

# 12<sup>th</sup> UIC Sustainability Conference



## Rolling Stocks Adaptation to Climate change

Dr. Véronique Andriès, Alstom, UNIFE  
Sustainable Transport Committee



## UNIFE represents the European Rail (Supply) Industry

- **Based in Brussels since 1992**
- **22 permanent employees**
- **A trusted partner of the **European institutions** in all matters related to rail and transport**
- **Full members: 76** of the largest and medium-sized companies in the rail supply sector
- **Associated members: 16** National Associations, representing almost 1,000 suppliers of railway equipment + EFRTC and UNISIG
- UNIFE members have an **80% market share in Europe** and supply more than **50% of the worldwide production** of rail equipment and services.



# Extreme Weather Conditions & Main Issues



## ■ Different weather conditions met :

- Nordic conditions : low temperatures, snow falls, frost (Sweden, Finland, China, Russia...)
- Desert conditions : high temperatures, sun radiation, sands (Dubai, southern parts of Italy and Spain, Morocco, Iraq, Iran...)
- High humidity, salty environment, swift temperature variations (Eurostar, Singapore, India...)
- Strong winds (Japan, Southern France...)

## ■ Main issues:

- Reliability and availability
- Safety
- Passengers' comfort
- Maintenance

# Rolling stock issues – reliability and availability



## Snow and frost

- Blocking of systems (doors and steps, coupling, pantograph),
- Priming of the power system
- Disruption of cooling system (clogging of filters)
- Difficult channeling



## Low temperatures

- Deterioration of the performance of the electronic components
- Capacity loss of the batteries



# Rolling stock issues - reliability and availability



## High temperature

- Reliability of the electronic and the electric components

## Sand and dust

- Disruption of the equipments' cooling unit
- Deterioration of the working systems (rotation and platforms)

## Humidity and salt

- Disruption of the power systems especially in the event of swift weather variations
- Corrosion



# Rolling stock issues - Safety



- **Bogie and brake system:** blocking and suspension of the braking system



- **Windshield:** limited visibility and windshield wipers deterioration

- **Fall of passengers** due to the presence of ice in the access area to the trains

- Disruption of high-speed trains' **stability** by strong winds

- Impact on materials' **mechanical resilience**

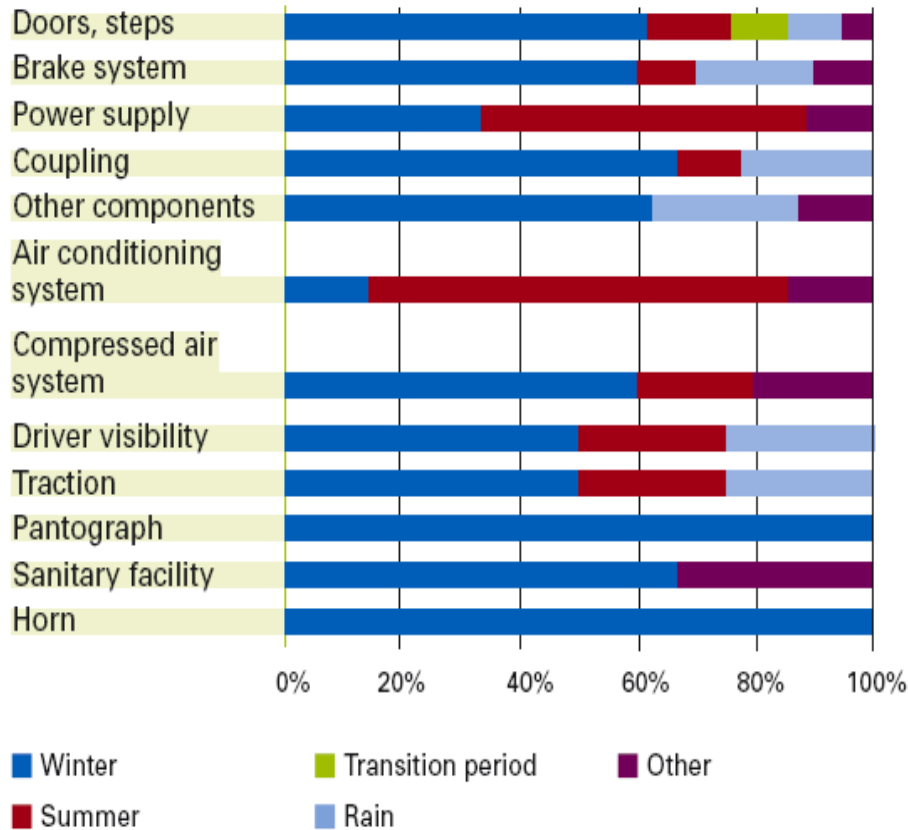
- Big weather variations create differential **dilatations'** problems



