

A national Hydrogen Aviation Action Perspective

Process and key findings



Marek Alliksoo – co-founder and CEO of SKYCORN
Estonian Association of Hydrogen Technologies – Member of the board

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Goals

- Analyse the value chain
- Specific use-cases in Aviation
- Preconditions for H₂ success
 - Policy
 - Investment climate
 - Stakeholder commitment
 - Projects
 - Knowledge and R&D
- Action Perspective
 - Short-term (0-5)
 - Mid-term (5-10)
 - Long term
- Airport Hydrogen Hub



Why?

- License to operate
- Competitive advantage
- ETS & CO2 price
- ReFuelEU Aviation mandate
- Market demand
- Energy independence
- Security of fuel supply

Why hydrogen?

- “Electrifying the skies won’t work”
- Grid congestion and curtailment
- Perfect combination with RES
- First time airports can create their own dynamic fuel in the process



Value chain Opportunities

- **Cooperation along the value chain** – Port Hub, RES producers, Import & Export terminals & R&D along climate neutrality 2030 goals



Use-cases

- H2 ground and air
- H2 infrastructure & refuelling
- Local RES & H2 production
- Seasonal storage
- Grid balancing
- Back-up for electric GPU's
- Heavy Duty Vehicles
- Airport logistics
- H2 transport between airports
- Liquid H2 uptake with maritime
- SAF & e-Kerosene
- GH2 Aircraft -> LH2 Aircraft



- **Off-shore wind potential exceeds national needs by >2x**
- **Hydrogen backbone est. 2030**
- **On-site Airport PV potential >100MW**
- **Synergies with large projects**
- **Serve as a National Testbed with the Climate Neutral Air Mobility Hub**

Preconditions

- **Policy** – Taxonomy, Alignment, ENCP representation
- **Investment climate** – Stable predictable legal environment and framework through public sector support, long-term vision
- **Stakeholder commit** – Money vs costs, systems perspective, cooperation,, learning curve
- **Knowledge** – Re-skill/Up-skill, retrofit, R&D and MRO

Year	Aviation Fuel (tonnes)	SAF (% EU target)	E-Kerosene (% EU target)	SAF (tonnes)	E-Kerosene (tonnes)	Kerosene imports (tonnes)	Hydrogen (tonnes)	Hydrogen (%)
2019	70.000	0.0%	0.0%	0	0	70.000	0	0
2025	80.000	2.0%	0.0%	1.600	0	78.400	0	0
2030	100.000	5.0%	0.7%	5.000	35	95.000	500	0.5%
2035	110.000	20.0%	5.0%	22.000	1.100	88.000	2.200	2.0%
2040	120.000	32.0%	8.0%	38.400	3.072	81.600	6.000	5.0%
2045	125.000	38.0%	11.0%	47.500	5.225	77.500	12.500	10.0%
2050	130.000	63.0%	28.0%	81.900	22.932	48.100	22.100	17.0%

Take-aways

- Don't wait for "EU's approval"
- Show not tell
- Rather than fast money, avoid future costs
- Infrastructure first
- Retrofitting has massive potential
- Politicians and investors like "black and white"
- Exploit the capacity to experiment
- Avoid "hydrogen lock out"

<- Untapped potential

Action Perspective

- **0 – 5 years**

Action	Stakeholder Groups
Invest in renewable energy generation and conversion to hydrogen	Business
Hydrogen transport and fueling infrastructure	Business and Government
Start a feasibility study on a SAF location in Estonia	Government
Invest in local hydrogen projects for innovation and knowledge gaining	Business
Invest in education, re-skilling and up-skilling	Education

- **5 – 10 years**

Action	Stakeholder Groups
Cooperation with partners for storage and distribution of hydrogen	Business
Establish hydrogen partnerships with local and public transportation	Business
Start up pilots with airliners for their hydrogen aircrafts in Baltic area	Business
Follow developments on hydrogen solutions for pushbacks and GPU's	Business

Parallel tracks

- Challenges similar to maritime
- Cross-industry cooperation
- H2 Drone -> (eVTOL) -> Plane?
- EU projects (Horizon, CHE, INTERREG etc.)
- “Feasibility studies”
- Include h2 in every roadmap and strategy up to SUMP (with clear targets)
- Chicken/Egg alignment
- Connecting hubs
- Open Airport policy
- Forming corridor synergies
- Greater focus on P2X
- Get ready for the Sustainable Aviation Fund

