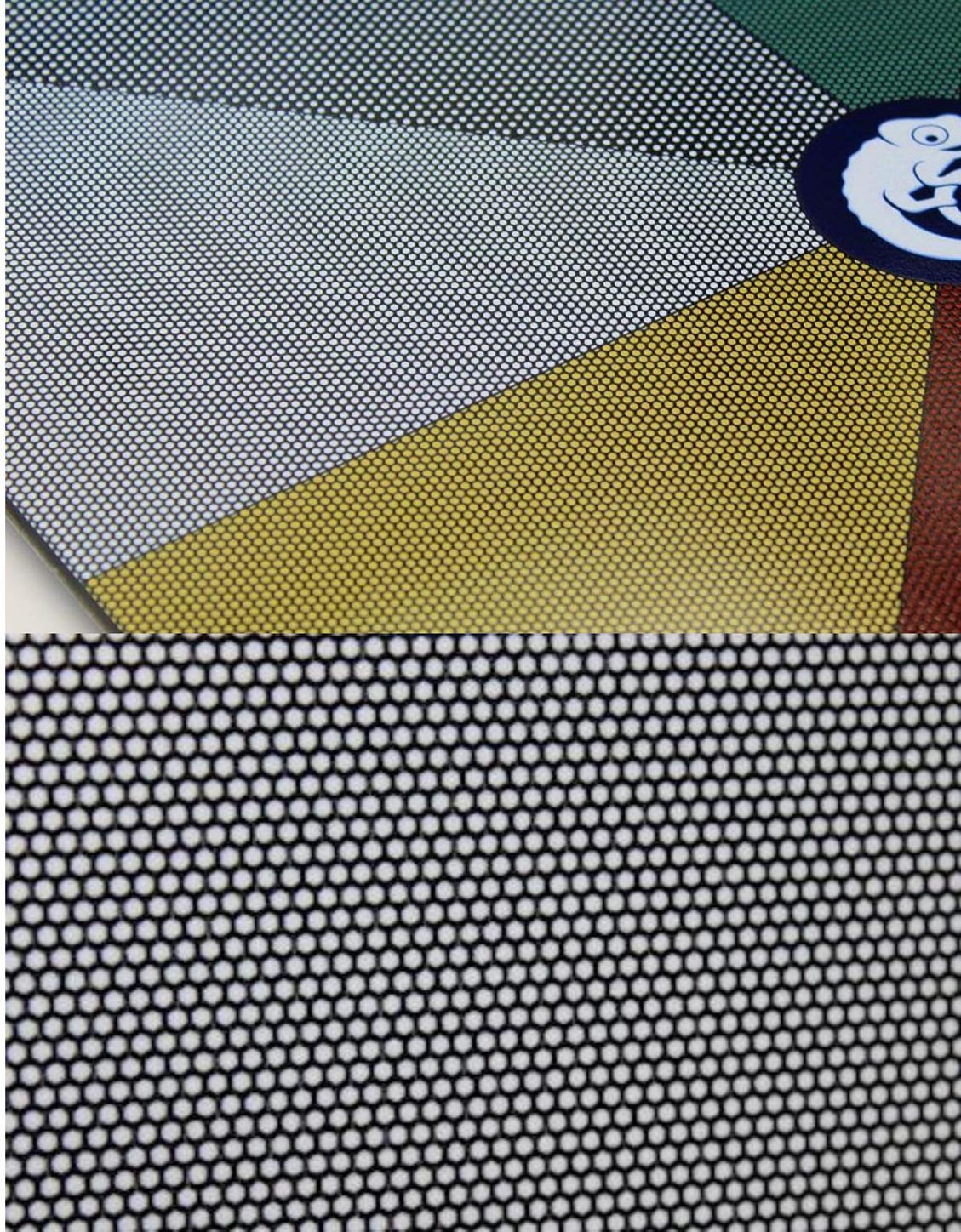




ColorBlast™
2. How it works

Ceramic printing

- Ceramic inks are digitally printed on face 1 of the glass
- The ink is deposited in a hexagonal pixel pattern
- Light passes around and partially through the printed hexagons to the solar cells beneath
- The pattern creates an optical illusion of a homogeneous color: the cells become invisible
- The metric patterns prevents hotspots within the panel
- Ceramic inks maintain their color for more than 50 years



ColorBlast™
3. Possibilities

Printing:

- The density of the pixel pattern can be adapted so that the image is homogeneous at a closer or greater distance. The lower the density of the printed pattern, the higher the power.
- Images and designs can be printed. Provided the amount of colors does not exceed 20 per panel (complex images may be possible, upon request).
- Color can be matched, provided they are feasible.

