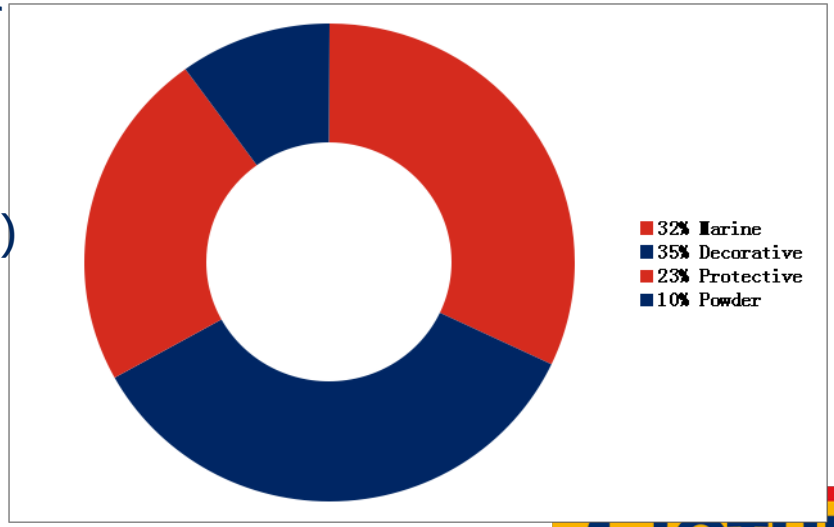
Jotun ‘Green Steps’ for Building Powder Coating

CONTENT

- **Jotun Group**
- **Jotun ‘Green Steps’**
- **Jotun Powder ‘Green Strategy’**
  - Superior Durability
  - Heat Reflection Technology

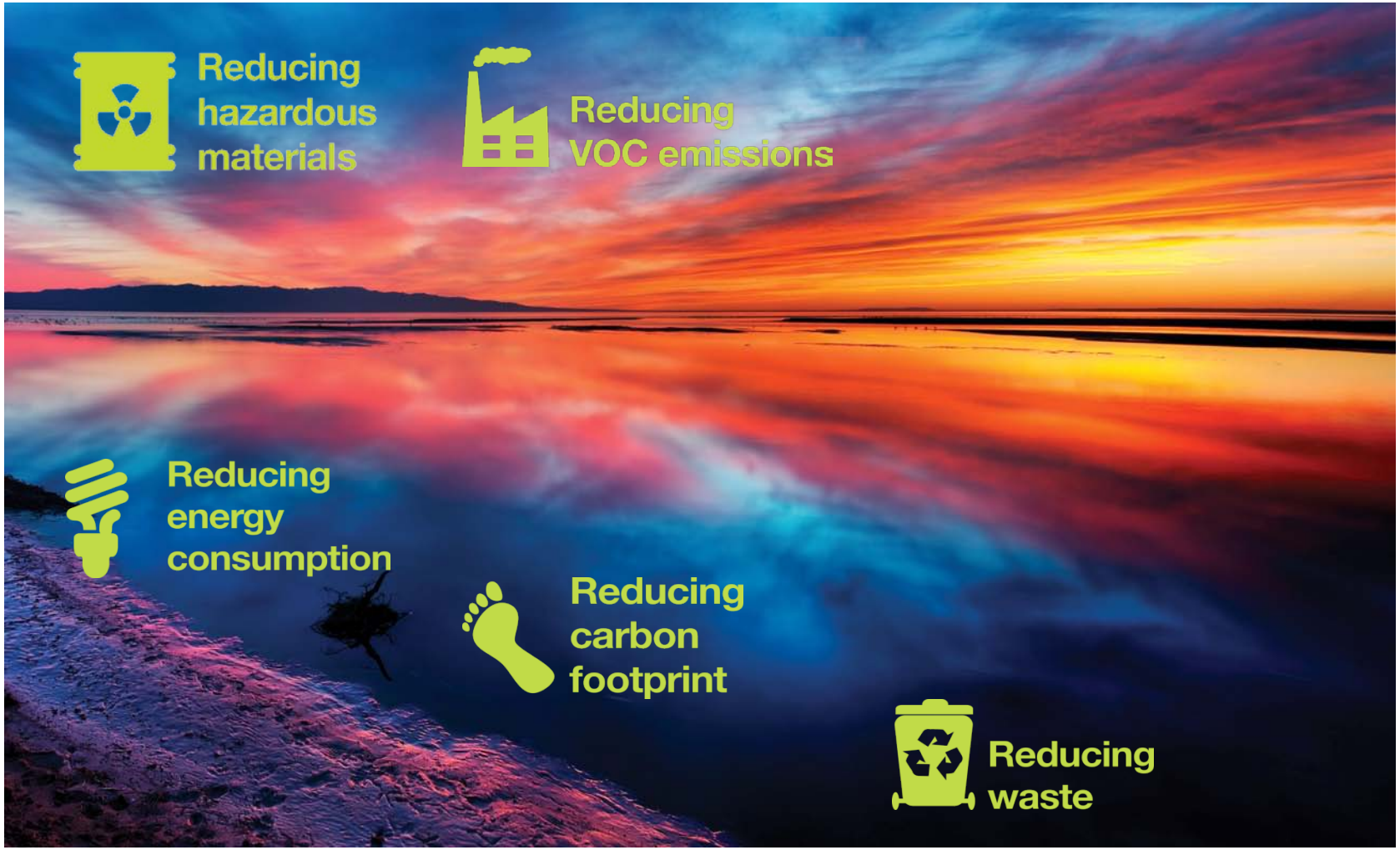
- 2012 2.67 billion US Dollar in revenue
- Among the largest paint companies in the world
- 74 companies and 39 production facilities in 43 countries on all continents
- Present in more than 80 countries with 8,600 employees
- Head office in Sandefjord, Norway

- World’ s 4th largest manufacturer
- 11 manufacturing units spread across 3 regions
- 267 million US Dollar sales (2012)
- 1,080 employees



SUSTAINABILITY IN JOTUN

Jotun GreenSteps


Reducing hazardous materials
Reducing VOC emissions
Reducing energy consumption
Reducing carbon footprint
Reducing waste

2 dimensions of Jotun Powder Green Steps

Superior Durability

- Jotun Facade
- Jotun Super Durable
- Jotun Durasol

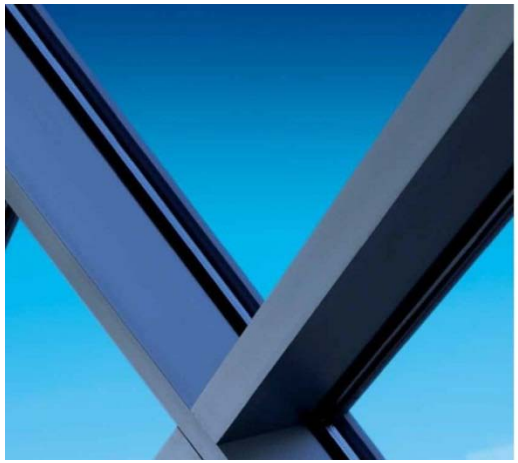
Jotun Facade

Optimized Coating Solution

FEATURES

High quality polyester powder coating

- Qualicoat Class 1, GSB Standard, AAMA 2603
- TGIC (Corro-Coat PE-F) and TGIC-free ranges
- From matt to full gloss
- Any color, metallic, pearlescent and textured effects
- Available as heat reflective technology (Cool Shades) and in Sahara collection (textured finish)
- Particle Size Distribution management process



BENEFITS

- More than 30 years track record
- 10-year product warranty for exterior
- Good appearance
- Optimized powder consumption/enhanced mileage
- More sustainable and economical solution vs Anodizing

Burj Dubai– Dubai, U.A.E.
Skidmore, Owing and Merril

Jotun Facade Iris & Oyster Bond

Jotun Super Durable

Friendly on Design. Tough on Protection.

