Environmentally sustainable improvement of IWT on the Danube

DI Markus Simoner
June 25th 2007, Cernavoda
Agenda

1. via donau – company profile
2. Ecological impacts of IWT
3. European activities to promote IWT
4. Framework conditions for competitive Danube navigation
via donau – company profile
via donau is ...

- ... the Austrian national waterway operator
- ... owned by the Ministry of Transport Innovation and Technology
- ... responsible for 351 km of the Danube waterway
Sites via donau

250 employees
Status: April 2007
Ecological impacts of IWT
Environmental performance of IWT (1)

- IWT is a **safe** and **environmentally friendly** transport mode.
- **Low contribution to total traffic emissions** due to very low share of total traffic energy consumption (road + rail + IWT, where IWT’s share is about 1.5%!).
- IWT cannot solve the problematics associated with the achievement of **Kyoto target**, but it can **significantly contribute to it**.

![Distribution of final energy consumption by sector in EU 25 (2003)](source: EEA)
Environmental performance of IWT (2)

- IWT in comparison to road transport:
  - On average approx. 1/3 energy consumption, CO$_2$ emissions (per tkm)
  - HC, CO emissions significantly lower
  - SO$_x$ emissions high due to sulphur content in fuel
  - Improvement potential w.r.t. NO$_x$ and PM high compared to road transport adapting fast to new technologies
  - Engine age higher, engine replacement rate slower
Ecological impacts of IWT

IWT has ecological impacts on:

1) The river through waterway infrastructure and low-water regulation
   • River engineering measures (training walls, groynes)
   • Maintenance works (dredging)

2) The environment (emissions, waste) through the operation of vessels
   • Emissions: \( \text{CO}_2, \text{HC}, \text{CO}, \text{SO}_x, \text{NO}_x, \text{PM} \)
   • Waste
     • Ship-borne (used oil, bilge water, others)
     • Waste caused by cargo (washing water, slops)
     • Environmental pollution through ship accidents

The first domain is subject of the ongoing process – the joint statement should minimise the ecological impacts of future infrastructure improvement measures
IWT has the lowest CO\textsubscript{2} emissions

- Example transport relation Constanta – Vienna
- CO\textsubscript{2} emissions caused by the transport of one container (TEU):
  - Danube: 349 kg CO\textsubscript{2} / TEU (100%)
  - Rail: 567 kg CO\textsubscript{2} / TEU (162%)
  - Road: 933 kg CO\textsubscript{2} / TEU (267%)
Areas of innovation for fleet

Innovations in Vessel Technology

Vessel Propulsion
- Vessel construction
- Materials
- Vessel hydrodynamics

Vessel Construction
- Propulsion systems
- Fuels
- Motors

Navigation, Logistics, Operational form
- Navigation and information systems, e.g. RIS
- Automation and use of electronics on board
- Functional flexibility vs. vessel specialisation
# Emission reduction technologies

<table>
<thead>
<tr>
<th>MODERN DIESEL ENGINES / INTERNAL ENGINE IMPROVEMENTS</th>
<th>ALTERNATIVE COMBUSTION ENGINES</th>
<th>NEW PROPULSION AND AUXILIARY SYSTEMS</th>
<th>DRIVE MANAGEMENT IMPROVEMENTS</th>
<th>HIGHER DIESEL FUEL QUALITY / SUBSTITUTES</th>
<th>EXHAUST GAS AFTER-TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>• EGR (Exhaust gas recirculation)</td>
<td>• Diesel electric concepts</td>
<td>• FC (fuel cell)</td>
<td>• ATM (Advising Tempomaat)</td>
<td>• LSF (Low sulphur fuel)</td>
<td>• PMF (Particulate matter filter)</td>
</tr>
<tr>
<td>• Steam/water injection</td>
<td>• Gas engines</td>
<td></td>
<td></td>
<td>• BD (Bio diesel)</td>
<td>• SCR (Selective catalytic reduction)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• BDB (Bio diesel blend)</td>
<td>• Diesel oxidation catalyst</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• NG (Natural gas)</td>
<td>• Wet scrubber</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Hydrogen</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Reformed liquid fuels</td>
<td></td>
</tr>
</tbody>
</table>

**LEGEND**
- Orange: Short / medium term
- Grey: Medium / long term
- White: Niche applications

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http://www.creating.nu
Emission reduction potentials

Achievable reduction potential with different emission reduction technologies. Initial situation is a vessel according to CCNR I standards without application of emission reduction technologies.

