Presentation of system:

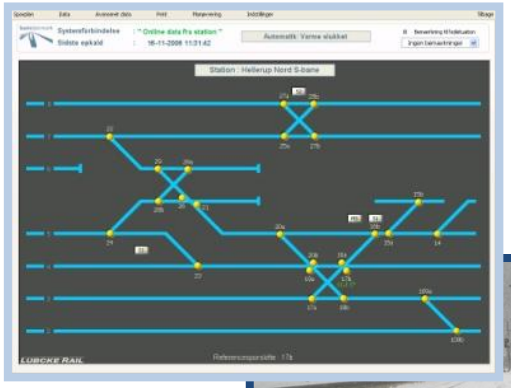
Electrical Switch Point Heating System

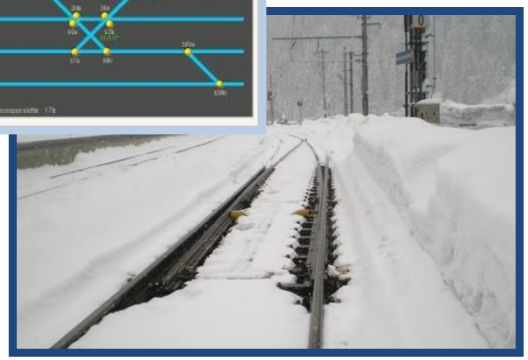
Complete energy saving systems to secure reliable railway traffic, through switch points in severe winter weather conditions.

SAN Electro Heat a/s

System advantages

- Energy savings from 25% to 70%
  - From Stand Alone to Forecasting
- Monitoring
  - Supervision of the entire territory
  - Heater or System Faults are Immediately alarmed to Personnel
  - Energy management
- Remote Control
  - Save money on site maintenance
  - On-line tuning of the system
  - Individual control parameters
- Traffic reliability
  - Quality components
  - System integration





Blue Point Reference list, top 9

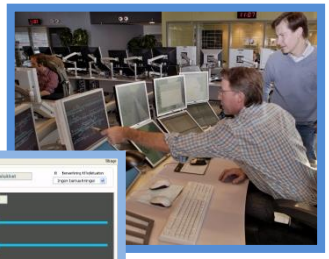
Customer	Country	Application	Power	First installation
Danish Railways	Denmark	Blue Point	300W/m - 50V	1978
Swedish Railways	Sweden	Heating + Weather stations	300W/m - 230V	1989
NSB	Norway	Heating + Control components	300W/m - 50V	1989
Network Rail	U.K.	Heating	200W/m - 110V	1990
ÖBB	Austria	Heating + Control components	300W/m - 230V	1999
Estonia Rail	Estonia	Blue Point	360W/m - 230V	2002
National Rail	Lithuania	Heating + control components	330W/m - 220V	2003
HZ	Croatia	Blue Point	330W/m – 230V	2014
PKP	Poland	Heating	300W/m – 230V	2010

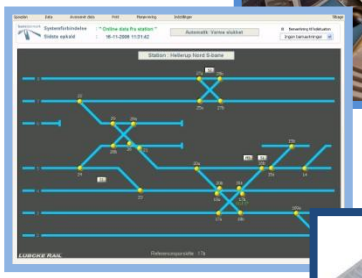
Blue Point Cloud Reference list

Customer	Country	Application	Weather forecast	installation
NJBA	Denmark	Branch line, 7 stations	Yes	2009
Oresund bridge	Denmark/Sweden	Complete land – tunnel – bridge switch point heating	Yes	2011
ÖBB	Austria	Test - 6 switch point	Yes	2011
Brixlegg	Austria	Private industry site	No	2009
Wiener Strassenbahn	Austria	Test Depot area	Yes	2011
ÖBB	Austria	Weather monitors	Yes	2011
Chicago	USA	Platform heating	No	2013
MVB	Germany	Tramline City solution	Yes	2014
Cph Metro	Denmark	Metro System	Yes	2015

