Things that remain eternal:

Taking care of the world around us

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JSC “RZD” Senior Vice-President

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Session 6: “Green Logistics – railway potential”

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Implementing the Company’s ecological strategy

JSC "RZD" ecological strategy for the period up to 2015 and for 2030 perspective

Ecological strategy target indices by 2015 and for 2030 perspective

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction of pollutant emissions into ambient air</td>
<td>by 5%</td>
<td>by 30%</td>
<td>by 70%</td>
</tr>
<tr>
<td>Reduction of disposal of insufficiently treated waste waters</td>
<td>by 3%</td>
<td>by 35%</td>
<td>by 70%</td>
</tr>
<tr>
<td>Increase of hazardous waste products treatment</td>
<td>by 2%</td>
<td>by 40%</td>
<td>by 70%</td>
</tr>
<tr>
<td>Liquidation of pollutions caused by last years business activities</td>
<td>by 8%</td>
<td>100%</td>
<td>Maintain normal condition</td>
</tr>
</tbody>
</table>

JSC "RZD" ecological strategy implementation program in 2010 with prospects up to 2015

2010 activities:

- Sewage treatment facilities
  - 21 facility
- Air cleaning equipment from dust and gas
  - 48 units
- Boiler installation
  - 16 units
- Ties utilization
  - Wooden - 3,7 thsd.t
  - Concrete - 45 thsd.t
Improvement of JSC “RZD” environmental indices

<table>
<thead>
<tr>
<th>Year</th>
<th>Commercial freight tkm, bln.</th>
<th>Passenger-km, bln.</th>
<th>Emission of pollutants, thsd.t</th>
<th>Waste water discharge to surface water bodies, thsd.t</th>
<th>Waste production, mln.t</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>1801,6</td>
<td>164,3</td>
<td>181,3</td>
<td>33,2</td>
<td>3,0</td>
</tr>
<tr>
<td>2007</td>
<td>2090,3</td>
<td>174,1</td>
<td>148,0</td>
<td>16,0</td>
<td>2,8</td>
</tr>
<tr>
<td>2009</td>
<td>1865,3</td>
<td>153,6</td>
<td>181,3</td>
<td>2,2</td>
<td>113,3</td>
</tr>
<tr>
<td>2015</td>
<td>182,0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Environmental indices**

- Change: -25%, -23.4%, -21.4%, -13.1%, -10.8%, -10.8%, -10.8%, -10.8%, -10.8%, -10.8%, +11%, +5%

**Operation indices**

- Change: -35%, -30%, -25%, -21.4%, -11.8%, -11.8%, -11.8%, +11%, +5%
Train – lab of the XXI century

DETECTION, DIAGNOSTIC, PREDICTION AND EVALUATION OF EXTREME ENVIRONMENT AND EMERGENCY SITUATION CONSEQUENCES
Possibilities of environment monitoring with train-lab

Remote control of reactive chemical compounds emissions (NO, SO2, O3, stack ash)

Projection of NO concentration change on the railway track in the vicinity of Tyumen

Kits for remote testing are used for receiving 3D tomographic images of air condition and exact identification of pollutant sources.
Hazardous and special cargoes transportation monitoring system

Hazardous freight information

Designated computer workstations

Train sheet

JSC "RZD" Geographic Information System

Time-coordinate information collecting and processing integrated center
GLONASS/GPS
JSC "RZD"

Emergency situation card

Online cooperation

Demilitarized zone

Mobile satellite services operators

Ministry of Emergency Situations

Internal Affairs Ministry

Federal Security System
Raising the Company’s energy efficiency

Energy strategy target indices by 2015

- Reduction of energy unit consumption costs for traction power:
  - electric – 3.5 – 4.0%;
  - diesel – 4.5-5.5%.
- Reduction of fuel-energy resources for non-traction needs – 13-15%.

Note: ASKU TER System - System for integrated fuel&power resources accounting;
KTU-3 System - Catalytic centralized heating water supply modular installation

Energy saving and energy efficiency target indices in 2010

- Reduction of fuel&power unit consumption for traction power:
  - electric – 0.5 kW/h/10 thsd. tkm gross (by 0.4%);
  - Diesel - 0.6 kg of fuel unit/10 thsd./tkm gross (by 0.9%).
- Increase of energy pumpback return - 6%
- Reduction of main fuel&energy resources consumption in stationary power systems – 3%

2010 activities

- Automatic control operation
- Diesel fuel accounting system
- Diesel heating system
- Building energy saving system
- Pilot project
- KTU-3 System
- ASKU TER System
- L.E.D. systems
- 3 boiler plants
- 883 systems
- 4 systems
- 360 systems
- 305 systems
- 304 systems
Automatic system for commercial accounting of power consumption (ASKUE)

- Instrumental accounting of power consumption;
- Energy consumption mode on-line control;
- Data transmission to different control levels.

Basic functions of ASKUE

Advantages vs analogues

- Low operation costs;
- No availability of wired communication links;
- Compactability of system;
- Easy service maintenance;
- High level of data security;
- Multilevel redundancy system.

Automated system for integrated fuel and power resources accounting (ASKU TER)

Objective

- Line-up of control strategy for planning and consumption of fuel and power resources.

Functions of ASKU TER

- Instrumental accounting of power consumption;
- Automated data collection and processing;
- Database forming;
- Providing of remote users database access;

Targets, solved by ASKU TER

- Evaluation of power consumption pattern, consumption analysis and define directions towards fuel and power resources cost savings;
- Realization of settlement payments with energy suppliers on the basis of ASKU TER database;
- Transparent scheme of financing fuel and resources procurement.