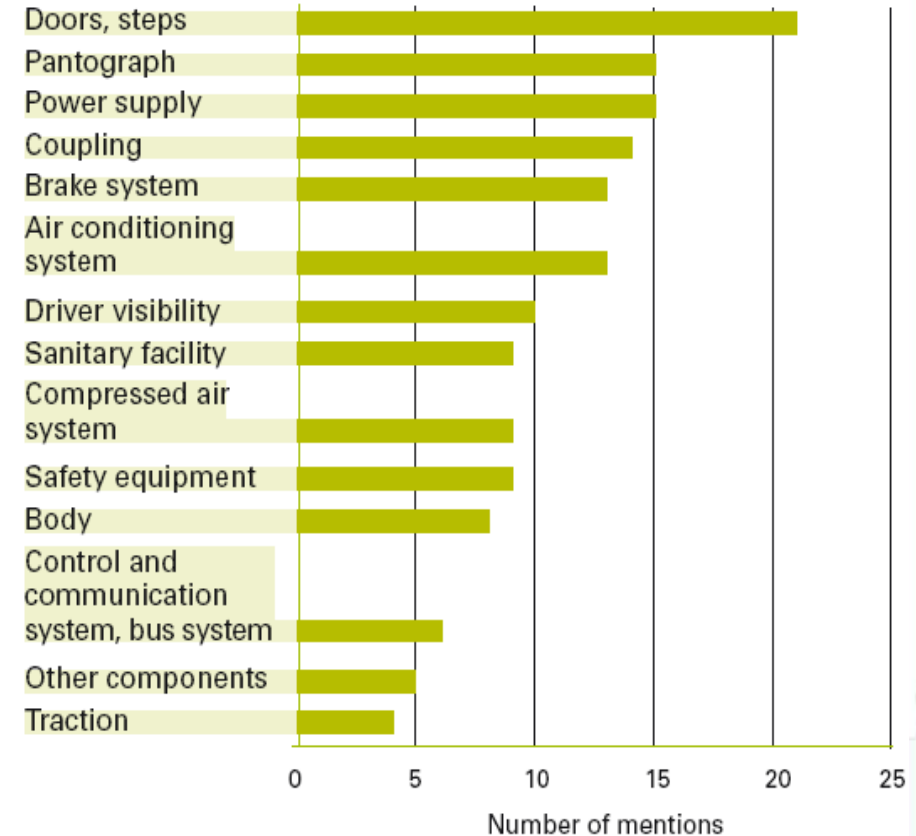
# Extreme weather conditions – main tested problems



## Relevance of different climatic conditions for different components



## Failure rate of different components



# Adaptation of the Rolling stocks to the Nordic conditions : Exemples



Roof air supply and installation of the body-shell under pressure



Protection of the mechanical components:  
bellow suspensions



Reinforcement of the isolation  
and the heating systems



Protection of the cabling

Heating of the door steps, the  
hydraulic system and the  
windshield...



Protection of the coupler &  
local heating system



# Adaptation of the Rolling stocks to the Nordic conditions : Exemples



## Modular Brake System for extreme climate conditions

Modular Brake System for Russian and CIS market with extreme climate conditions

Modular Brake System for locomotives with BP Compact and distributor valve KAB60.

The modular brake control system is in accordance with GOST requirements and due to BP Control it can be easily adapted to different operator and system integrator requirements.

### Advantages:

- Designed to operate between -50 °C and +70 °C
- Knorr-Bremse distributor valve for 1520 mm gauge
- Flexible design for different installation spaces
- High availability through back-up levels
- High precision and high power relay valve (BP Compact)
- Intelligent self-diagnostic system
- Optimized overhaul period of at least 6 years



# Adaptation of the Rolling stocks to desertic conditions : Exemples



## ■ Sanding equipment

- Cyclonic filters, blades, bellow
- Roof air supply for extreme events (same for snow)

## ■ Resizing of the electric and the electronic equipment

- Temperature of functioning of the standardized interface equipments
- Cooling of the power supply system, power converter, engine

## ■ Reinforcement of the thermal isolation (car shell, window) and installation of window-blinds

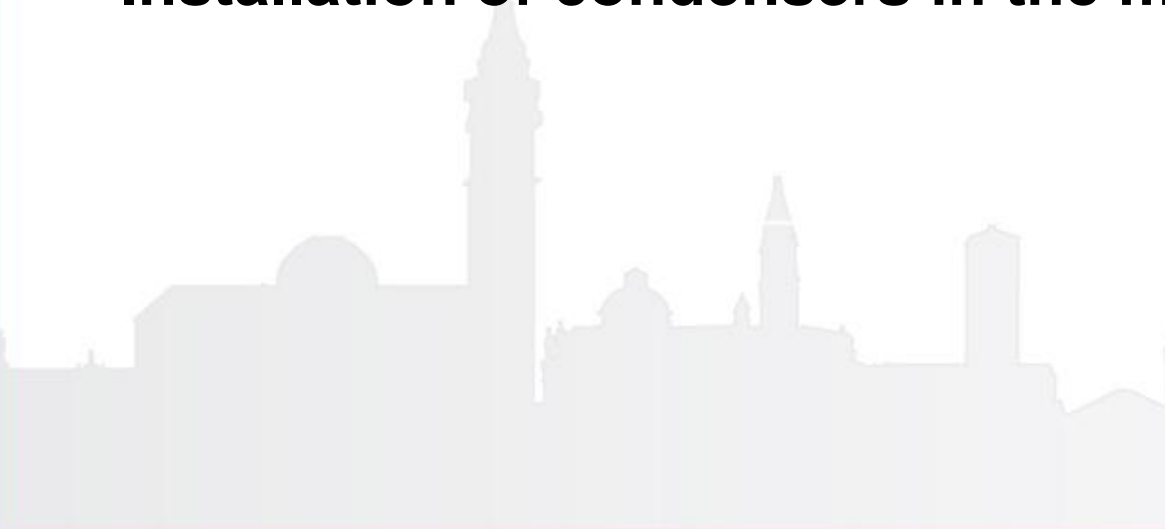
## ■ Reinforcement of the air-conditioning system and its autonomy in extreme weather conditions



# Adaptation of the Rolling Stock to hot and humid conditions: examples



- **Condensation protection**
- **Management of air-flow**
- **Protection of the electronic control panel**
- **Installation of condensers in the machines' area**



# Conclusion

**Adaptation to the extreme weather conditions :**

**Constraints .....  
and solutions**





# Conclusion



## Climate change adaptation of Rolling stocks :

- **Weather forecast + 10 / + 20/ +30 years  
?.....**

**In New Rolling stocks, refurbishment activities,  
Technologies development....**

- **Modular solutions**