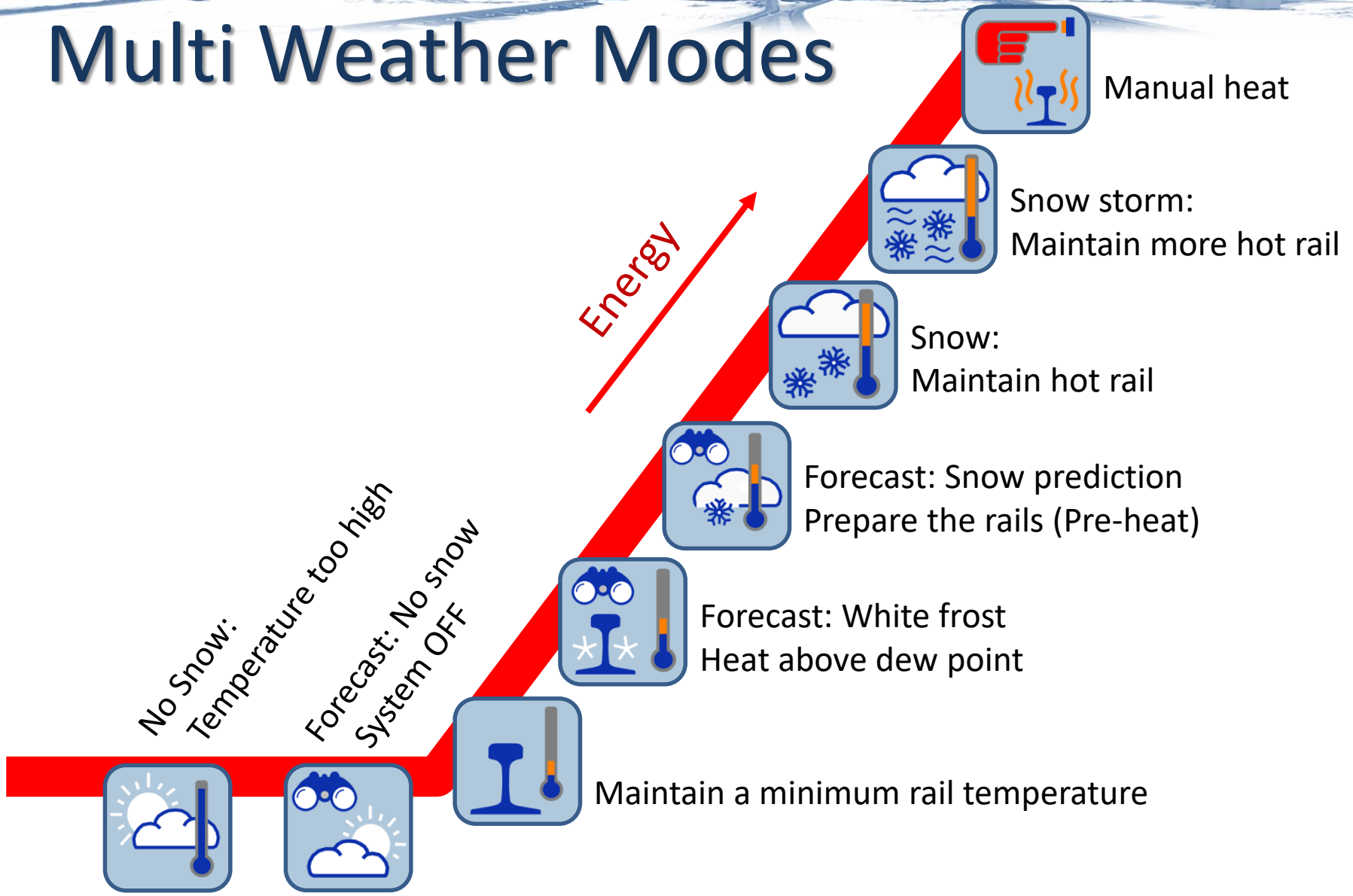
Solution components

- Heating elements
- Control cubicles
- Weather stations
- Monitor & control SCADA
- Power/safety transformers
- Consultancy services