<table>
<thead>
<tr>
<th>After treatment techniques</th>
<th>NO&lt;sub&gt;x&lt;/sub&gt;</th>
<th>PM</th>
<th>Fuel consumption</th>
<th>CO&lt;sub&gt;2&lt;/sub&gt;</th>
<th>SO&lt;sub&gt;x&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCR (Selective catalytic reduction)</td>
<td>-81%</td>
<td>-35%</td>
<td>-7.5%</td>
<td>-7.5%</td>
<td>none</td>
</tr>
<tr>
<td>PMF (Particulate matter filter)</td>
<td>none</td>
<td>-85%</td>
<td>+2%</td>
<td>+2%</td>
<td>none</td>
</tr>
<tr>
<td>Drive management systems</td>
<td>-10%</td>
<td>-10%</td>
<td>-10%</td>
<td>-10%</td>
<td>none</td>
</tr>
<tr>
<td>ATM (Advising tempomaat)</td>
<td>-10%</td>
<td>-10%</td>
<td>-10%</td>
<td>-10%</td>
<td>none</td>
</tr>
<tr>
<td>Diesel fuel quality / substitutes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BD (Bio diesel)</td>
<td>+10%</td>
<td>-5%</td>
<td>+15%</td>
<td>-65%</td>
<td>~100%</td>
</tr>
<tr>
<td>BDB (Bio diesel blend, 20 % BD)</td>
<td>+2%</td>
<td>-1%</td>
<td>+3%</td>
<td>-13%</td>
<td>~20%</td>
</tr>
<tr>
<td>LSF (Low sulphur fuel)</td>
<td>none</td>
<td>-17%</td>
<td>none</td>
<td>none</td>
<td>~100%</td>
</tr>
<tr>
<td>New engine technologies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NGE (Natural gas engine)</td>
<td>-98.5%</td>
<td>-97.5%</td>
<td>+4.5%</td>
<td>-10%</td>
<td>100%</td>
</tr>
</tbody>
</table>
Outlook on emissions (1)

- **EC** considers introduction of *low sulphur fuel to IWT* (300 ppm in 2009, 10 ppm in 2011)

- Implementation of **NAIADES** will contribute directly to a more environmentally friendly fleet (action: *improve logistics efficiency, environmental and safety performance of IWT*) => EU project **PLATINA**

- **Research** and **feasibility studies** are required with respect to the application of **new technologies** like **NGE** and **fuel cells** to inland navigation
Outlook on emissions (2)

- **Research** with respect to **new vessel concepts** leading to less fuel consumption per tkm by **improved hydrodynamics** and **lighter construction** has to be carried out => first step taken with **EU project 2Create**

- **National subsidy programmes** for a modern and environmentally friendly fleet have to be established and enhanced as they are not sufficient yet – modernisation of vessel engines is an important topic

- **IWT must remain the most environmentally friendly transport mode**
Waste caused by inland navigation

Ship-borne waste
- Oily and greasy ship-borne waste
  - Used oil
  - Bilge water
  - Other oily and greasy waste
    - Used grease, used filters, used rags, bundles and packaging of such waste
- Other ship-borne waste
  - Domestic sewage
  - Domestic refuse
  - Sewage sludge
- Other hazardous waste
  - Paint, varnish, resolvents and the like

Waste caused by cargo
- Washing water
- Slops
WASTE management for inland Navigation on the DAnube

Programme
• Interreg (forthcoming call, autumn 2007)

Motivation
• Development and implementation of a sustainable and transnationally coordinated approach in ship waste management along the Danube