FEATURES

Heavy-duty polyester powder coating

- From matt to high gloss
- Qualicoat Class 2, AAMA 2604, GSB Master
- Over 170 RAL and NCS color selection
- With metallic and pearlescent effects
- TGIC (Corro-Coat PE-SDF) and TGIC-free ranges
- Available as heat reflective technology (Cool Shades), in Color Beats and Sahara collections
- High scratch and abrasion resistance vs PVDF

BENEFITS

- >15 years track record on monumental project
- 25-year product warranty
- Ideal for sustainable architectural projects
- Design-friendly
- Protection against damage

Atlantis Hotel, The Palm Jumeirah – Dubai, U.A.E.
DSA Architects

Jotun Super Durable

Burj Al Arab, Dubai - UAE
Atkins Architects

Jotun Super Durable

Jotun Durasol

For Timeless Protection

FEATURES

Hyper durable Fluoropolymer powder coating

- Qualicoat Class 3, AAMA 2605
- 35 main colors with the option of customization
- Smooth finish and pearlescent effect
- TGIC-free product
- High scratch and abrasion resistance vs PVDF

BENEFITS

- Outstanding durability in line with PVDF
- Superior abrasion properties compared to PVDF
- Maximum color stability
- 30-year product warranty
- Ideal for public areas and protection against damage

King Abdullah Economic City, Jeddah – Saudi Arabia
Dar El Handasah Architects

Corro-Coat Durasol


Ping'An Financial Center
Shenzhen, China
Jotun Durasol

Heat Reflection

- Cool Shades Collection

Powder Coatings and Green Standards

•Several Green standards allocate points for the use of powder coatings and heat reflective coatings:

i.e. LEED

- Heat Island Effect/Roof Credit 7.2 (+1 point **for roof** with high Solar reflectance)
- Low-emitting materials for **interior** (+1 point if not exceed 150 gr/L) –Credit 4.2

HOWEVER

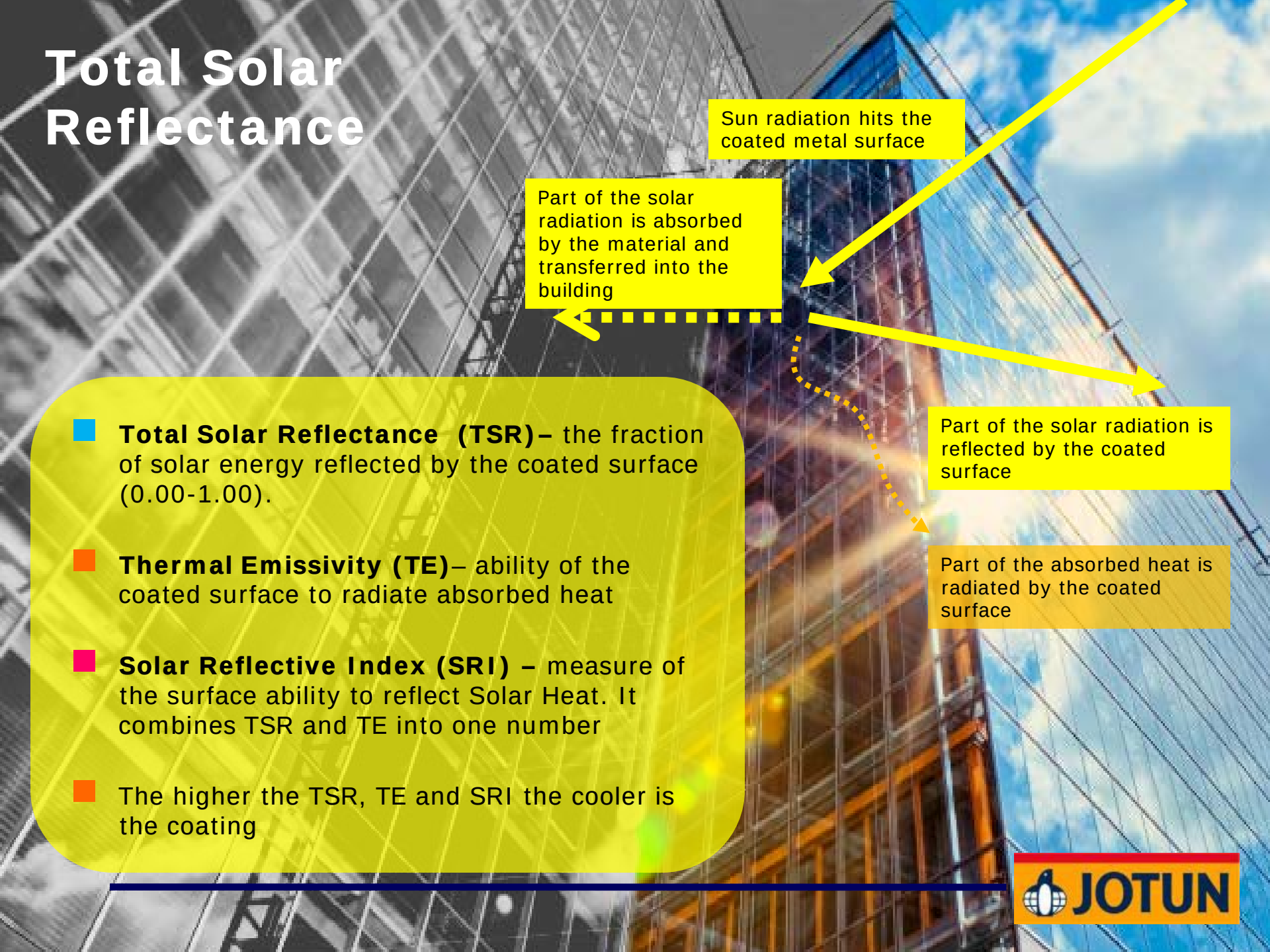
- Recent AAMA initiative creates opportunity for LEED points when heat reflective coatings are applied on façade (AAMA 643-13)

- Purpose –create platform for LEED to allocate points for heat reflective coating on facade

Cool Shades Collection

- Heat-reflective collection of 20 architectural powder coatings
- Special heat management pigment in formulation reduces the temperature of aluminum building components exposed to sunlight
- Available in Jotun Façade and Jotun Super Durable
- Supports Sustainable architecture trends by **reducing energy consumption** and **improving interior comfort**

Total Solar Reflectance



- **Total Solar Reflectance (TSR)–** the fraction of solar energy reflected by the coated surface (0.00-1.00).
- **Thermal Emissivity (TE)**– ability of the coated surface to radiate absorbed heat
- **Solar Reflective Index (SRI) –** measure of the surface ability to reflect Solar Heat. It combines TSR and TE into one number
- The higher the TSR, TE and SRI the cooler is the coating