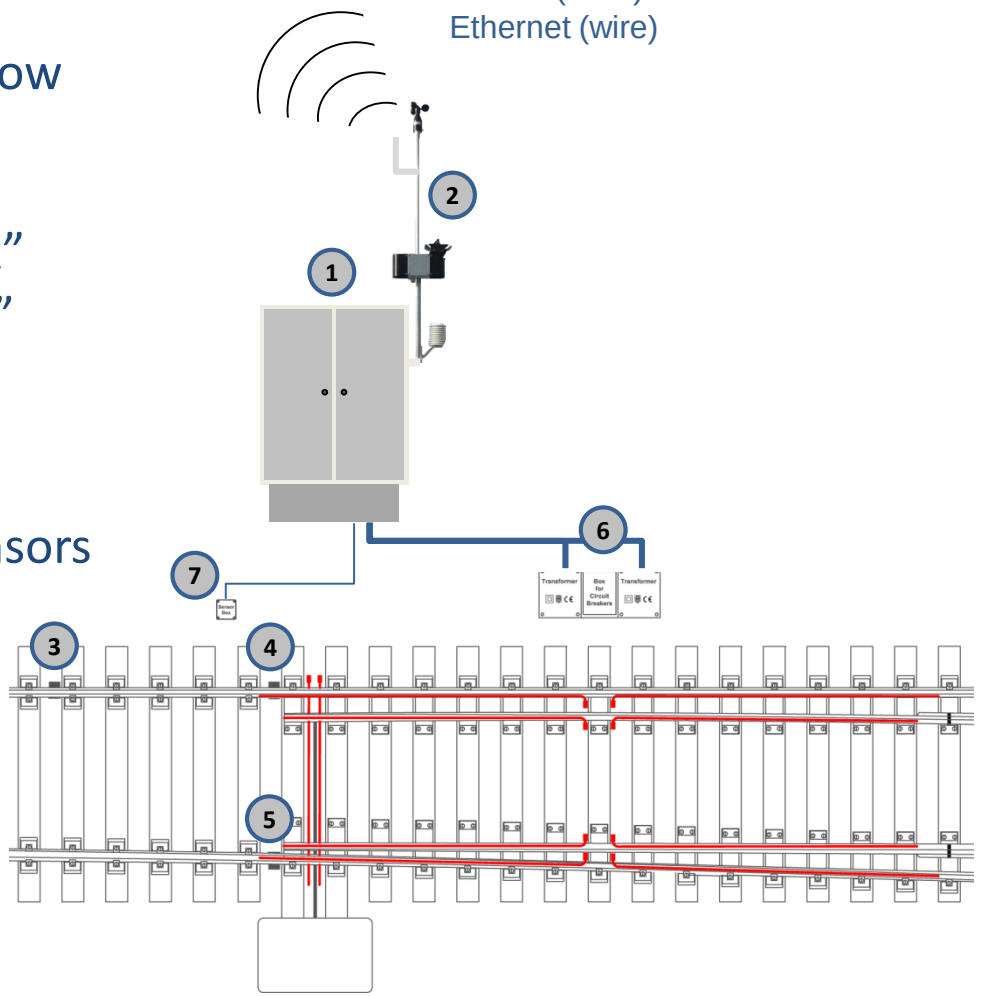
Multi Weather Modes



Master switch point

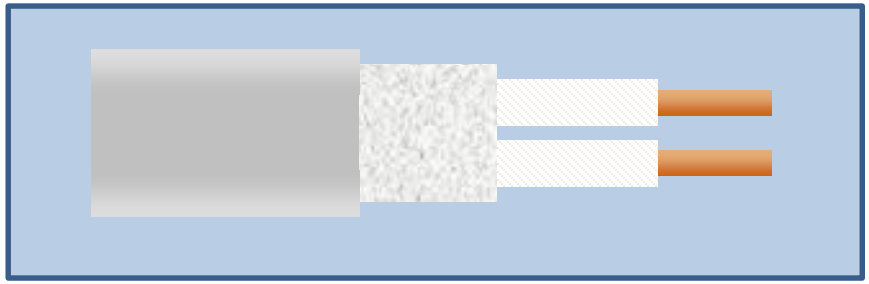
1. Master Control Cubicle
2. Weather station: Wind speed, Snow detector, Temperature and
3. Temperature sensor – Cold Rail
4. Temperature sensor – Hot Rail “R”
5. Temperature sensor – Hot Rail “L”
6. Safety/isolation transformer and/or power distribution box to heating elements
7. Junction box for temperature sensors Noise free: Pt100 to 4-20 mA

Communications:
GPRS (GSM)
RS485 (Wire)
Ethernet (wire)



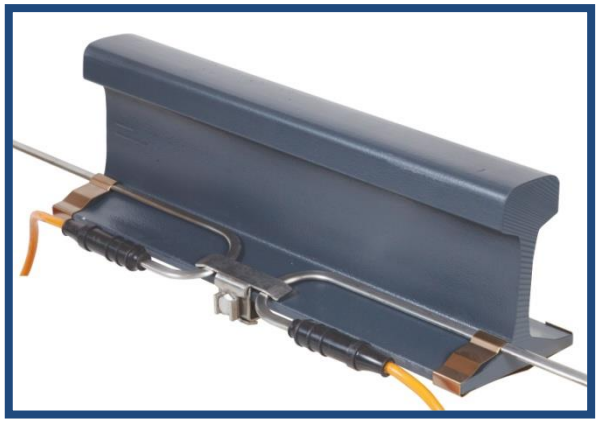
High quality heating elements

- Increase energy saving
  - Flat shape maximizes surface contact
- Proven reliability & long life time
  - Monel 400 sheath impervious to salt & most chemicals – 10 year warranty
  - Designed specially for railway environment
  - Unique mechanical shock absorbent fibre glass wrap
  - Water Tight Sealed cable connection (IPx7/IPx8)
  - 500.000+ successful installations