Objectives
• Protection of water resource Danube by implementing preventive measures
• Preparation of transnationally coordinated ship waste management concepts, setting the basis for implementation and elaboration of an international financing model for oily and greasy ship waste
Partners
Key activities

- Coordinated elaboration of national ship waste management concepts
- Preparation and implementation of pilot actions
- Development of financing model for oily and greasy ship waste
- Harmonisation and coordination activities
European activities to promote sustainable inland waterway transport
NAIADDES Action Programme

- Presented by the European Commission on 17 January 2006
- Multi-annual Action Programme in order to foster transport by inland waterways in Europe (2006 – 2013)

- **Objectives:** Increase competitiveness of inland waterway transport & integrate into door-to-door logistics chains
  - More freight transport on European inland waterways

- **Addressees:** EU member states, industry, social partners, river commissions, European Commission and other EU institutions
Adoption process of NAIADES

• Adoption of „Council Conclusions on the promotion of inland waterway transport“ on 8 – 9 Juni 2006 in Luxembourg

• Resolution of the European Parliament on the promotion of inland waterway transport on 26th October 2006
National Austrian action plan for an active IWT policy
Austrian Action Plan Danube Navigation

- Comprehensive and dynamic planning and decision-making instrument for Austrian inland navigation policy until 2015
- Austrian implementation strategy of the European NAIADES action programme
- Catalogue of measures developed in cooperation with the inland navigation sector and environmental stakeholders
### Catalogue of Measures

#### Comprehensive Strengthening of Danube Navigation within the Austrian Freight Transport System

<table>
<thead>
<tr>
<th>Measures</th>
<th>Infrastructure</th>
<th>Ports</th>
<th>Information Systems</th>
<th>Fleet</th>
<th>Education &amp; Training</th>
<th>Promotion</th>
<th>Facts &amp; Figures</th>
<th>New Markets</th>
<th>Grants</th>
<th>International Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Remove bottlenecks on the Austrian Danube</td>
<td></td>
<td></td>
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<tr>
<td>2. Ensure adequate waterway maintenance and management</td>
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<tr>
<td>3. Minimize lock closing times due to revision works</td>
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<tr>
<td>4. Support an integrative improvement of fairway conditions on the entire Danube</td>
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</tbody>
</table>

### Measures

1. **Infrastructure**
   - Maintain and improve waterway infrastructure
   - Remove bottlenecks on the Austrian Danube
2. **Ports**
   - Further develop Danube ports into multimodal logistics centres
   - Ensure adequate waterway maintenance and management
   - Minimize lock closing times due to revision works
3. **Information Systems**
   - Implement DoRIS in Austria
   - Push for the modernization of ports and transhipment sites
   - Further develop technologies relevant to RIS
4. **Fleet**
   - Modernize the Austrian fleet
   - Further develop RIS for official and commercial use
   - Improve the safety of inland navigation
   - Increase the availability of education
5. **Education & Training**
   - Modernize the Austrian fleet
   - Further develop RIS for official and commercial use
   - Support the construction of scheduled liner services and new multimodal transport
6. **Promotion**
   - Launch a training offensive
   - Provide web-based facts and figures about Danube navigation
   - Support an integrative improvement of fairway conditions on the entire Danube
   - Support the modernization of South-Eastern European Danube ports
7. **Facts & Figures**
   - Implement DoRIS in Austria
   - Push for the modernization of ports and transhipment sites
   - Strengthen pro-Danube navigation national lobbying activities
   - Support the further development of South-Eastern European Danube ports
8. **New Markets**
   - Collect and process fundamental data on Danube navigation
   - Provide logistics advice in the field of Danube navigation
   - Support the modernization of South-Eastern European Danube ports
   - Support the development of scheduled container liner services and new multimodal transport
9. **Grants**
   - Create and implement a coordinated PR strategy
   - Create a national platform for pro-Danube navigation public relations work
   - Support the implementation of the European action plan
   - Support the modernization of South-Eastern European Danube ports
10. **International Activities**
    - Improve the image of European inland navigation
    - Provide logistics advice in the field of Danube navigation
    - Support the modernization of South-Eastern European Danube ports
    - Support the development of scheduled container liner services and new multimodal transport