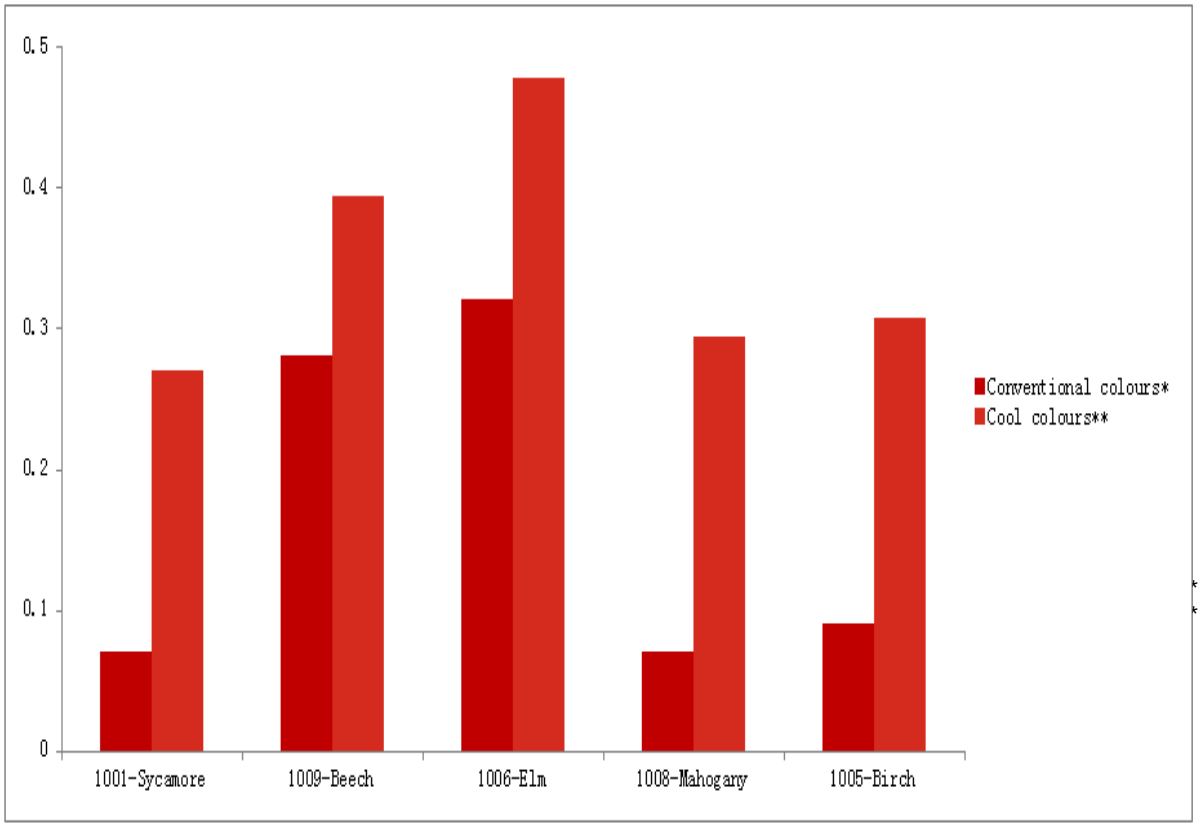
JOTUN

Cool Shades Collection

TSR, TE and SRI Values

Colour Name	Colour Description	TSR	TE	SRI
Pear	White Smooth	0.84	0.86	105
Eucaliptus	White Pearlescent	0.75	0.87	92
Bamboo	Off White Smooth	0.71	0.86	84
Apple	Yellow Smooth	0.61	0.88	70
Ash	Light Grey Sparkle Metallic	0.50	0.84	54
Redwood	Orange Smooth	0.50	0.88	55
Elm	Light Sand Grey Smooth	0.48	0.87	52
Rosewood	Sand Smooth	0.48	0.87	52
Cherry	Red Smooth	0.45	0.87	47
Beech	Dark Grey Sparkle Metallic	0.39	0.84	39
Larch	Blue Sparkle Metallic	0.36	0.84	34
Oak	Madinat Smooth	0.33	0.86	32
Pine	Green Smooth	0.31	0.88	30
Hickory	Dark Blue Smooth	0.31	0.88	30
Birch	Dark Grey Smooth	0.31	0.87	29
Laurel	Brown Sparkle Metallic	0.30	0.86	27
Mahogany	Chocolate Brown Smooth	0.29	0.88	28
Spruce	Near Black Sparkle Metallic	0.28	0.86	26
Chestnut	Brownish Black Smooth	0.28	0.87	25
Sycamore	Near Black Smooth	0.27	0.89	26

Total Solar Reflectance (TSR)



Fraction of solar energy reflected by the coated surface (0%-100%)

Conventional dark coatings absorb more than 90% of the radiation –surface gets hot

TSR of Cool Shades coatings is higher that 25%

**Tested by Momentum Technologies
* Simulated by pigment supplier

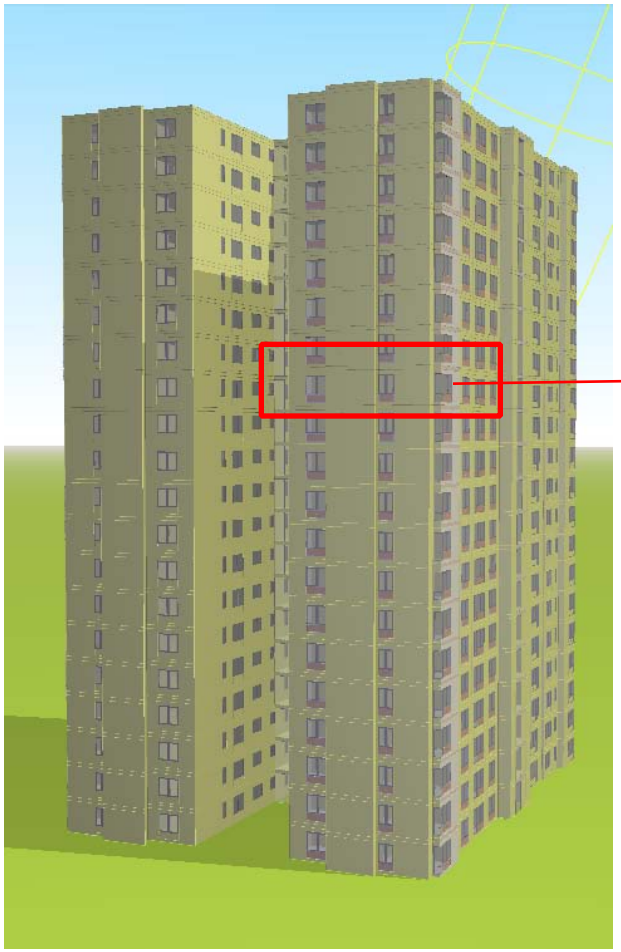
Cool Coatings Study

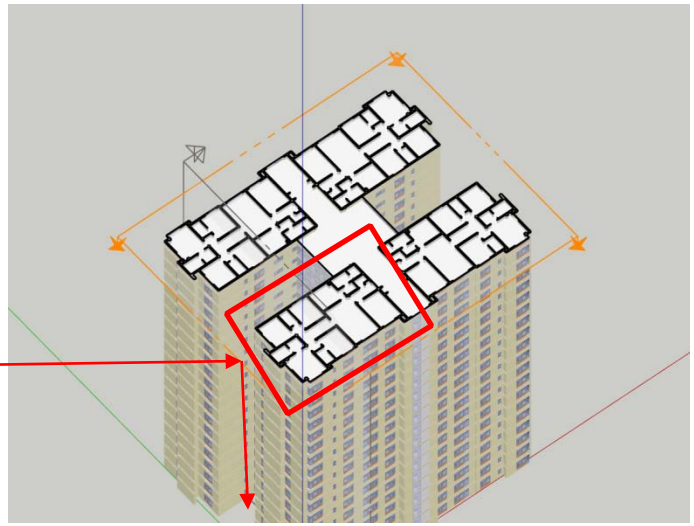
"Impact of the TSR Value on the Users Comfort and the Energy Performance of Buildings" *(Oct 2013 for Jotun)*

- Prepared by sustainable architecture consultancy in Germany **ai³**
- Simulations made for 5 cities: Istanbul, Doha, Bangkok, Shanghai and Sydney
- Two types of window systems considered in the model: non-insulated (typical for hot climates) and highly insulated (typical for cold climates)
- The **energy requirements** are simulated on residential building model containing 80 apartments and 20 floors . Building orientation is South

