MARINE GREENTECH HUB AND HYDROGEN VALLEY

Academia role in advancing maritime sustainability and hydrogen innovation

The Center of Excellence "Smart Sea„ annual seminar 2025

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VALENTIN BRATKOV

- **Current role:**
  - Early-stage researcher at EMERA.
  - Marine Engineering study programm director at EMERA
  - Actively contributing to hydrogen and maritime innovation in Estonia.
- **Ongoing projects:**
  - **EMERA H2ICE Laboratory** - Developing hydrogen internal combustion engines for maritime applications.
  - **LSHV** – Large scale hydrogen valley
  - **REISFER** - Reducing CO_2 emissions in CB island ferry traffic.
  - **GreenSkillsforH2** - Addressing the skills gap in Europe's hydrogen economy by providing specialized workforce training.
- **Research interests:**
  - **Digital Twins** for ship retrofit and maintenance.
  - **Multi-fuel systems with hydrogen application** for commercial use.
  - **Hybrid power plants and propulsion with hydrogen**, focusing on maintenance-related challenges.
  - Digital optimization of integrated maritime systems and technologies.

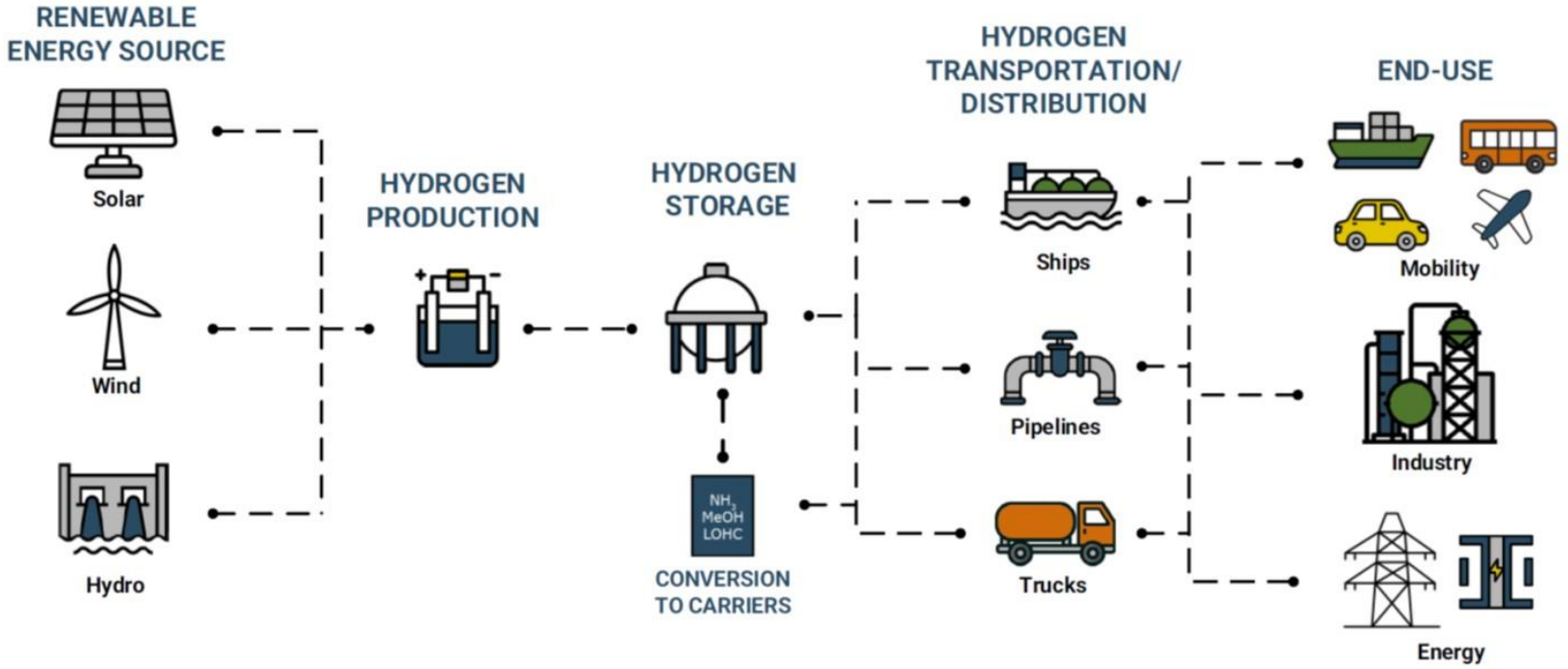
TAL TECH

TALTECH AND "SMART SEA" UNIQUE CONTRIBUTIONS

- TalTech and the Center of Excellence 'Smart Sea' **complement existing maritime and hydrogen initiatives** without duplicating efforts, focusing on cutting-edge innovations, education, and collaboration.
- TalTech as a **hub for research, education, and innovation in maritime** sustainability.

WHAT IS A HYDROGEN VALLEY?