### Key Areas

- **Infrastructure**
- **Ports**
- **Information Systems**
- **Fleet**
- **Education & Training**
- **Promotion**
- **Facts & Figures**
- **New Markets**
- **Grants**
- **International Activities**
Selected projects of via donau with relevance to environmental protection
Donau River Information Services
River Information Services (RIS)

Traffic related services

- Fairway information
- Traffic information
- Traffic management
- Calamity abatement
River Information Services (RIS)

Transport related services

- Cargo & fleet management
- Waterway charges and harbour dues
- Information for law enforcement
- Statistics
DoRIS Components

- 23 base stations
- 9 work stations at Danube locks
- 12 fixed authority work stations
- 15 mobile work stations
- 1 national control center

- Equipped ships (per 24.05.07):
  - 78 passenger vessels
  - 198 cargo vessels
  - 25 authority vessels
  - **301 total**
Status Quo of RIS on the Danube (June 07)

- Electronic Navigational Charts
- Water level information
- Notices to skippers
- Electronic reporting (in prep.)
- Tactical traffic information
- RIS Centre
- Electronic Reporting (in prep.)

- Electronic Navigational Charts
- Notices to skippers
- Electronic reporting (in prep.)
- Tactical traffic information (in prep.)
- RIS Centre

- Electronic Navigational Charts
- Water level information
- Notices to skippers
- Tactical traffic information
- VTMIS for maritime Danube

- Electronic Navigational Charts
- Notices to skippers
- Calamity abatement support
- Tactical traffic information
- RIS Centre
- Electronic Reporting (in prep.)

- Electronic Navigational Charts
- Water level information
- Notices to skippers
- Tactical traffic information (in prep.)
- RIS Centre

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- Water level information
- Notices to skippers
- Tactical traffic information (in prep.)
- RIS Centre
- Electronic Reporting (in prep.)

- Electronic Navigational Charts
- Water level information
- Notices to skippers
- Tactical traffic information (test)
- RIS Centre
- Electronic Reporting (in prep.)

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- Notices to skippers
- Tactical traffic information (test)
- RIS Centre
- Electronic Reporting (in prep.)
Environmental benefits of DoRIS

• Reduced fuel consumption / less emissions through better fairway information
  • water depth info in electronic navigational charts (ENCs)
  • better resource management at locks and in ports
• Increased traffic safety through
  • tactical traffic image on board of vessel
  • continuous monitoring of hazardous goods
• Reduced impact of accidents through
  • improved calamity abatement / traceability of accidents
• Higher share of IWT in transport market / less emissions through
  • acceleration of logistical processes
  • close-to-real-time tracking of shipments
Project COLD
Container Liner Service Danube
... a new transport route: Constanta and the Danube waterway
Enormous growth of container traffic

Asia-Europe 2004: + 16.5 % !!!

Sources: Containerisation International, ISL, BRS, respective port authorities
* TEU (Twenty-Foot-Equivalent Unit)

Quelle: Hulocon 2005
Project COLD
Container Liner Service Danube

- Austrian – Romanian initiative
- Provides unbiased and comprehensive information on potentials to all interested stakeholders
- Feasibility study covering:
  - Starting situation: Congestion in North Sea ports, worldwide growth of container transport etc.
  - Market and peer analysis: Container market in Austria, Hungary and Slovakia, forecast 2010 – 2020, rail tariffs
  - Inland navigation concept
  - Analysis of supply chain Krems – Shanghai in terms of duration, cost and environmental balance
  - Conclusions and recommendations for action
Conclusions

- Alternative routing via Constanta and Danube highly attractive for trade between Asia and Central Europe:
  - Significant advantage in total cost (10-30 %)
  - Similar transit time for total supply chain
  - Environmental balance very positive (16 % less CO₂ per container)
Feasibility Study of Container Liner Services on the Danube

Inland Navigation eLearning System

= eLearning Platform for the Danube

• **Target groups**
  • Logistics schools
  • Universities and Fachhochschulen
  • Practitioners
  • Private individuals

• **7 learning topics** prepared for **3 learning levels**
  • Content is clearly structured
  • Usage of multimedia material, interactive elements, pictures and graphs

• **Access** free of charge for all interested parties at [www.ines.info](http://www.ines.info)
Manuals on Danube Navigation
Framework conditions for competitive Danube navigation
Competitive factors of freight transport

main factors: 1. transport price
  2. quality of service

The predominant factor is transport price in relation to quality indicators.