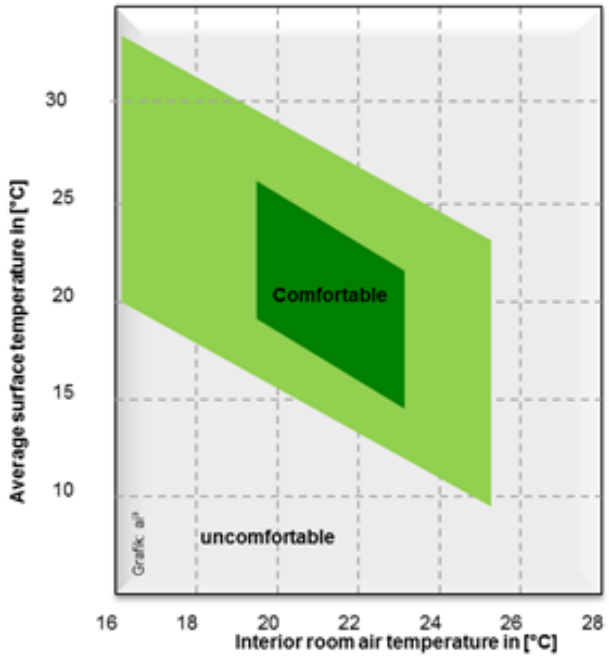
Model settings

Model selected – Collective residential at 20 floors with 80 appartments



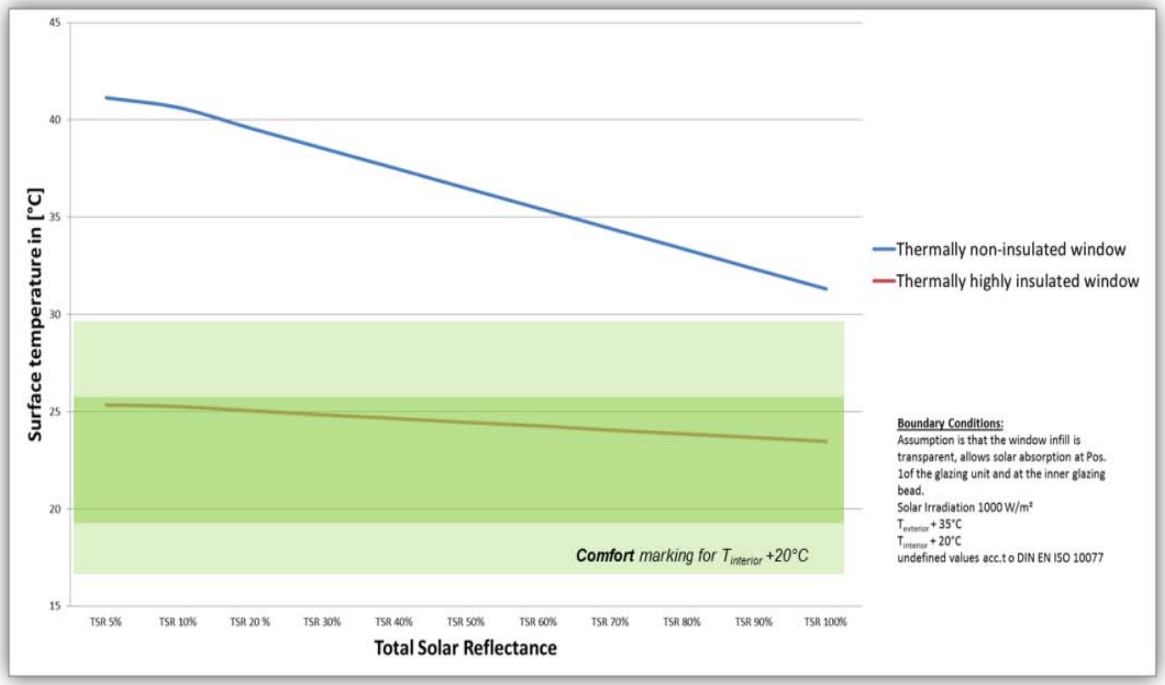


Interior Comfort



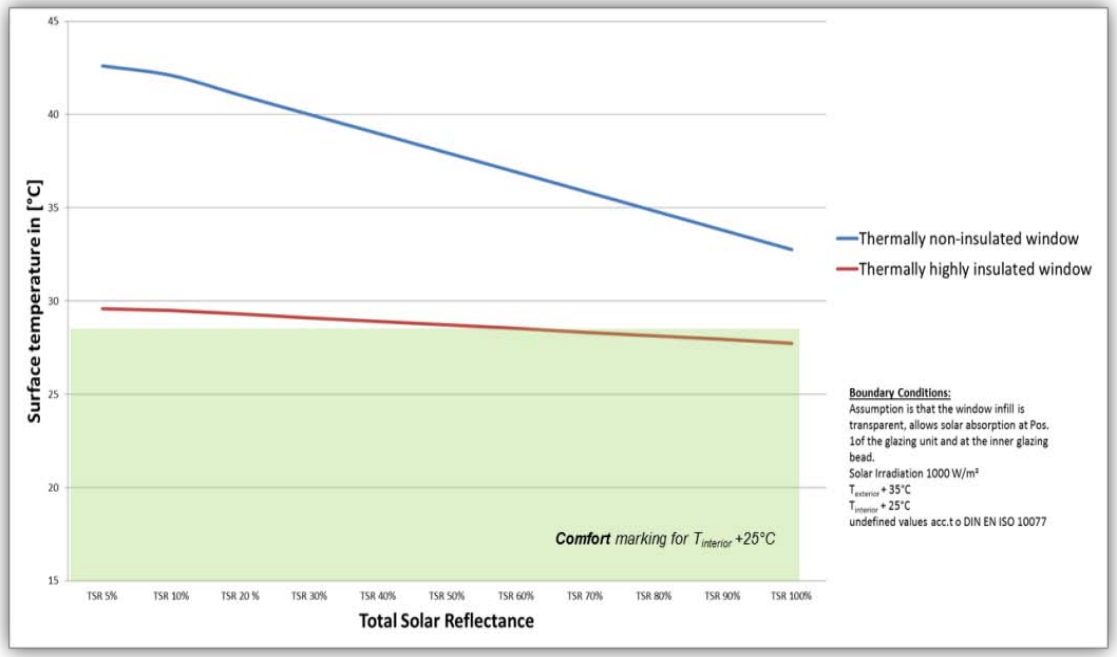
- A function of inner air temperature and the average temperature of the room surfaces
- The impact of the interior surface temperatures on the *comfort* - long wave infrared heat exchange b/w surfaces and human skin
- In the study by W. Frank for inner air temp of **+20°C**, surface temp of +19°C - +25°C *comfortable*, surface temp. i+16°C to +19°C, +25°C to +28°C *acceptable*; surface temp below +16°C and above +28°C *uncomfortable*

