Education and workforce development for securing Estonia's hydrogen future

Tartu Hydrogen Days 2025

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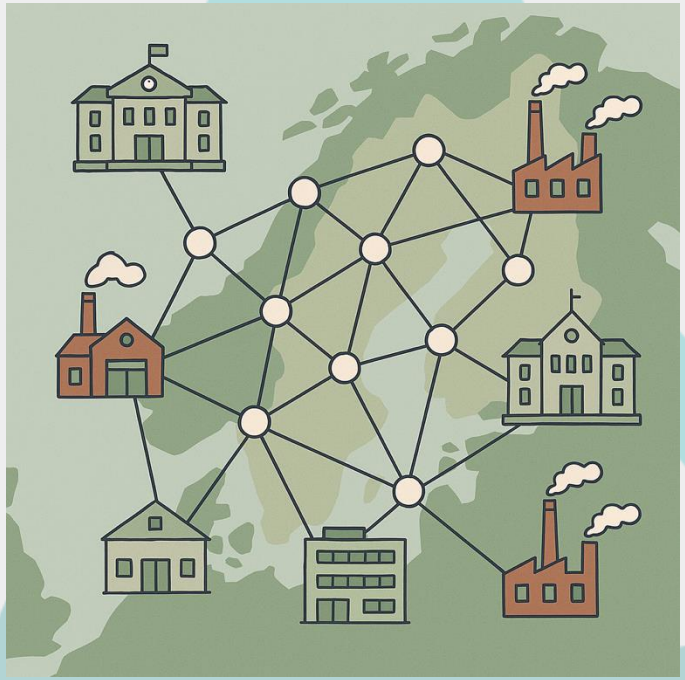
Hydrogen Centres of Vocational Excellence

Equip Europe’s workforce with high-quality vocational skills for the growing hydrogen economy

- Duration: 2024 – 2028
- Deliver courses for the hydrogen sector and building regional vocational centers (ecosystem)

Hydrogen Courses

Regional and European Networks



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Partners and target groups

19 partners from 5 regions

People	Workers, students, teachers, trainers, people outside the workforce, people with fewer opportunities, young people, researchers, policymakers, career advisors, the general public.
Organisations	Vocational schools, higher education institutions, welfare organisations, hydrogen businesses, SMEs and industry, career services, science parks, local government, national authorities and agencies, Non-Governmental Organisations, and business hubs.

Goal: Build regional *Hydrogen Vocational Excellence Centres* (HIVEs) and deliver education, training, and reskilling programs for the hydrogen value chain.

Vestland County, Norway

Tyrol Austria

Estonia

Northern Netherlands

Precarpathian region, Ukraine

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Why hydrogen skills matter for Europe's Green Transition

- Hydrogen is a key enabler of decarbonisation, energy security, and industrial innovation.
- A skilled workforce is essential to meet government and industry targets.
- Currently, skills gaps exist across the entire value chain – from production to storage and end-use.
- H_2CoVE builds a European knowledge and training ecosystem that connects VET, universities, and industry.
- Knowledge transfer between countries bridges missing expertise and accelerates business investments.

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Building hydrogen competence in Estonia

Regional coordinator: **TalTech Virumaa College**

- Partners:
  - **Estonian Aviation Academy**
  - **Tartu Vocational College (VOCO)**
  - **Skycorp Technologies**
- Focus areas:
  - Mapping national hydrogen competence and labour needs
  - Developing new hydrogen-related curricula and training modules
  - Creating collaboration between education, research, and industry
  - Supporting regional energy transition and defence-related applications