Quality:
- Reliability
  - punctuality – just in time and door-to-door
  - Care for cargo (no damage to cargo during transport)
  - Integration into logistics chains – interfaces between modes of transport
- Regularity of transport service (liner services)
- Speed
- Security
- Environmental compatibility
Inland navigation as a system

„Hardware“ of the IWT system:

- **waterway infrastructure** (navigation fairway width and depth)
- **ports** (interface for transshipment and auxiliary services)
- **vessels** (means of transport)
Cost factors for operating a vessel

- Standby costs = fixed costs
- Operating costs = variable costs (fuel consumption)

Total costs = fixed costs + variable costs

Standby costs amount 70 - 80% of total costs

Operating costs amount 20 - 30% of total costs
Standby costs and daily rates of vessels

<table>
<thead>
<tr>
<th>Operating Mode</th>
<th>A 14 h/d</th>
<th>C 24 h/d</th>
<th>C 24 h/d</th>
<th>C 24 h/d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vessel category</td>
<td>MCV</td>
<td>MCV</td>
<td>MCPV</td>
<td>PL</td>
</tr>
<tr>
<td>Current value €</td>
<td>500,000</td>
<td>1,000,000</td>
<td>1,150,000</td>
<td>290,000</td>
</tr>
<tr>
<td>Operator</td>
<td>Private</td>
<td>Private</td>
<td>Company</td>
<td>Company</td>
</tr>
<tr>
<td>t/dw/Drive power</td>
<td>1,350 t</td>
<td>2,000 t</td>
<td>2,000 t</td>
<td>1,700 t</td>
</tr>
<tr>
<td>Days in use/year</td>
<td>320</td>
<td>320</td>
<td>330</td>
<td>330</td>
</tr>
<tr>
<td>Costs in €/year</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crew</td>
<td>112,000</td>
<td>173,000</td>
<td>184,000</td>
<td>-</td>
</tr>
<tr>
<td>Repairs</td>
<td>25,000</td>
<td>30,500</td>
<td>32,500</td>
<td>9,000</td>
</tr>
<tr>
<td>Insurance</td>
<td>15,000</td>
<td>23,000</td>
<td>23,000</td>
<td>7,300</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>20,000</td>
<td>30,000</td>
<td>11,000</td>
<td>-</td>
</tr>
<tr>
<td>Amortisation/Depreciation(^1)</td>
<td>40,000</td>
<td>80,000</td>
<td>92,000</td>
<td>23,200</td>
</tr>
<tr>
<td>Interest(^2)</td>
<td>15,000</td>
<td>30,000</td>
<td>34,500</td>
<td>8,700</td>
</tr>
<tr>
<td>Overhead shipping company (30 %)</td>
<td>-</td>
<td>-</td>
<td>113,000</td>
<td>14,500</td>
</tr>
<tr>
<td>Total costs</td>
<td>227,000</td>
<td>359,500</td>
<td>490,000</td>
<td>62,700</td>
</tr>
<tr>
<td>Daily costs</td>
<td>709</td>
<td>1,123</td>
<td>1,485</td>
<td>190</td>
</tr>
</tbody>
</table>

\(^1\) Assumed remaining period of use 12.5 years
\(^2\) 6% of 50% of the current value

Source: Manual on Danube navigation, via donau
Operating costs (fuel consumption)

Development of average annual fuel price:

<table>
<thead>
<tr>
<th>Year</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price of 100 litres, in euros</td>
<td>26.50</td>
<td>30.07</td>
<td>35.88</td>
<td>46.67</td>
</tr>
</tbody>
</table>