Influence of Cool Coatings on interior comfort



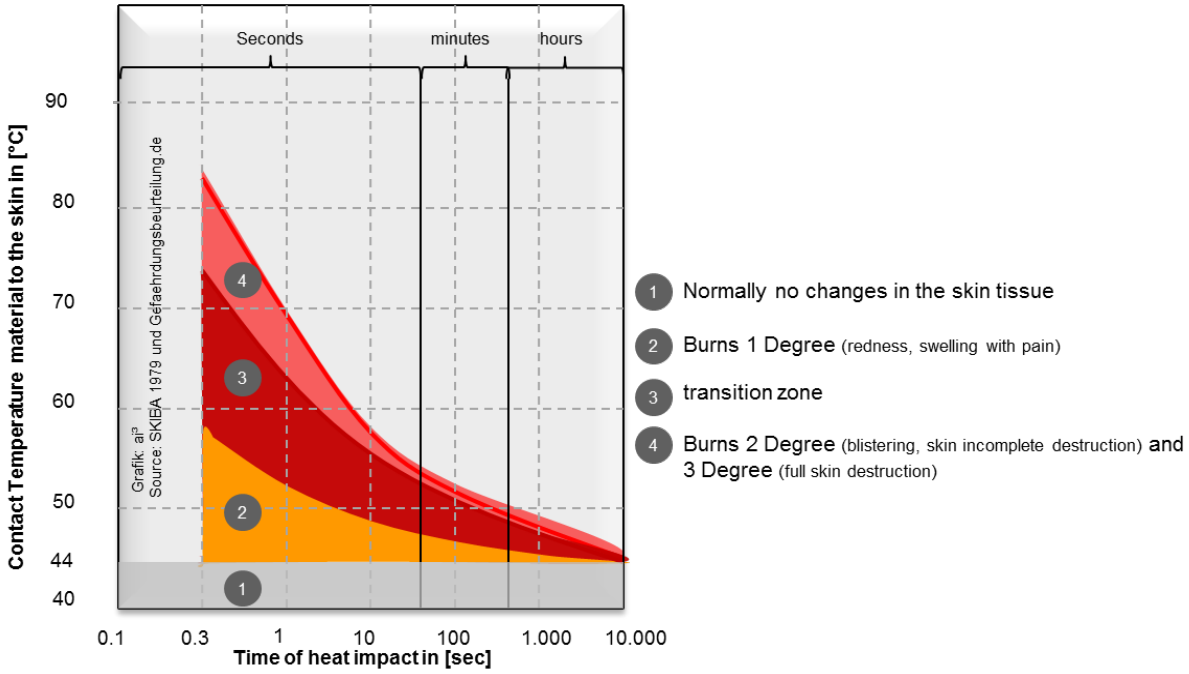
- At exterior temp +35C and interior air temp of 20C surface temp of non-insulated system can reach 41 C with a TSR value of 5%
- Higher TSR coatings reduce this temperature to achieve higher comfort level

Influence of Cool Coatings on interior comfort



- At interior air temp of 25C surface temp of non-insulated system can reach 43 C with a TSR value of 5%
- Neither insulated not insulated systems can achieve comfort zone
- Window frame coatings with higher TSR value improve comfort for the users

Cool Coatings on interior comfort



- The scenario: 35C exterior and 25C interior air temp, thermally non-insulated window and TSR 5%
- Interior surface temperature can go up to 50C and higher
- Risk of skin irritation and burns (1 minute at 51 C)
- Using the coating with 90% TSR in this case will reduce temp to 35 C and eliminate the risks

Cool Coating Study

Energy Savings from using TSR coatings

- Energy savings simulations were run in 3 modes:

✓ A: determine the total energy saving effect of TSR coatings on all opaque surface areas of the envelope (window frames + vertical walls + roof). Non-insulated systems are used

✓ B: investigate pure energy savings effect of TSR coatings on window frames only. Non-insulated systems are used

✓ C: determine the difference in effect of TSR coatings on highly insulated and non-insulated window systems

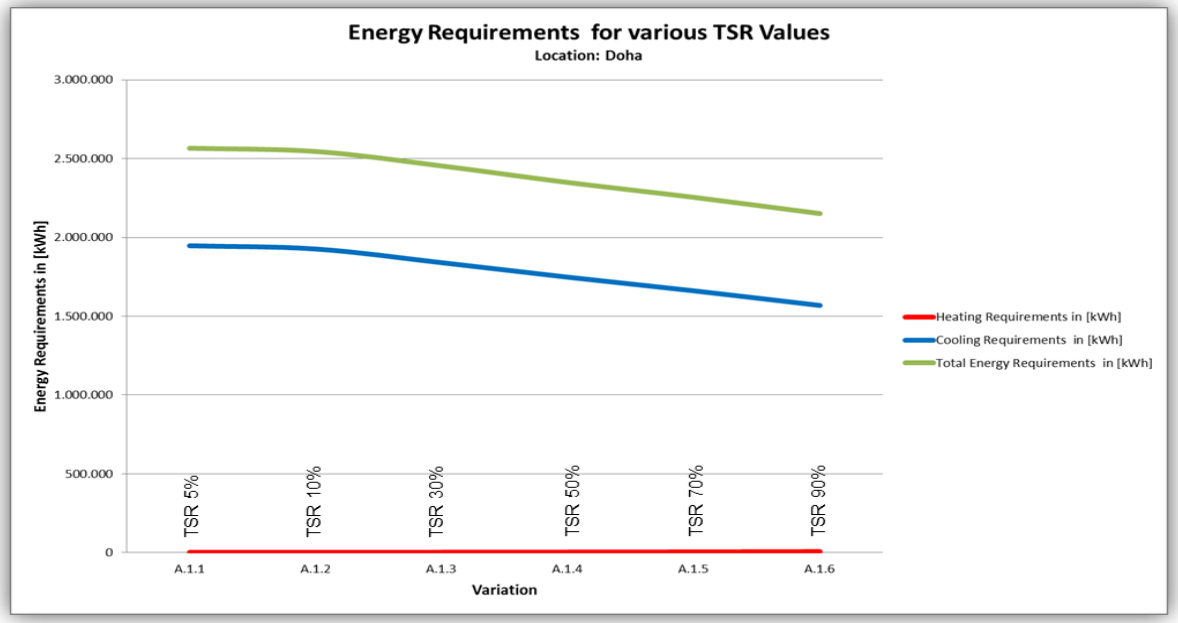
Cool Shades Collection

Energy Efficiency

- Increased TSR value simultaneously lowers cooling and increases heating consumption. Therefore in TR/AUS/CN energy efficiency argument doesn't work
- Heat reflective coatings show reduction in energy consumption in South East Asia (Bangkok type) and ME (Qatar type) climates
- Heat reflective coatings show particularly good improvements on low insulated systems
- In ME and SEA energy savings can be derived from applying heat reflective coatings to the entire façade and window frames alone

Energy Efficiency

A: heat reflective façade in Doha

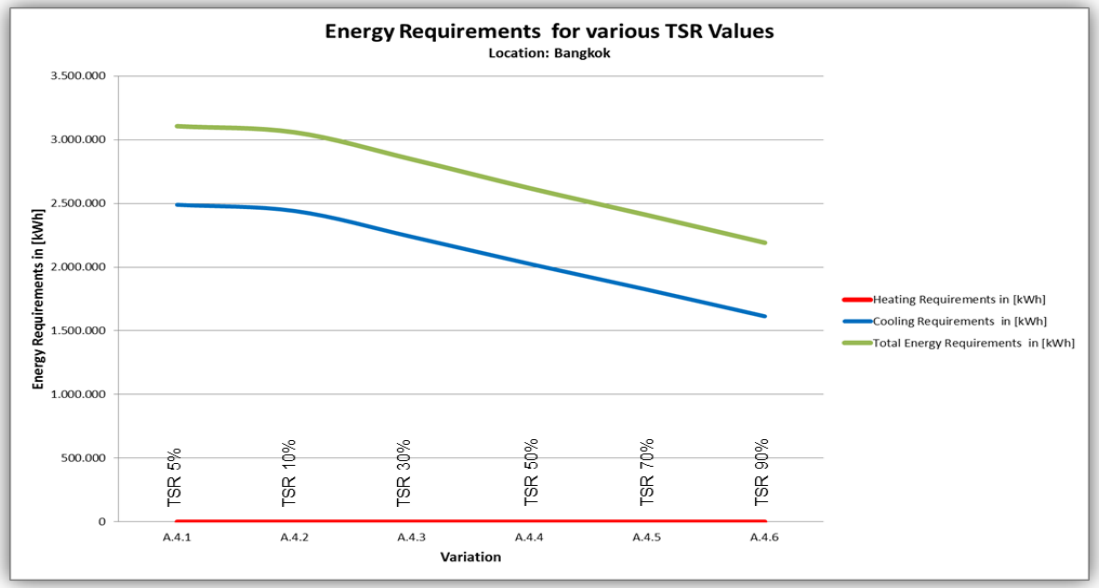


- Coating opaque parts of the Façade with Cool Shades Cherry (TSR 44.6%) instead of Conventional Red (simulated reference TSR 30%) could bring ~3% overall energy savings and ~ 4.5% lowered cooling demand