Pictures: Made by ChatGPT

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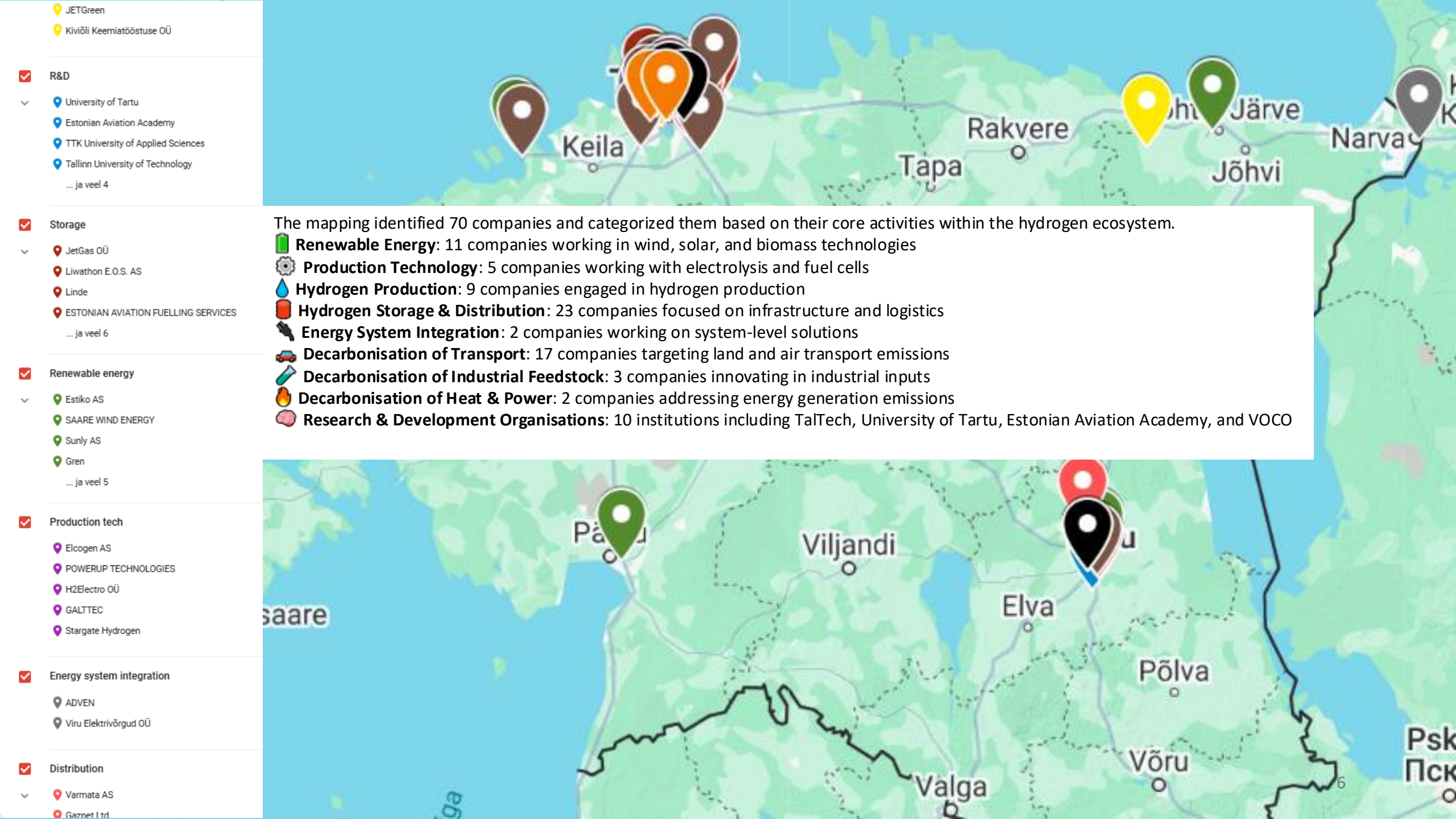

The mapping identified 70 companies and categorized them based on their core activities within the hydrogen ecosystem.