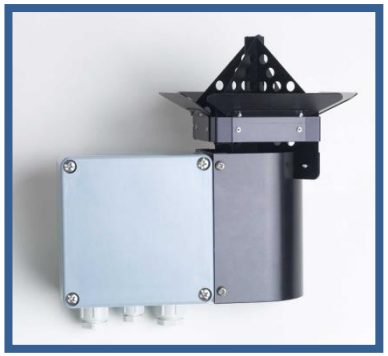
Easy to install heating elements

- Fits existing power installation
  - Supply voltage supply from 48V to 750V AC & DC
  - Power up to 300 watts per foot
  - Lower wattage avoids track fires < 300 w/ft
- Easy installation
  - Stainless Steel Spring Clips – “kick-on” clips easy installation low corrosion
  - Custom terminations and connectors for any switch



Weather Station Control

- Heat only when necessary
- Save 60 – 70 % energy, compared to manual systems
- Maintenance free weather station
  - Wind speed
  - Air temperature
  - Snow detector (precipitation)
  - (Air humidity)
- Hot & Cold Rail Temperature Sensors



Master Control Cubicle

- Intelligent pre-programmed RTU
  - Energy optimized temperature settings
  - Multiple weather modes
- Control up to 8 switch points
- Connect up to 7 Slave Cubicles
  - Each slave controls and powers up to 8 switch points
  - Total up to 64 points
  - Perfect for Yards
- Input from:
  - Weather station
  - Cold and heated rail temperature sensor
  - Weather forecast

Control – 4 main modes

Forecast - No Snow

- Weather forecast has no snow warning out
- Switch points are switched off (Energy saving)

Forecast - Snow

- Weather forecast has a warning out
- Switch points are pre-heated, ready to heat further

Snow

- Snow or Ice rain detected
- Switch point heating to a higher temperature

Snow Storm

- Snow is detected and wind speed is high.
- Switch point heating is 100%

Control Modes 1:3

MODES – NO HEATING				
Mode	Icon	Trigger	Parameter	Aktion
Automatic OFF		Air temperature Or SCADA controlled	> 46F Automatic OFF	No heat No heat
Air Temp. High		Air temperature	> 43F	No heat
Forecast No Snow		Weather forecast	No Snow	No heat

Control Modes 2:3

MODES – MEDIUM HEATING				
Mode	Icon	Trigger	Parameter	Aktion
Min. Rail temp.		Hot Rail	< 23F	Maintain rail at: 23F
Pre-heating*		Air temp.	< 37F	Heat rail to: 35F to 36.5F
Forecast SNOW		Weather forecast + Air temp.	Snow < 37F	Heat rail to: 35F to 36.5F
Forecast White frost		Weather forecast: Dew point:	White frost warning < 41F	Heat rail to: Dew point + 35F

*Pre-heating = Only if weather forecast is not active

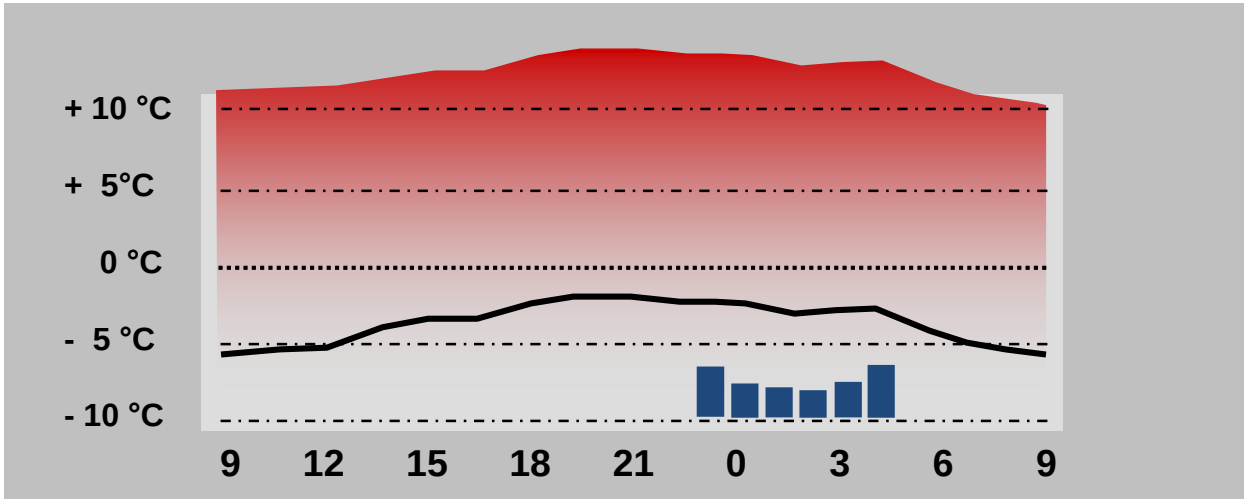
Control Modes 3:3

MODES – HIGH HEATING				
Mode	Icon	Trigger	Parameter	Aktion
Snow		Air temp. Or Cold rail + Snow detector	Snow	Heat rail
Constant Heat		SCADA Activated ”constant heat”	Active 12 hour timer	Heat rail: Max
Manuel ON		Control Service switch	Position ”Manual”	Heat rail: Max + Fail status
Snow Storm		Mode ”Snow”: + Wind speed	Yes High	Heat rail: Max

Always ON

Switch point heating turned on late autumn turned off mid spring.