Fuel and power resources consumption savings make up 1% per year
Main energy saving approaches in railway operations

Introduction of optimum energy-saving train movement schedules

Energy saving is achieved through:
- Maximum use of the train’s kinetic energy;
- Maximum reduction of non-productive energy consumption

Planned electric energy volume savings on railway network in 2010 – over 50 mln.kW/h

Energy saving is achieved through:
- Maximum use of the train’s kinetic energy;
- Maximum reduction of non-productive energy consumption

ATO systems

ATO systems started to be introduced on JSC «RZD» locomotives in 1998. By the present time ATO systems have been installed on 3029 passenger and freight electric locomotives as well as on 1561 EMUs. It is planned to start in 2010 installation of ATO systems also on TEP70 passenger diesel locomotives and EP2K passenger electric locomotives.

Large-scale introduction of ATO systems resulted in reduction of energy consumption by 3 - 12 per cent.

Introduction of optimum energy-saving train movement schedules has permitted to reduce indirect greenhouse gas emissions by 135,57 thsd.t CO₂ equiv.
Worlds first main-line gas-turbine locomotive GT1, working on liquefied natural gas

<table>
<thead>
<tr>
<th>Power equipment capacity</th>
<th>8300 kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turbine type</td>
<td>NK 361</td>
</tr>
<tr>
<td>Turbine resource</td>
<td>&gt;100 thsd.h</td>
</tr>
<tr>
<td>Liquefied natural gas reserve</td>
<td>17 t</td>
</tr>
<tr>
<td>Fuel endurance</td>
<td>1000 km</td>
</tr>
</tbody>
</table>

Emission reduction – by more than 5 times

<table>
<thead>
<tr>
<th>Locomotive</th>
<th>2TE116</th>
<th>GT1</th>
<th>Change, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life cycle cost, bln. RUB</td>
<td>1.17</td>
<td>0.98</td>
<td>-19.4</td>
</tr>
</tbody>
</table>
Innovative technical solutions for raising rolling stock energy efficiency

**Double-diesel engine unit ČME 3 shunting locomotive**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction of greenhouse gas emissions (%)</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Decrease in fuel consumption (%)</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Emission reduction (%)</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>Engine power, kW</td>
<td></td>
<td>2x478</td>
</tr>
</tbody>
</table>

*Engineering company: VNIKTI*

**Hybrid shunting locomotive**

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<tr>
<td>Reduction of greenhouse gas emissions (%)</td>
<td></td>
<td>35</td>
</tr>
<tr>
<td>Decrease in fuel consumption (%)</td>
<td></td>
<td>35</td>
</tr>
<tr>
<td>Emission reduction (%)</td>
<td></td>
<td>38</td>
</tr>
<tr>
<td>Engine power, kW</td>
<td></td>
<td>441</td>
</tr>
</tbody>
</table>

*Engineering company: VNIKTI*

**Gas-turbine locomotive ČME 3 working on compressed natural gas**

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<th>Feature</th>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated replacement of diesel fuel with natural gas (%)</td>
<td></td>
<td>60</td>
</tr>
<tr>
<td>Reduction of toxic exhaust gases when operated on natural gas (%)</td>
<td></td>
<td>Not less than 30</td>
</tr>
<tr>
<td>Emission reduction (%)</td>
<td></td>
<td>52</td>
</tr>
<tr>
<td>Engine power, kW</td>
<td></td>
<td>990</td>
</tr>
</tbody>
</table>

*Engineering company: VNIIZhT*
Catalytic centralized heating-water supply modular installation KTU-3 (first in Russian Federation)

- Reducing coal consumption for 439 t (28%)
- Energy saving 74400 kWh (27%)
- Reduction of ashes and slag waste from 518 to 145 t
- Reduction of greenhouse gas emissions equivalent to 1400 t CO₂

ECOLOGICAL EFFICIENCY OF USING HEATING-WATER SUPPLY MODULAR INSTALLATION KTU-3 AT ARTYSHTA STATION (ZAPADNO-SIBIRSKAYA RAILWAY) DURING THE HEATING SEASON 2008 – 2009:
Alternative energy sources application

The first in Russia power plant of railway control and communication on hydrogen fuel cells

The power plant is intended for the usage as an automatically switching emergency power source for railway control and communication devices.

The power plant possesses some benefits: independency, high efficiency, silent running, ecological safety, compact size. Maximal capacity of the plant – 15 kW, three-phase output - 380/220 V at 50 Hz AC.

The power plant permits complete power supply of all operating devices at Malino station, which provide safety of railway operation.

Combined solar water heater

Combined solar water heater USKV-1 is used in heating and hot water supply systems. Usage of USKV-1 allows reducing of annual consumption of fuel oil by 10 t, of energy by 355 thousand kW·h, and of coal by 35 t.

| Reduction of greenhouse gases emission into atmospheric air, t CO₂ e | 1082 |
| Reduction of harmful substances emission, t | 131 |
JSC “RZD” main indicators of energy efficiency and environmental impact reduction in 2015

**Unit energy consumption for train traction, kg of fuel unit / 10 thousand gross t-km**

- **2004**: 44.4 kg
- **2009**: 42.6 kg
- **2015**: 41.7 kg

**Change**: -2.1%

**CO₂ annual emission in rail segment operation, mln. t**

- **2004**: 37.0 mln. t
- **2009**: 35.0 mln. t
- **2015**: 32.3 mln. t

**Change**: -7.7%

**Average operating speed of freight trains, km/h**

- **2004**: 39.6 km/h
- **2009**: 40.8 km/h
- **2015**: 42.4 km/h

**Change**: +3.9%

**Average train weight, gross t**

- **2004**: 3670 t
- **2009**: 3854 t
- **2015**: 4100 t

**Change**: +6.4%