- **Renewable Energy**: 11 companies working in wind, solar, and biomass technologies
- **Production Technology**: 5 companies working with electrolysis and fuel cells
- **Hydrogen Production**: 9 companies engaged in hydrogen production
- **Hydrogen Storage & Distribution**: 23 companies focused on infrastructure and logistics
- **Energy System Integration**: 2 companies working on system-level solutions
- **Decarbonisation of Transport**: 17 companies targeting land and air transport emissions
- **Decarbonisation of Industrial Feedstock**: 3 companies innovating in industrial inputs
- **Decarbonisation of Heat & Power**: 2 companies addressing energy generation emissions
- **Research & Development Organisations**: 10 institutions including TalTech, University of Tartu, Estonian Aviation Academy, and VOCO

Mapping hydrogen skills scross Europe – WP3 approach

Methodology – 5 Tools:

Literature review
National & EU hydrogen strategies, education reports

Job board monitoring
Mapping emerging occupations

Online surveys
Industry feedback on skill needs

Interviews
Stakeholders & employers across value chain

Stakeholder validation
Regional workshops to confirm findings

Goal: Identify current and future hydrogen-related skills for VET and higher education and prepare regional roadmaps for course development in WP5.

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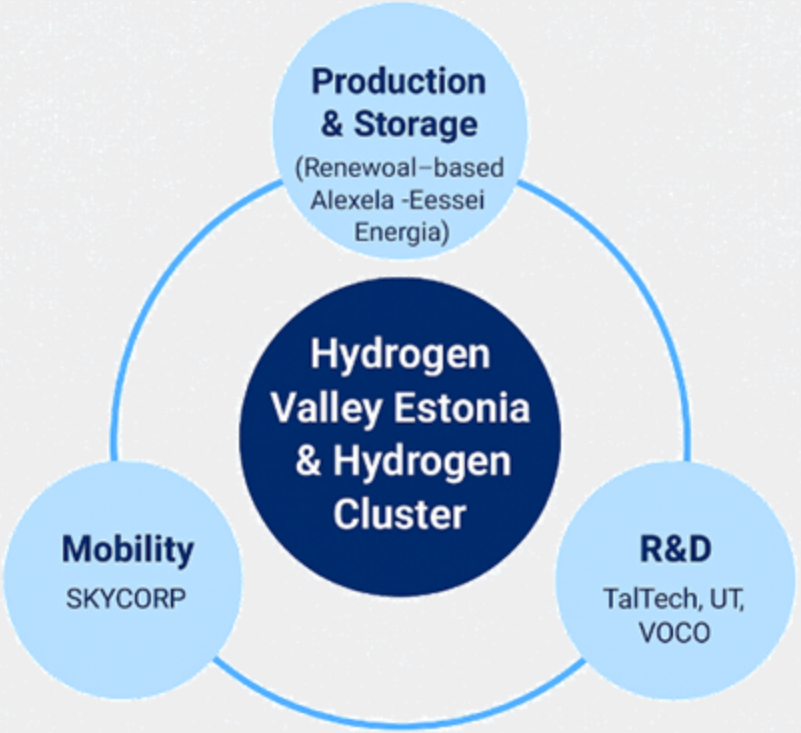
Emerging hydrogen economy in Estonia

- ~40 organisations involved in production, storage, logistics, and R&D
- Key drivers: **Hydrogen Valley Estonia & Hydrogen Cluster**
- Focus sectors: renewable-based H_2 production (Alexela, Eesti Energia), mobility (SKYCORP), and R&D (TalTech, UT, VOCO, EAVA)
- National **Hydrogen Roadmap** → 2035 targets: pilot → industrial scale → export readiness
- Strong collaboration between research, education, and SMEs — **yet limited workforce base and formal training pathways**



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Current hydrogen education and research in Estonia

Institutions & Activities:

- **TalTech Virumaa College:** modules in *Sustainable Chemical Technologies* & *Green Energy Systems* (electrolysis, storage, system integration)
- **Tartu VOCO:** vocational modules on hydrogen compression, storage, distribution
- **University of Tartu:** materials & electrochemistry research, hydrogen production
- **Estonian Aviation Academy:** applied studies in hydrogen for aviation
- **Metrosert Hydrogen Technologies Centre:** applied testing & safety R&D

Gaps identified:

- No dedicated hydrogen curricula or certification
- Fragmented research & limited lab infrastructure
- Lack of short courses for technicians and engineers