	TSR 5% A.1.1	TSR 10% A.1.2	TSR 30% A.1.3	TSR 50% A.1.4	TSR 70% A.1.5	TSR 90% A.1.6
Heating Requirements in [kWh]	*1.573*	*1.677*	*2.225*	*3.116*	*4.385*	*6.205*
Cooling Requirements in [kWh]	*1.947.241*	*1.926.690*	*1.839.853*	*1.747.896*	*1.661.348*	*1.568.661*
Total Energy Requirements in [kWh]	***2.566.013***	***2.545.564***	***2.453.681***	***2.348.865***	***2.254.526***	***2.151.660***
Variation Heating in [%]	-41,4	-32,7	0,0	28,6	49,3	64,1
Variation Cooling in [%]	5,5	4,5	0,0	-5,3	-10,7	-17,3
Variation Total in [%]	4,4	3,6	0,0	-4,5	-8,8	-14,0
Variation Heating in [kWh]	-652	-548	0	891	2.160	3.980
Variation Cooling in [kWh]	107.388	86.837	0	-91.957	-178.505	-271.192
Variation Total in [kWh]	112.332	91.883	0	-104.816	-199.155	-302.021

Energy Efficiency

A: heat reflective façade in Bangkok

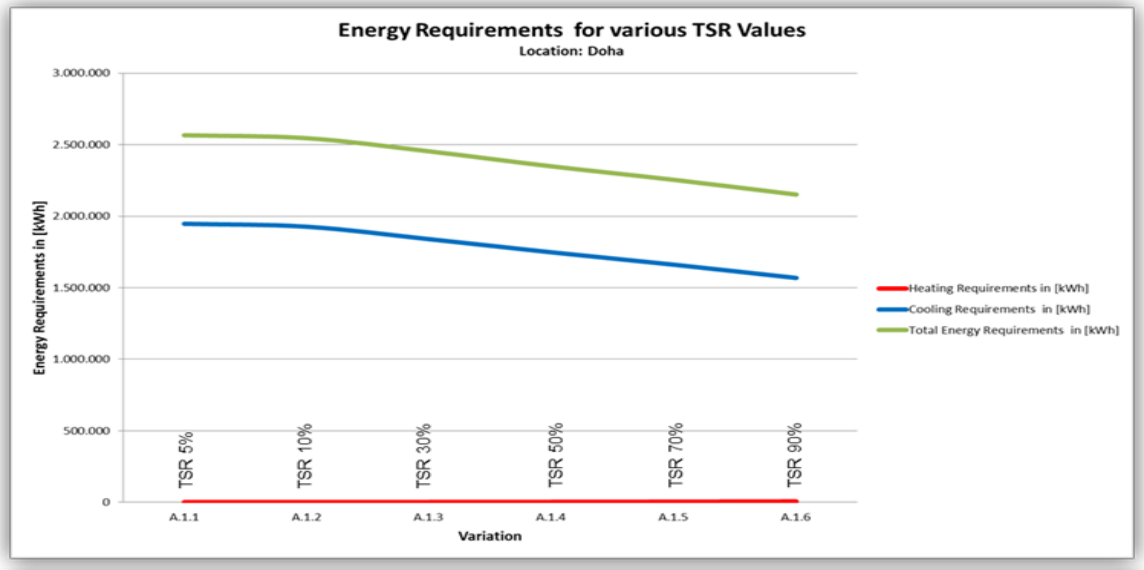


- Coating opaque parts of the Façade with Cool Shades Cherry (TSR 44.6%) instead of Conventional Red (simulated reference TSR 30%) would bring ~6% overall energy savings and 7% lowered cooling demand

	TSR 5% A.4.1	TSR 10% A.4.2	TSR 30% A.4.3	TSR 50% A.4.4	TSR 70% A.4.5	TSR 90% A.4.6
Heating Requirements in [kWh]	*0*	*0*	*0*	*0*	*0*	*0*
Cooling Requirements in [kWh]	*2.489.119*	*2.440.588*	*2.236.749*	*2.024.928*	*1.822.787*	*1.613.646*
Total Energy Requirements in [kWh]	***3.106.317***	***3.057.763***	***2.845.524***	***2.619.231***	***2.407.889***	***2.191.521***
Variation Heating in [%]	0,0	0,0	0,0	0,0	0,0	0,0
Variation Cooling in [%]	10,1	8,4	0,0	-10,5	-22,7	-38,6
Variation Total in [%]	8,4	6,9	0,0	-8,6	-18,2	-29,8
Variation Heating in [kWh]	0	0	0	0	0	0
Variation Cooling in [kWh]	252.370	203.839	0	-211.821	-413.962	-623.103
Variation Total in [kWh]	260.793	212.239	0	-226.293	-437.635	-654.003