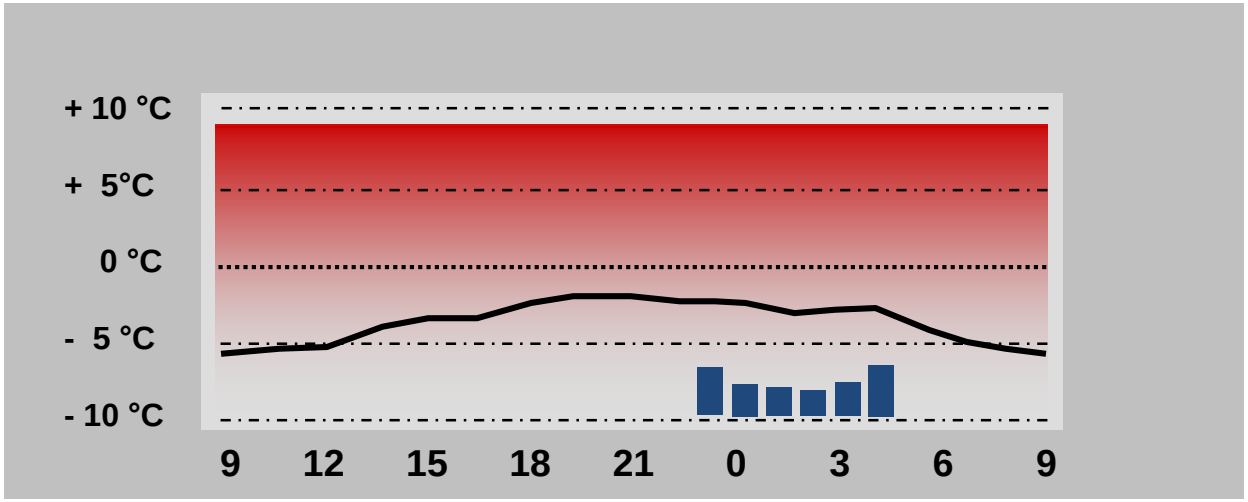
Energy saving 0 %



Thermostat

Temperature feedback from hot rail.
Temperature level as for “snowfall”