Hydrogen testing station and demo center at the Competence Center for Sustainable Chemistry Technologies, TalTech Virumaa College

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Skills for Estonia’s hydrogen transition

Industry demand:

- Technical specialists for **electrolyser operation, storage & transport systems**
- **Safety & certification** knowledge
- Engineers for **system design and integration**
- **Digital skills** – automation, sensors, data monitoring

Education gaps:

- Training not yet aligned with industry demand
- Need for hands-on modules, lab practice, and micro-credentials
- Collaboration between universities, VET schools and companies essential

Recommendation:

Develop modular learning pathways combining vocational, higher education, and lifelong learning.

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Skills required across the hydrogen value chain

The transition to a hydrogen-based economy requires a comprehensive approach to workforce development. From basic safety awareness to advanced system integration, each stage of the hydrogen value chain demands specific competencies and training programs. Estonia stands at a critical juncture—well-equipped with strong research capabilities, yet facing significant gaps in practical, technician-level education infrastructure.

H_2 Basics
Fundamental awareness and safety protocols

Production
Electrolysis and generation systems

Compression
Pressure management and equipment

Storage
Safe containment and handling

Distribution
Transportation and logistics systems

Usage
End-use applications and integration

Policy
Regulatory framework awareness

Cross-cutting
System-wide competencies

- **Estonia's current position:** Strong research foundation at university level, but fragmented training landscape and critical shortage of vocational education programs for technicians and operators.

Key training gaps & priority interventions

An analysis of Estonia's hydrogen training landscape highlights four critical domains requiring urgent development. The goal is to establish flexible, EU-aligned (EQF) programs that support upskilling and reskilling across the workforce.

1. Hydrogen Fundamentals (EQF 4–6)

Basic understanding of hydrogen properties, safety, and applications is essential to ensure a common knowledge base across all workforce levels.

➡️ *Duration:* 40–80 hours | *Target:* All workforce levels

2. Electrolyser Operation & Safety (EQF 4–5)

Hands-on training needed for electrolyser operation, maintenance, and safe integration with renewable systems.

➡️ *Duration:* 120–200 hours | *Target:* Technicians, operators

3. Hydrogen Storage & Logistics (EQF 5–6)

Skills required in compression, liquefaction, transport regulations, and supply chain optimization.

➡️ *Duration:* 80–160 hours | *Target:* Technical specialists

4. Market & Policy Frameworks (EQF 6–7)

Advanced module covering EU hydrogen strategy, certification requirements, and business models to support investment decisions.

➡️ *Duration:* 60–120 hours | *Target:* Project managers, energy experts

💡 *All programs require industry co-creation, practical learning environments, and collaboration between universities and vocational schools to ensure relevance and long-term sustainability.*

Cross-cutting skills and infrastructure needs

Beyond domain-specific technical knowledge, Estonia's hydrogen workforce requires a robust ecosystem of practical learning environments and flexible credential pathways. The infrastructure for hands-on training is as critical as the physical infrastructure for hydrogen production and distribution itself.

Hands-on learning facilities

Development of dedicated hydrogen laboratories equipped with electrolysers, storage systems, fuel cells, and comprehensive safety equipment. Simulators and demonstration rigs enable safe practice with realistic scenarios before working with actual hydrogen systems.

Micro-credential programs

Creation of modular, stackable short courses that allow working professionals to upskill without leaving employment. These credentials should align with European standards and be recognized across industries for maximum workforce mobility.

Ecosystem collaboration

Systematic cooperation among universities (research and theory), vocational schools (practical skills), and industry partners (real-world application). This triangle ensures training addresses actual market needs while maintaining academic rigor.

> *"Education infrastructure is as critical as pipelines—without trained operators and technicians, even the best hydrogen systems cannot function safely or efficiently."*

The Learning Ecosystem Model

Effective hydrogen workforce development requires breaking down traditional silos between academic institutions, vocational training centers, and industry. A coordinated national approach ensures that theoretical knowledge, practical skills, and workplace experience are seamlessly integrated. Central to this ecosystem are shared **H_2 Skills Labs** — physical spaces where all stakeholders can collaborate on curriculum development, conduct joint training programs, and pilot innovative teaching methodologies.