- Definition - Integrated **ecosystem for hydrogen production, storage, and use**.
- Connects multiple sectors - **transport, energy, and industry**.
- Purpose - Accelerate **decarbonization through renewable energy and hydrogen** integration (piloting and scaling).



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ESTONIA'S STRATEGIC ROLE IN THE HYDROGEN VALLEY

- Estonia as a **Regional Hub**:
  - Positioned as a key player in hydrogen adoption in the Baltic Sea region.
- **Strengths**:
  - Abundant renewable resources, including **wind and solar energy**.
  - Advanced digital infrastructure supporting **hydrogen innovation**.
  - Strong maritime expertise, including **shipping and port operations**.
- **Opportunities**:
  - Development of **cross-border hydrogen infrastructure**.
  - Integration with EU networks for **green energy** and **hydrogen transport.**

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TALTECH AND „SMART SEA“ CONTRIBUTIONS TO HYDROGEN VALLEY

- **Growing hydrogen competencies:**
  - **Implementation** of hydrogen technologies into student curricula.
  - **Organizing** hackathons, innovation challenges, and research opportunities.
  - **Developing** hydrogen competencies at the student level (**TiVo**)
- **Collaboration across sectors:**
  - **Smart Sea" acts as a bridge** aligning government, industry, and academia.
- **University as a Platform:**
  - A **regional hub** for testing, scaling, and piloting hydrogen solutions.
- **Research, Development & Education**:
  - **Leading studies** on hydrogen production, storage, and integration.
  - **Educating** future experts through specialized programs.

TALTECH AND "SMART SEA" IN MARINE GREENTECH HUB

- **Testbed for innovation (TRL 7-9):**
  - Real-world testing of **hydrogen-powered vessels** and **port technologies**.
  - **Refining and validating solutions** to ensure industry readiness.
- **Testing, Editing, and Fine tuning:**
  - **Improving retrofitting** solutions for ships and port infrastructure.
  - **Optimizing green technologies** to reduce emissions and enhance energy efficiency.
- **Scaling hydrogen development across Estonia:**
  - **Expanding** maritime hydrogen integration through pilot projects and collaborations

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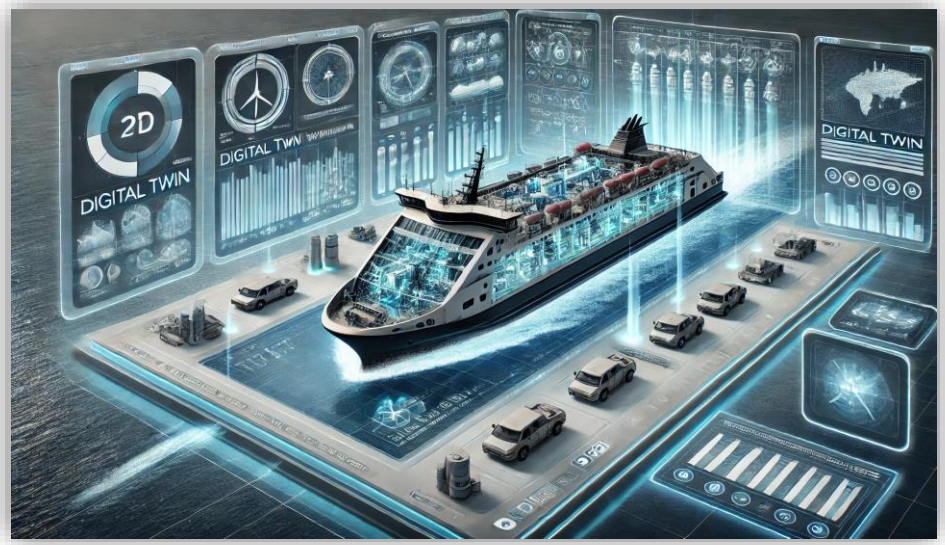
Estonian Marine Greentech & Retrofit HUB

ADVANCED TECHNOLOGIES DRIVING THE RETROFIT HUB

- **Digital Twin Technology for Retrofit and Repair:**
  - Virtual modelling for **precise analysis** and **retrofitting.**
  - **Predictive maintenance** and **optimization** before physical implementation.
- **Integration of AI and Robotics:**
  - Automates retrofitting processes, **improving accuracy** and **reducing human error**.
- **Autonomous and Remote-Controlled Ships:**
  - **Testing** and **deploying autonomous systems** for safer and sustainable maritime operations.