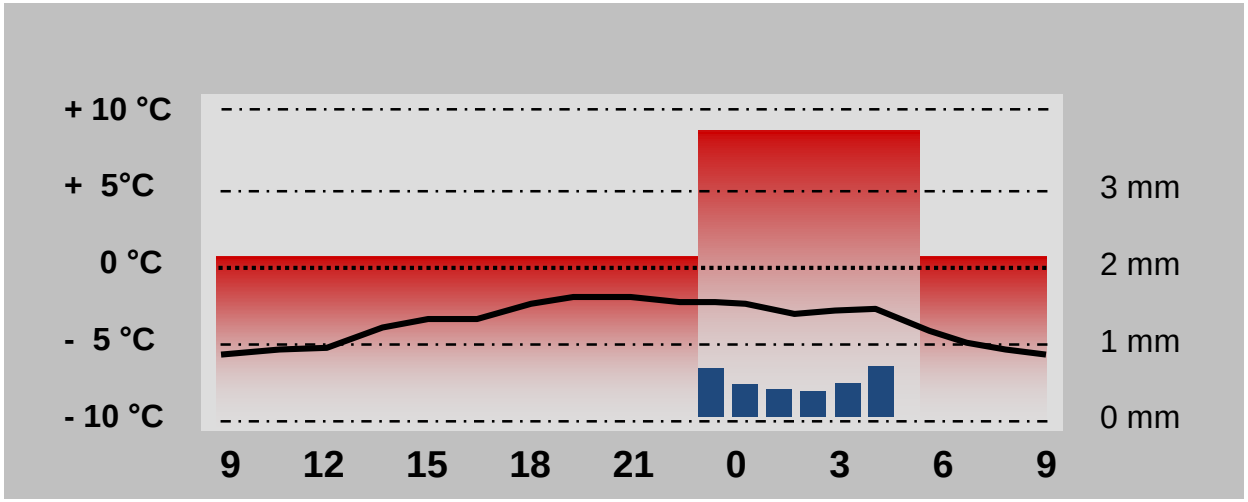
Energy saving 25 %



Weather station

Heating controlled by
Air + rail temperature
+ snowfall detection

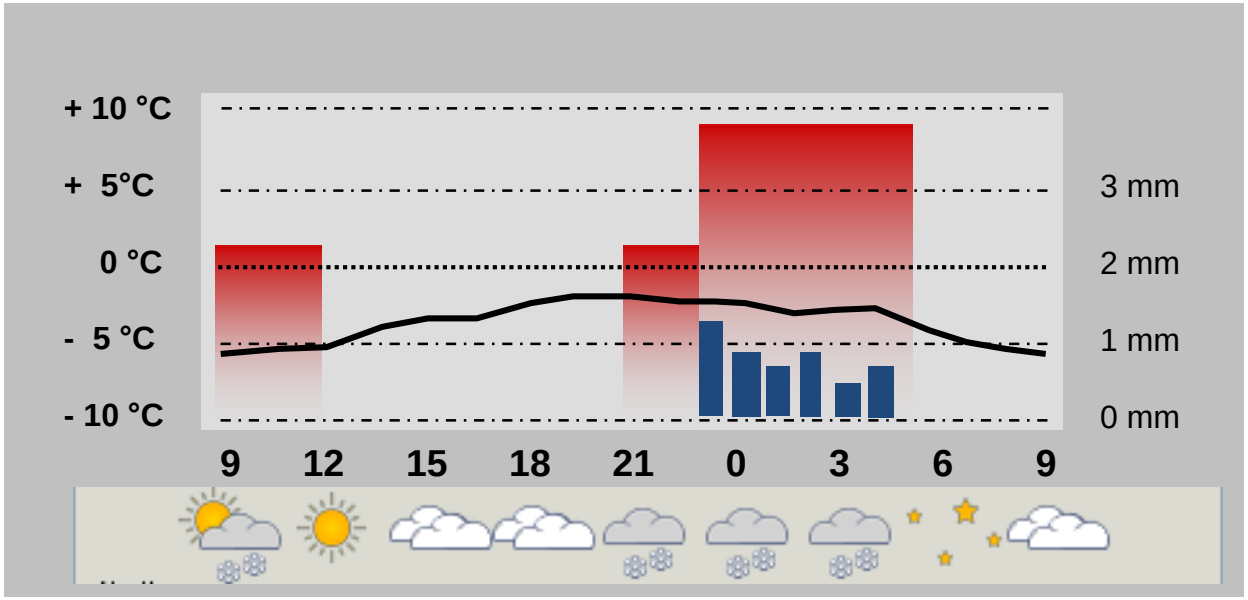
Energy saving 51 %
(from always on)
Energy saving 35 %
(from "Thermostat")



Weather forecast

Heating controlled as
"Weather station" +
incomming weather
forecast

Energy saving 71 %
(from always on)
Energy saving 41 %
(from "Weather station")



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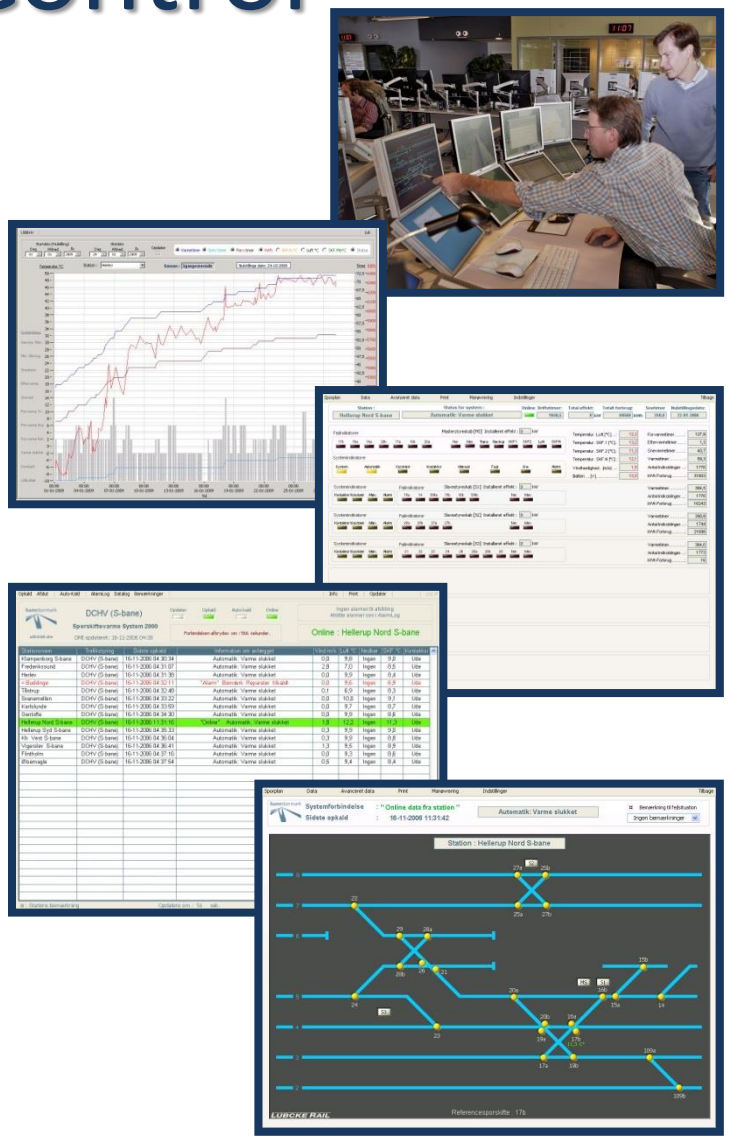
SCADA Monitoring & Control