These labs should serve multiple functions: initial training for students, upskilling for current workers, certification testing, and research into improved training methods. By pooling resources and expertise, Estonia can create world-class training capabilities despite its smaller scale compared to larger EU nations.

Strategic implementation principles

Successfully building Estonia's hydrogen workforce requires adherence to four foundational principles that ensure training programs remain relevant, practical, scalable, and collaborative. These principles should guide all curriculum development, infrastructure investment, and partnership formation in the coming years.

Industry Co-creation
Curriculum must be developed in direct partnership with hydrogen companies, equipment manufacturers, and end-users. Industry input ensures that training addresses real operational challenges, uses current technology platforms, and prepares graduates for actual job requirements rather than theoretical scenarios.

- Regular industry advisory board meetings
- Company participation in lab design
- Joint apprenticeship programs

Practice-Based Learning
Hydrogen safety and operations cannot be learned from textbooks alone. Training must include extensive hands-on experience with real systems, where safety procedures are practiced in realistic conditions and troubleshooting is carried out on actual equipment under expert supervision.

- At least **40% practical lab time**
- Use of **real equipment**, not just simulations
- Development of an **integrated safety culture**

Modular Scalability
Training architecture should use stackable micro-credentials that enable flexible learning pathways. Workers can acquire specific competencies as needed, while students can progressively build comprehensive qualifications. This approach supports both rapid workforce upskilling and long-term career development.

- Short-format courses (5–20 hours)
- Clear progression pathways
- Recognition of prior learning

National Collaboration
Estonia’s size is an advantage — it allows the creation of a unified national training network instead of duplicating regional programs. Shared standards, pooled infrastructure, and coordinated schedules maximize resource efficiency while ensuring consistent quality across all training providers.

- Single quality assurance framework
- Shared laboratory access protocols
- Unified credential recognition

Moving Forward Together

The opportunity before Estonia is significant: by acting now to build comprehensive hydrogen training infrastructure, the nation can position itself as a regional leader in green energy workforce development. The combination of strong research institutions, growing industry interest, and strategic geographic location creates ideal conditions for success.

Implementation should begin immediately with pilot programs in existing facilities, followed by gradual expansion as industry demand grows. Early wins will build momentum and demonstrate value to potential funding sources and industry partners. The time to act is now—the hydrogen economy is emerging globally, and Estonia must ensure its workforce is ready to compete and lead.

Comparing regional roadmaps – common challenges

Region	Stage of development	Skills focus	Training gaps
Estonia	Emerging ecosystem	R&D, renewable integration	Vocational & technician training
Norway	Mature	Maritime, storage, logistics	Coordination across sectors
Netherlands	Advanced	Industrial clusters, hydrogen safety	Upskilling for large-scale deployment
Austria	Intermediate	Green mobility, fuel cells	Modular lifelong learning
Ukraine	Early-stage	Pipeline & materials R&D	Foundational training & policy support

Despite different maturity levels, **all regions face workforce shortages and need integrated hydrogen education systems**.

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The partners

Vestland County Council

New Energy Coalition
Drivers of Change

TAL TECH

fen research

Precarpathian eco-energy cluster

Western Norway University of Applied Sciences

D·C
DRENTHECOLLEGE

TARTU RAKENDUSLIK KOLLEDŽ
TARTU VOCATIONAL COLLEGE

fen systems

Fagskulen Vestland

Hanzehogeschool Groningen
University of Applied Sciences

Eesti Lennuakadeemia
Estonian Aviation Academy

fh KufsteinTirol
UNIVERSITY OF APPLIED SCIENCES

УНІВЕРСИТЕТ Короля Данила

SUSTAINABLE ENERGY | NORSK KATAPULT SENTER
siva

Noorderpoort

SKYCORP TECHNOLOGIES

DIE HTL KRAMSACH

klasse! forschung

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