Energy Efficiency

B: effect of heat reflective coating on window frames in Doha

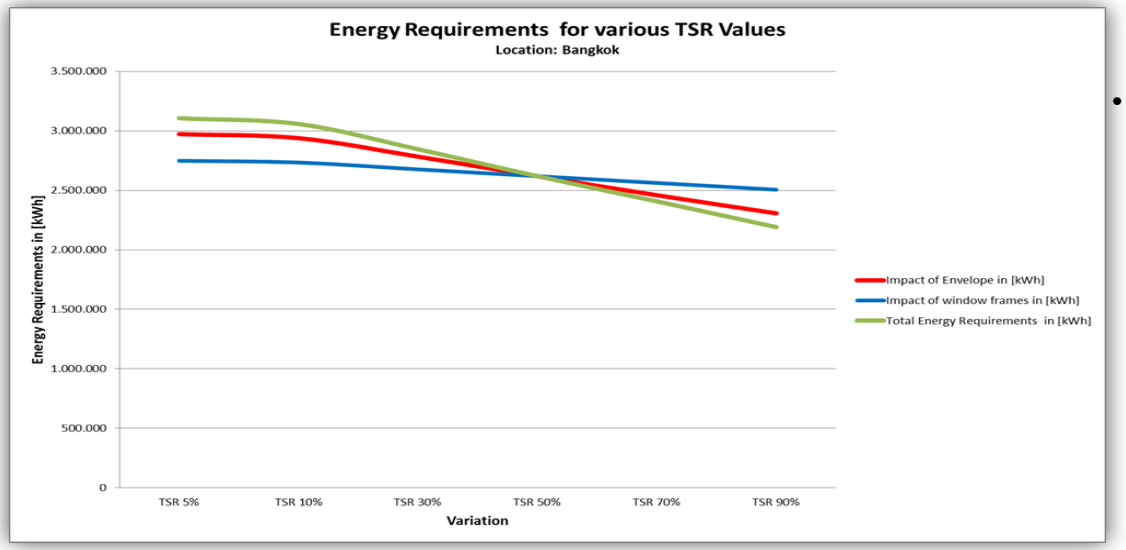


	Variation					
	TSR 5%	TSR 10%	TSR 30%	TSR 50%	TSR 70%	TSR 90%
Impact of Envelope in [kWh]	*2.491.992*	*2.479.578*	*2.418.426*	*2.348.865*	*2.282.741*	*2.217.009*
Impact of window frames in [kWh]	*2.422.680*	*2.414.434*	*2.381.462*	*2.348.865*	*2.316.392*	*2.284.272*
Total Energy Requirements in [kWh]	***2.566.013***	***2.545.564***	***2.453.681***	***2.348.865***	***2.254.526***	***2.151.660***
Impact of Envelope in [%]	5,7	5,3	2,9	0,0	-2,9	-5,9
Impact of window frames in [%]	3,0	2,7	1,4	0,0	-1,4	-2,8
Variation Total in [%]	8,5	7,7	4,3	0,0	-4,2	-9,2
Impact of Envelope in [kWh]	143.127	130.713	69.561	0	-66.124	-131.856
Impact of window frames in [kWh]	73.815	65.569	32.597	0	-32.473	-64.593
Variation Total in [kWh]	217.148	196.699	104.816	0	-94.339	-197.205

- Overall window frames coated with TSR product contribute higher to the entire energy saving given their small % of the surface
- a standard “Dark grey” color (TSR 9%) on a window frame , the use of the JOTUN “birch” Cool shades color (TSR 30.7%) will reduce the overall energy requirement by more than 33,000 [kWh] or 1.3%

Energy Efficiency

B: effect of heat reflective coating on window frames in Bangkok

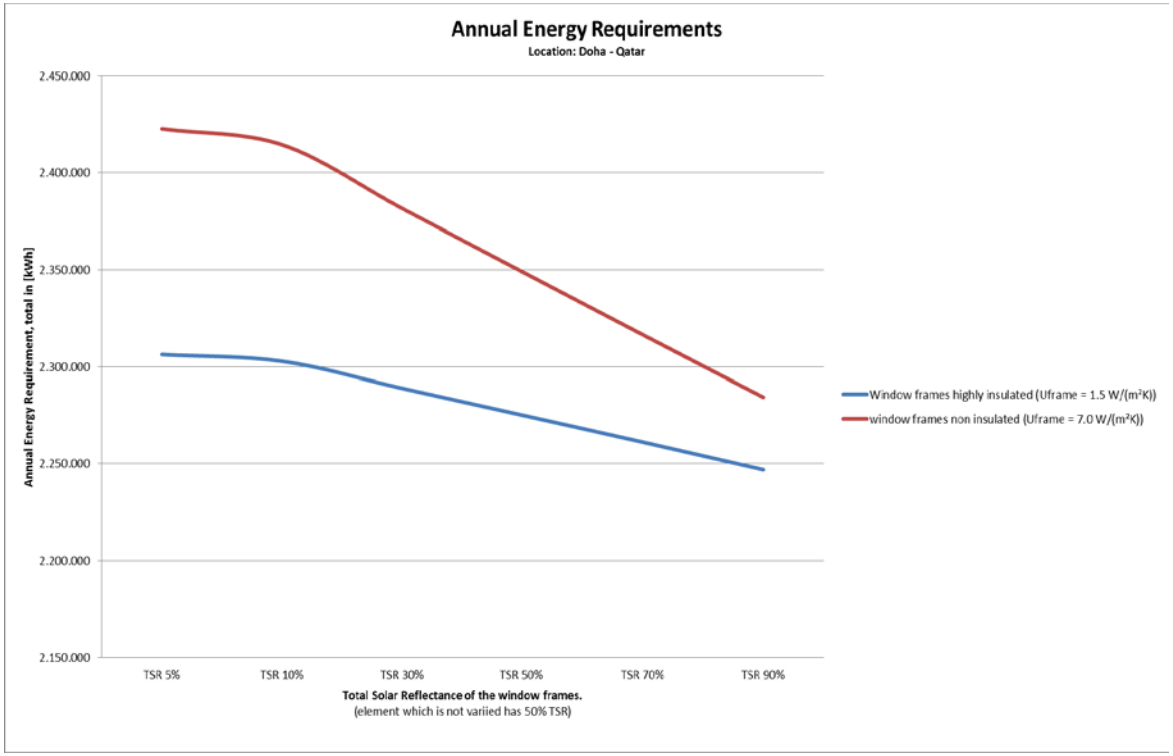


- a standard “Dark grey” color (TSR 9%) on a window frame , the use of the JOTUN “birch” Cool shades color (TSR 30.7%) will reduce the overall energy requirement by more than 57,000 [kWh] or 2.1%

	Variation					
	TSR 5%	TSR 10%	TSR 30%	TSR 50%	TSR 70%	TSR 90%
Impact of Envelope in [kWh]	2.973.108	2.938.780	2.783.237	2.619.231	2.459.250	2.307.349
Impact of window frames in [kWh]	2.748.220	2.733.836	2.676.363	2.619.231	2.562.436	2.505.795
Total Energy Requirements in [kWh]	**3.106.317**	**3.057.763**	**2.845.524**	**2.619.231**	**2.407.889**	**2.191.521**
Impact of Envelope in [%]	11,9	10,9	5,9	0,0	-6,5	-13,5
Impact of window frames in [%]	4,7	4,2	2,1	0,0	-2,2	-4,5
Variation Total in [%]	15,7	14,3	8,0	0,0	-8,8	-19,5
Impact of Envelope in [kWh]	353.877	319.549	164.006	0	-159.981	-311.882
Impact of window frames in [kWh]	128.989	114.605	57.132	0	-56.795	-113.436
Variation Total in [kWh]	487.086	438.532	226.293	0	-211.342	-427.710