- Reliable winter traffic
  - Instant messages for heating errors
- Analyze and Save Energy
  - Optimize settings based on historical information
- Reduce Maintenance Cost
  - Prioritize and bundle incoming services
- Instant status of all cubicles and switches
  - Change settings in seconds



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Branch Line BLUE POINT SCADA

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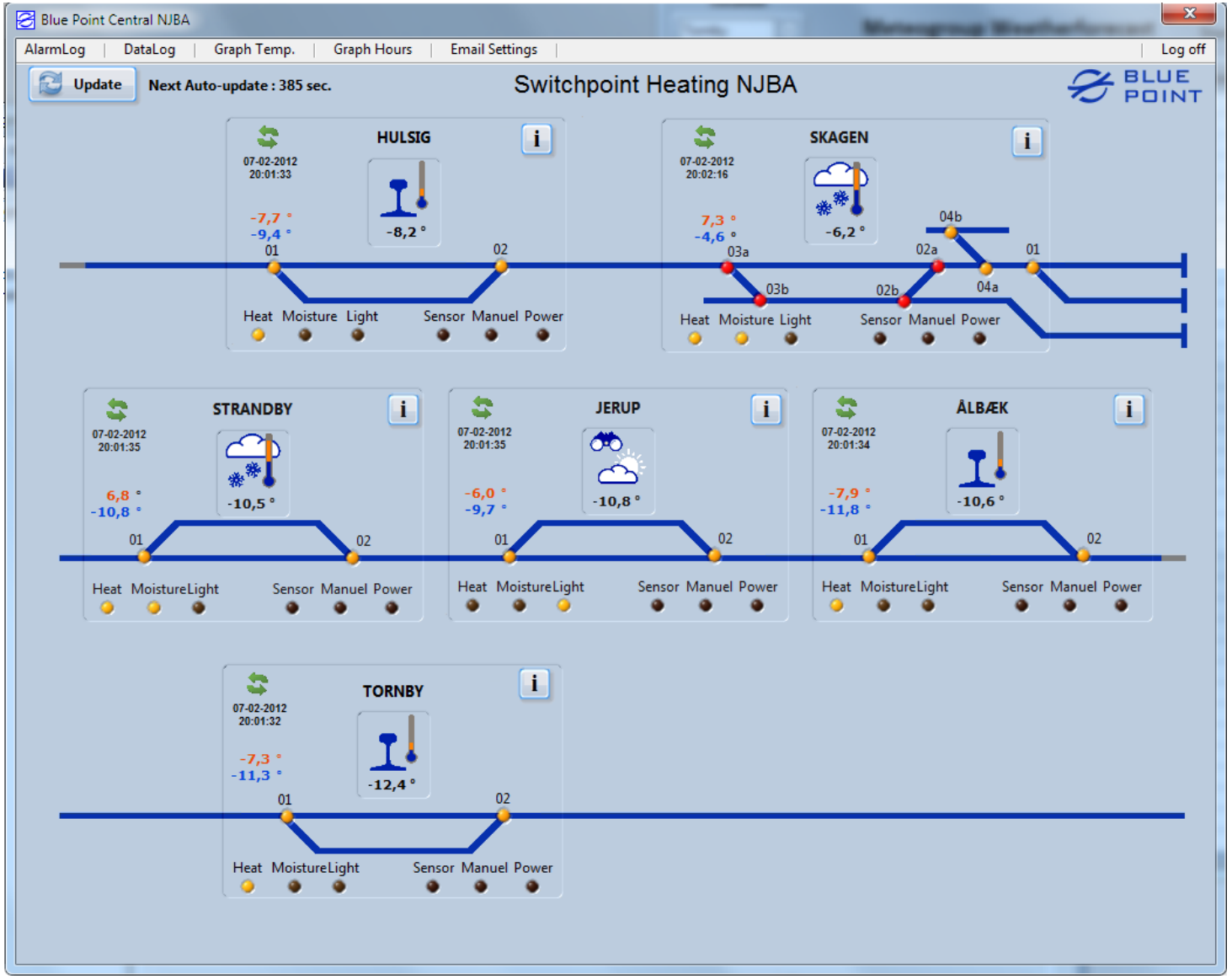
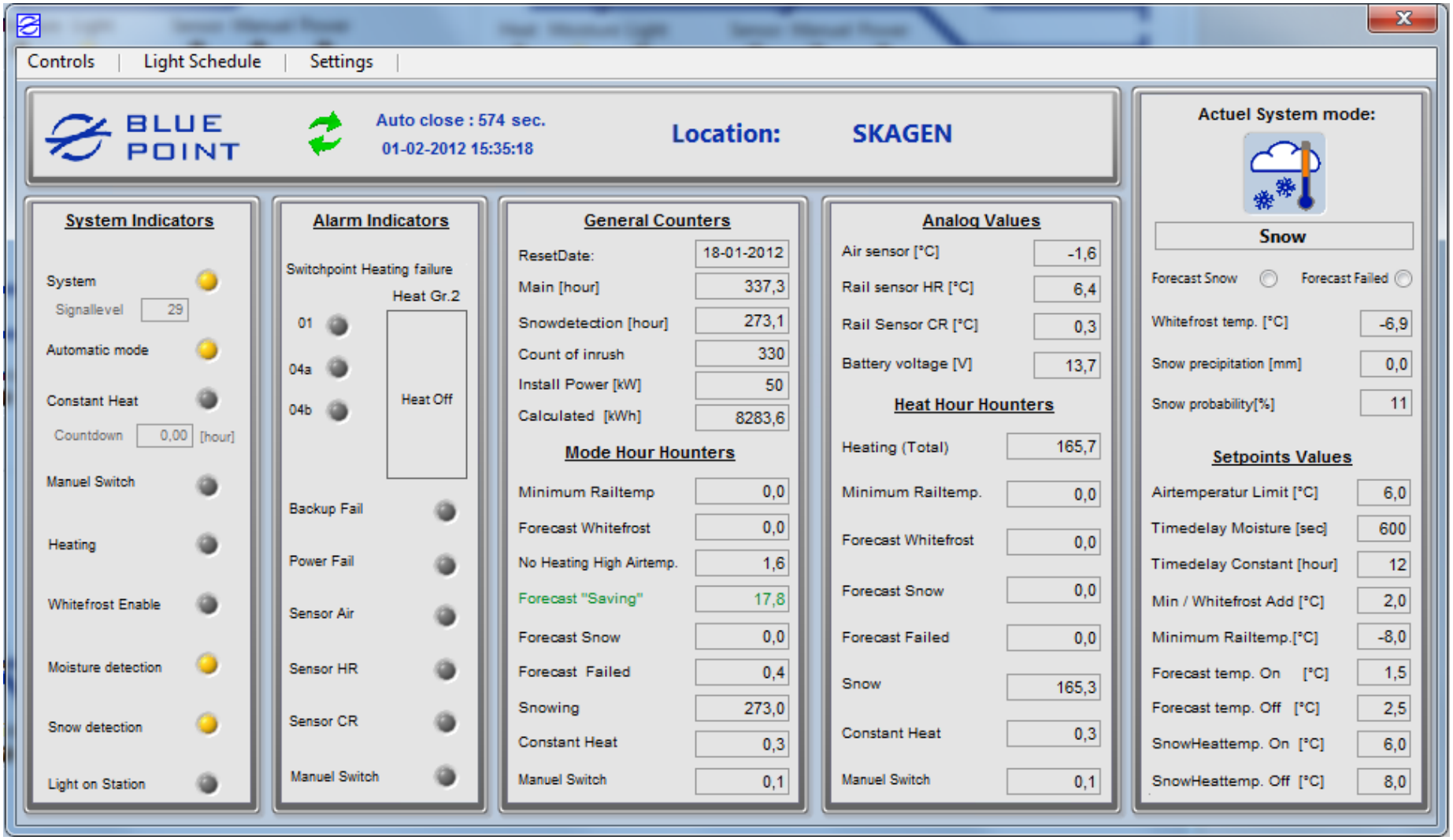
First page overview



Location overview (typically a Station)



Thank you for your time

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