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TALTECH AND "SMART SEA„ DRIVING MARITIME INNOVATION

- **Holistic approach:**
  - **Combine retrofitting** with **hydrogen propulsion**, renewable energy systems, and smart ports for a sustainable future.
- **Collaboration over Competition:**
  - **TalTech and "Smart Sea" complement existing initiatives,** fostering synergy and collective progress.
- **Vision:**
  - Build a resilient, forward-thinking **maritime sector powered by innovation** and **sustainability**

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BUILDING THE FUTURE TOGETHER

- **Collaborate with TalTech and "Smart Sea" CoE:**
  - Join initiatives focused on **hydrogen and retrofit pilot projects**.
- **Up-Skill and Re-Skill the workforce:**
  - Support workforce transformation through **specialized training programs**.
  - **Collaborate on the Hydrogen Maritime Academy** to prepare professionals for the hydrogen economy.

HYDROGEN VALLEY APPLICATION CONCEPT – BOLD VISION FOR COLLABORATION

1. **Core components:**
   - **Production** - hydrogen from renewables and wastes
   - **Storage and Distribution** - pipelines, refuelling stations, refuelling trucks
   - **Applications in Maritime and beyond** (cement, chemicals, etc)
2. **Collaborative Ecosystem**:
   - Academia, industry, and government working together
3. **Visionary goals:**
   - Short-Term (**2026**) - **Pilot projects** (refuelling hubs, H2-powered vessels+)
   - Mid-Term (**2030**) - Baltic Sea H2 Network (**cross border collaboration**)
   - Long-Term (**2050**) - Fully **decarbonized maritime** sector

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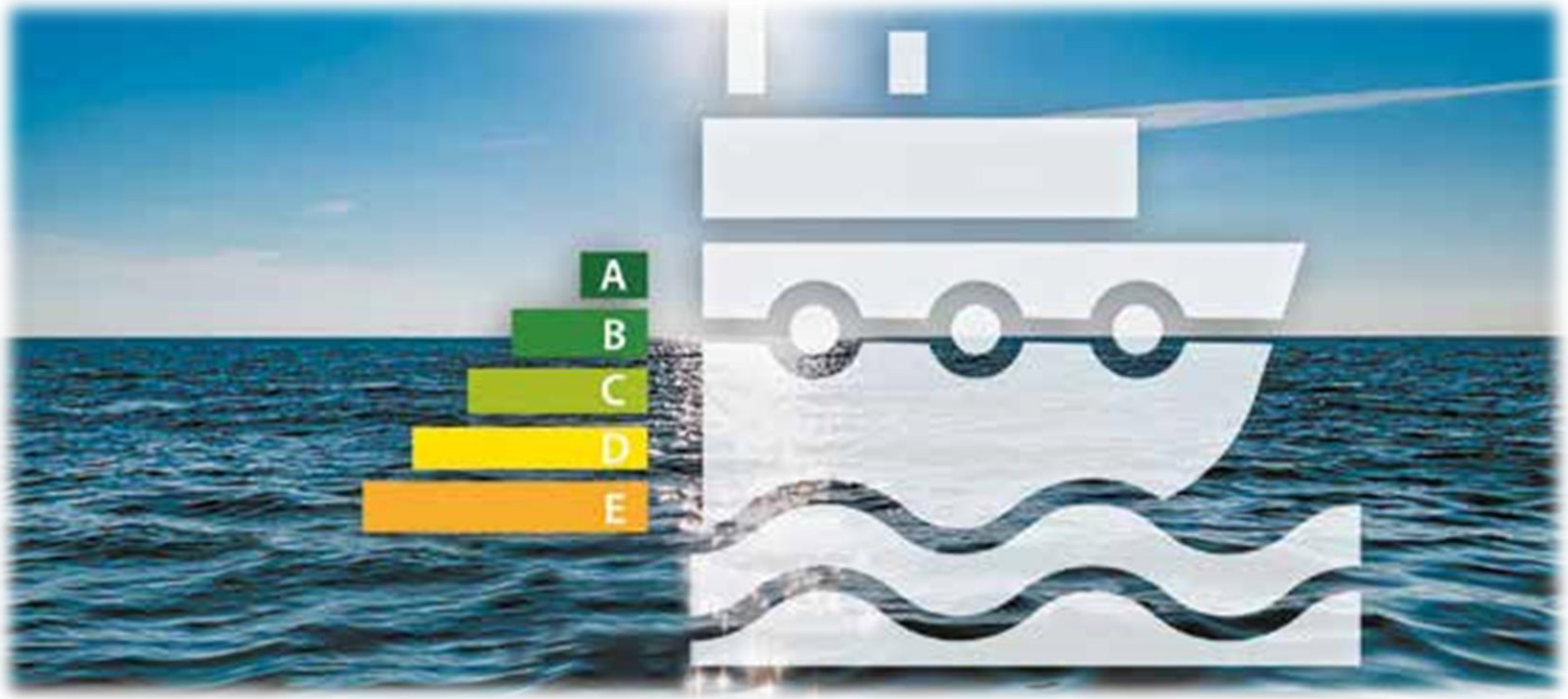
FINAL STATEMENT

Together, **we can make Estonia and the Baltic region global leaders** in maritime hydrogen innovation and GreenTech



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THANK YOU FOR YOUR ATTENTION!

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