ColorBlast™
3. Possibilities

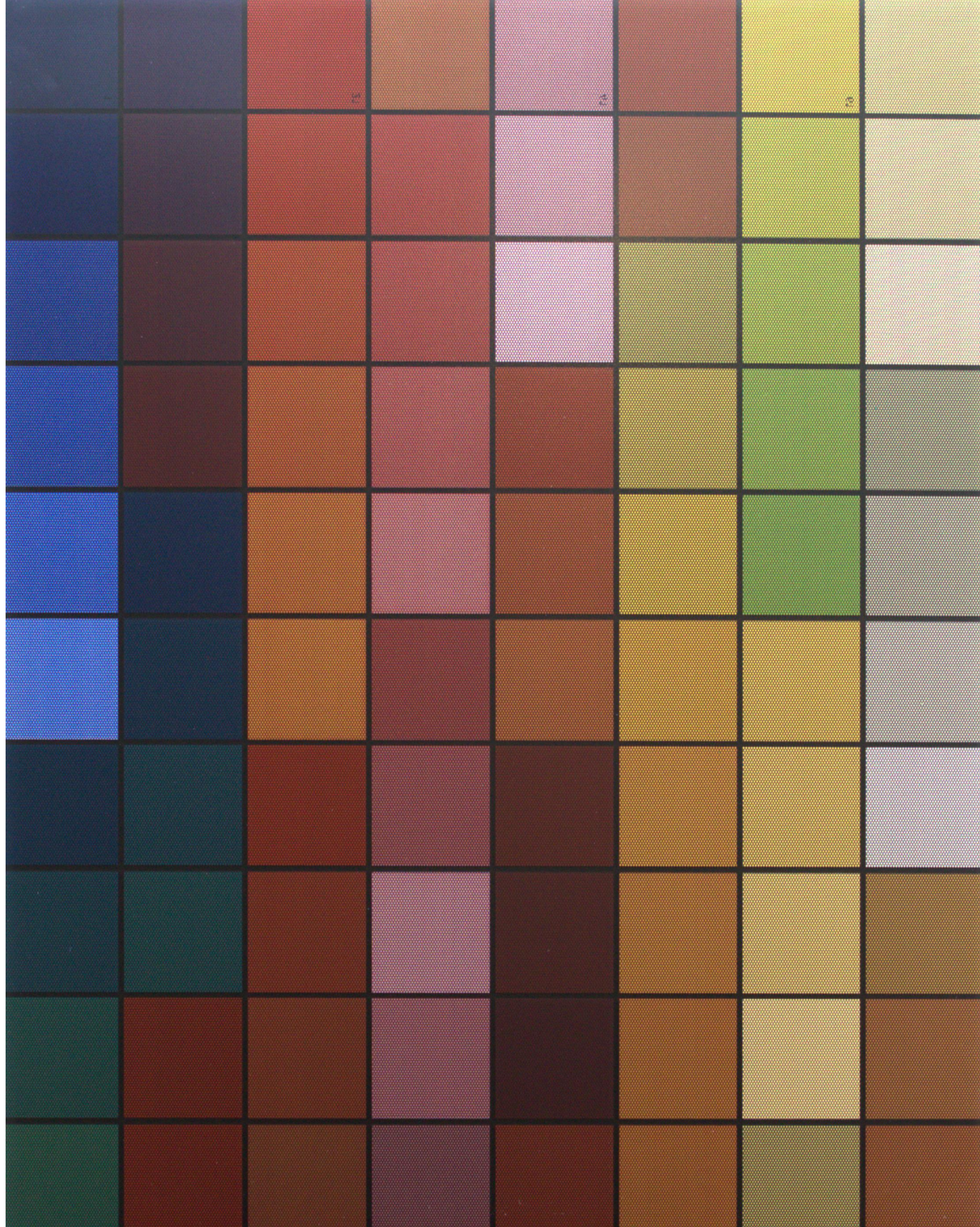
Customization:

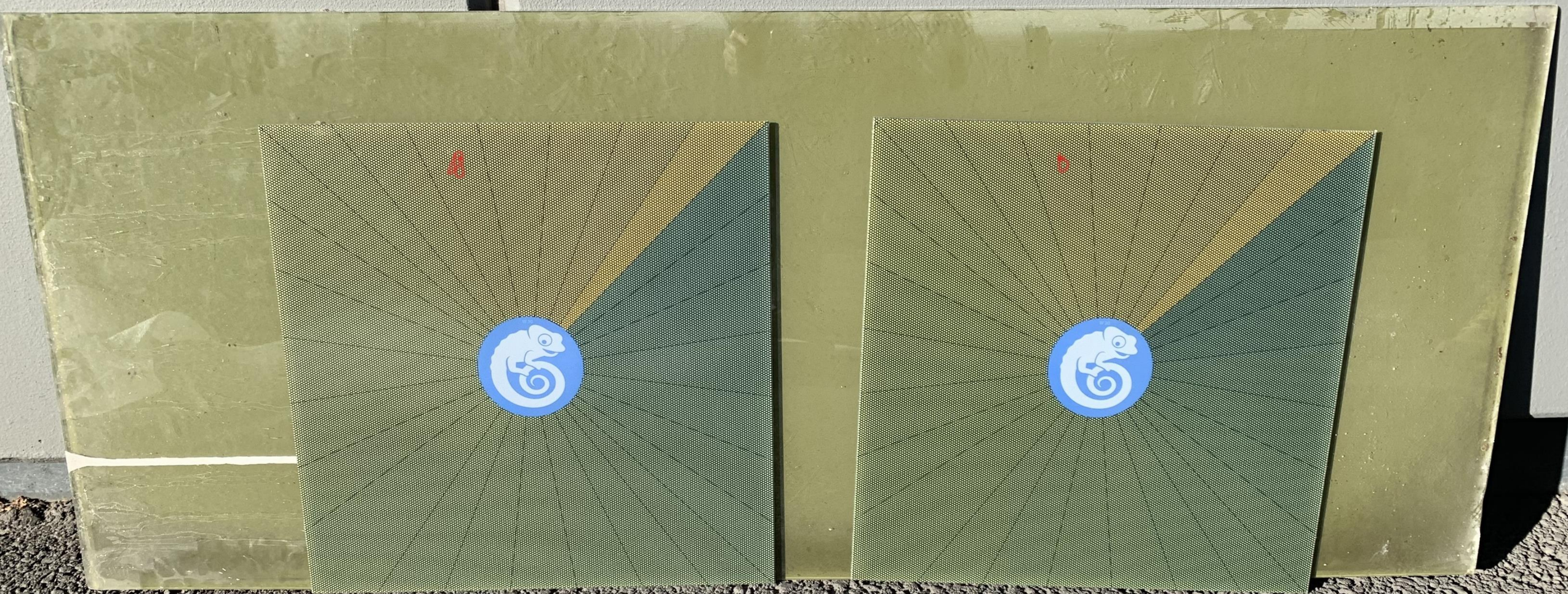
- Preferred lengths from 300 to 1850 mm
- Preferred widths from 300 to 1200 mm
- Thickness of rear glass from 4 to 8 mm
- Pattern density
- Colors
- Print area (leaving parts unprinted or special designs)
- Junction box placement
- Rear glass may be uncolored for transparent modules but cells will become visible

ColorBlast™
4. Limitations

Limits:

- Modules can be no larger than 2500 x 1800mm.
- Junction box cannot be placed on the front side
- Bright, vibrant colors are not possible with ColorBlast™ (white, for example)
- Some images may be too complex to be made safe against hotspots





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