Source: Market Observation for European Inland Navigation 2005, CCR and EK
Criteria for competitiveness

Freight rates depend on:

- Cost structure of IWT (fixed and variable costs)
- Possible utilization degree of vessels
- Market situation (competitive position towards road and rail)
  - transport relation
  - type of good
  - logistics factors
Interdependency of utilization degree of vessels and freight rate

Low water periods (as in autumn 2003) lead to lower utilization degrees of vessels and herewith to higher transport costs and prices
Impacts of insufficient and extremely varying water depths

- Failures in transport operation (waiting time, lightering, substitute traffic)
  - divergent price-performance ratio
  - reduced efficiency
  - reduced transport safety
- Necessity of high storage capacity for companies
  - limited market potential
  - reduced competitiveness of inland navigation
- Decision to opt for other transport mode!
  - smaller share of inland navigation in modal split
Interdependency of size of a vessel and freight rate

The vessel size has a direct relation to the freight index. As a general rule, smaller vessels have higher freight rates.

Source: Vaart! freight index, the Dutch Internet portal for inland navigation: www.vaart.nl
Economic reality of Danube transport
Cargo transports of an Austrian shipping company between 20.-23.10.2006

If the possible draught were +2 dm, the additional income would amount to 8,144 € within this period.

One dm draught corresponds to on average 90 tons additional payload; average freight rate/ton = 7,5 €; average additional income per vessel and additional dm payload = 675 €

<table>
<thead>
<tr>
<th>Transport Relation</th>
<th>vessel</th>
<th>tons loaded</th>
<th>draught</th>
<th>possible payload + 2 dm</th>
<th>difference in tons</th>
<th>difference in Euro</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vienna-Csepel</td>
<td>xy</td>
<td>420</td>
<td>13 dm</td>
<td>650</td>
<td>230</td>
<td></td>
</tr>
<tr>
<td>Vienna-Csepel</td>
<td>xy</td>
<td>606</td>
<td>13 dm</td>
<td>830</td>
<td>224</td>
<td></td>
</tr>
<tr>
<td>Vienna-Linz</td>
<td>xy</td>
<td>878</td>
<td>15 dm</td>
<td>1.050</td>
<td>172</td>
<td></td>
</tr>
<tr>
<td>Vienna-Linz</td>
<td>xy</td>
<td>869</td>
<td>15 dm</td>
<td>1.050</td>
<td>181</td>
<td></td>
</tr>
<tr>
<td>Vienna-Linz</td>
<td>xy</td>
<td>514</td>
<td>16 dm</td>
<td>630</td>
<td>116</td>
<td></td>
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<tr>
<td>Vienna-Linz</td>
<td>xy</td>
<td>513</td>
<td>15 dm</td>
<td>670</td>
<td>157</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3,800</td>
<td></td>
<td>4,880</td>
<td>1,080</td>
<td>8,144</td>
</tr>
</tbody>
</table>
Competitive container transport on the Danube

Wirtschaftlichkeitsberechnung Containerschiffe

Optimised Container vessel: Motor Cargo Vessel 105m x 11.4m x 2.7m
Transport capacity: 144 TEU (12x4x3 Container)
Average container weight: 14 gross tons

Utilisation degree:
100% utilisation degree: 144 TEU * 14 t = 2,016 t + 80 t supply = 2,096 t
2,096 t correspond to a draught of about 2.60 m

85% utilisation degree: 1,714 t + 80 t supply = 1,794 t
1,794 t correspond to 2.30 m draught

Requires a minimum draught of 2.30 m
Inland waterway transport is an interlinked system with many parameters to be taken into consideration.

The river Danube is the most international river of the world with 10 riparian countries.

Integrated actions, international cooperation and active national policies are needed to maintain and restore the Danube as a natural living space and habitat as well as a European transport axis!
DI Markus Simoner

via donau – Österreichische Wasserstrassen-Gesellschaft mbH
A-1220 Wien, Donau-City-Strasse 1
Tel +43 (0)50 4321 1607, Fax +43 (0)50 4321 1050,
markus.simoner@via-donau.org, www.via-donau.org