Energy Efficiency

Effect of thermal insulation on TSR energy savings

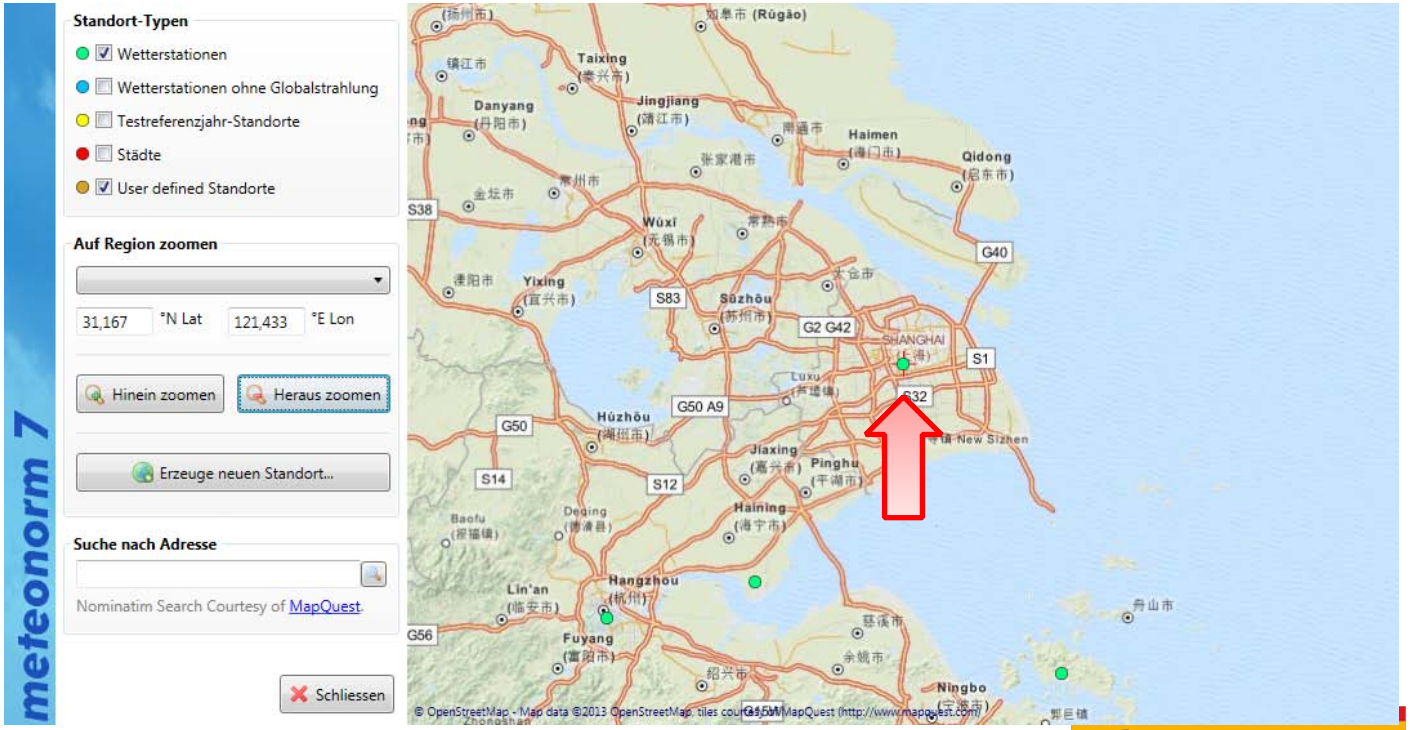


- The higher the insulation level the less TSR value of the coating influences reduction of energy
- Higher TSR reduces the gap b/w energy consumption in highly insulated and non-insulated windows
- At higher TSR values the need for thermal insulation is less dominant for ME and SEA climate conditions.

Impact of TSR Values

Weather Data Set – Shanghai

Location of the Weather Station



Impact of TSR Values

Monthly Energy Requirement Variation A.2.1.

Monthly requirements(kWh)	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
Heating requirements	361291	284448	191764	38647	1785	0	0	0	0	1404	91496	188521	1159356
Cooling requierements	0	0	0	0	467	41592	160883	119583	47787	503	0	0	370816
Lighting requirements	6258	5858	6524	6391	6258	6391	6258	3595	6657	6258	6125	5193	71764
Domestic hot water requirements	33733	30468	33512	30476	31711	30439	29424	19278	30439	32593	31542	24182	357794
Ventilation requirements	15936	14394	15936	15422	15936	15422	15936	15936	15422	15936	15422	15936	187639
Total :	417218	335169	247737	90936	56157	93844	212501	158392	100306	56695	144584	233832	2147370

Impact of TSR Values

Total Energy Requirement per year – *Data*

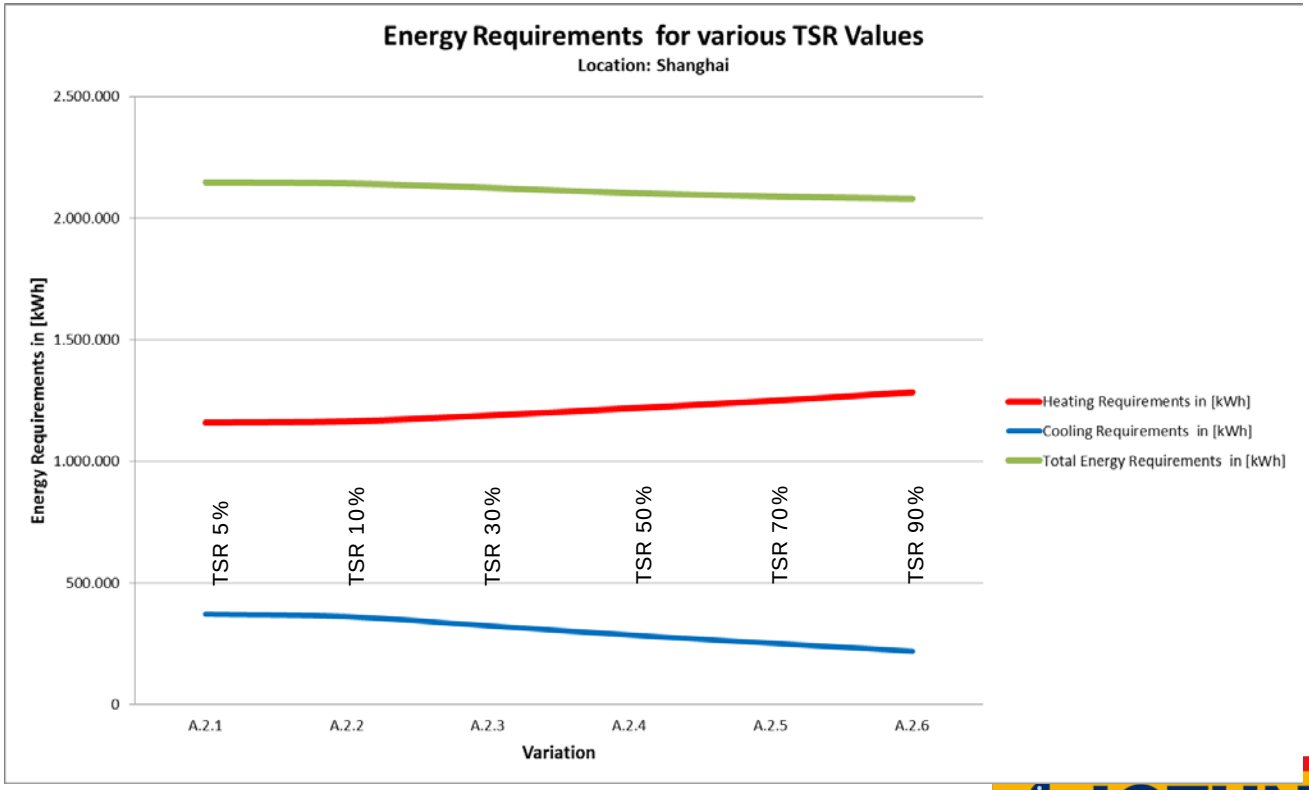
Location: Shanghai

	Variation					
	A.2.1	**A.2.2**	**A.2.3**	**A.2.4**	**A.2.5**	**A.2.6**
Heating Requirements in [kWh]	*1.159.356*	*1.164.772*	*1.188.924*	*1.218.241*	*1.249.147*	*1.284.446*
Cooling Requirements in [kWh]	*370.816*	*361.355*	*323.654*	*285.696*	*251.902*	*219.291*
Total Energy Requirements in [kWh]	***2.147.370***	***2.143.326***	***2.125.547***	***2.104.032***	***2.089.894***	***2.080.557***
Variation Heating in [%]	-2,6	-2,1	0,0	2,4	4,8	7,4
Variation Cooling in [%]	12,7	10,4	0,0	-13,3	-28,5	-47,6
Variation Total in [%]	1,0	0,8	0,0	-1,0	-1,7	-2,2
Variation Heating in [kWh]	-29.568	-24.152	0	29.317	60.223	95.522
Variation Cooling in [kWh]	47.162	37.701	0	-37.958	-71.752	-104.363
Variation Total in [kWh]	21.823	17.779	0	-21.515	-35.653	-44.990

Impact of TSR Values

Total Energy Requirement per year – *Graph*

Location: Shanghai



Cool Shades Collection

Project References

- Siemens HQ in Masdar City Abu Dhabi
- King Faisal Specialist Hospital (KSA)
- Lusail Multi-purpose Hall in Qatar
- Puchong Financial corporate center in Malaysia
- Yas Mall in Abu Dhabi and many more….

Thanks!