Tallinn Hydrogen Hub: An integrated system

In generation and use cases aviation cluster will realize substantial elements of that system others can make use of as well



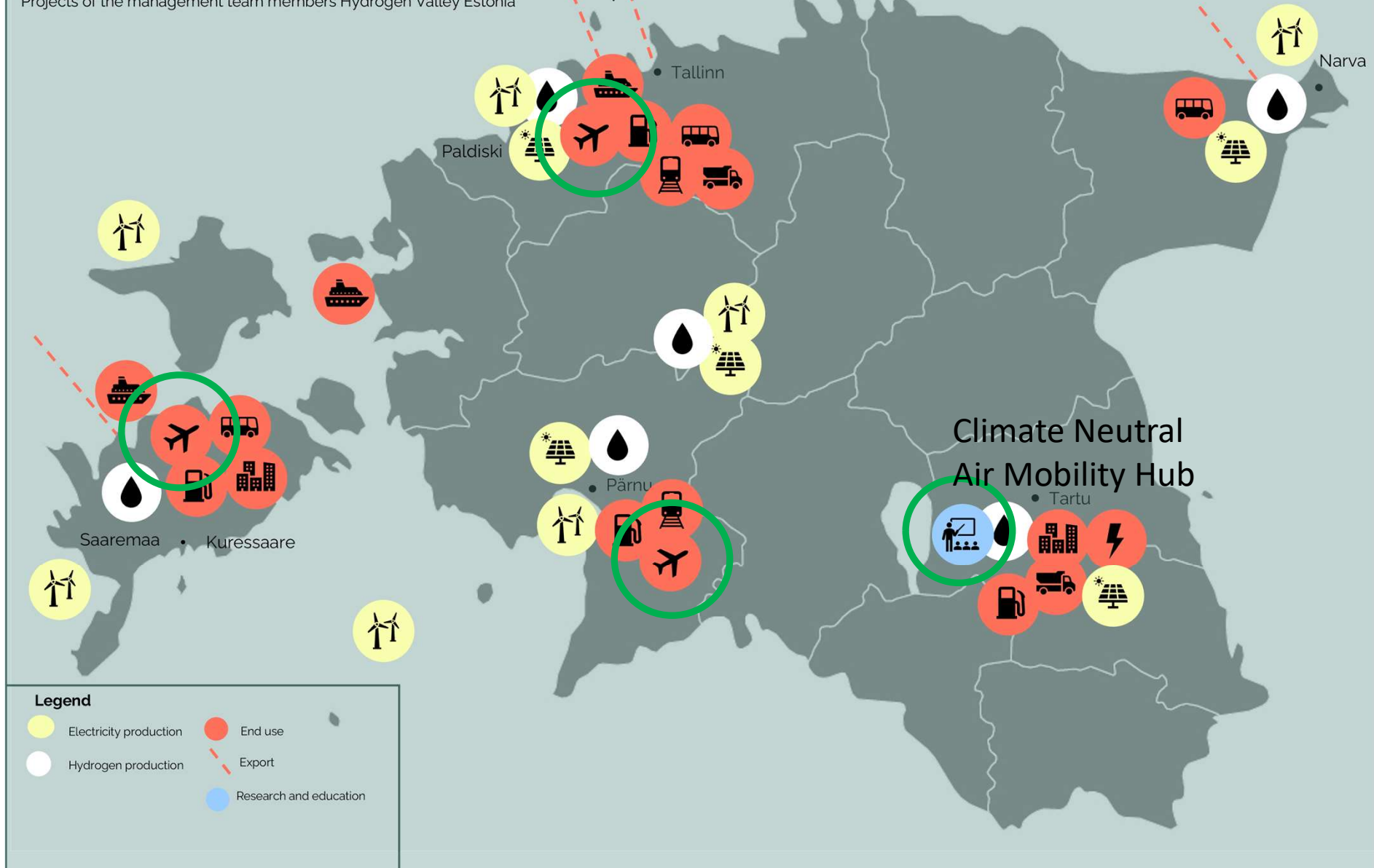
Like ports, airports can function as a hub in the system.

Synergies with public transport and security of supply can and should be achieved

In the end that will lower your costs in fuels (economy of scale) and knowledge and R&D.

Map Hydrogen Valley Estonia

Projects of the management team members Hydrogen Valley Estonia

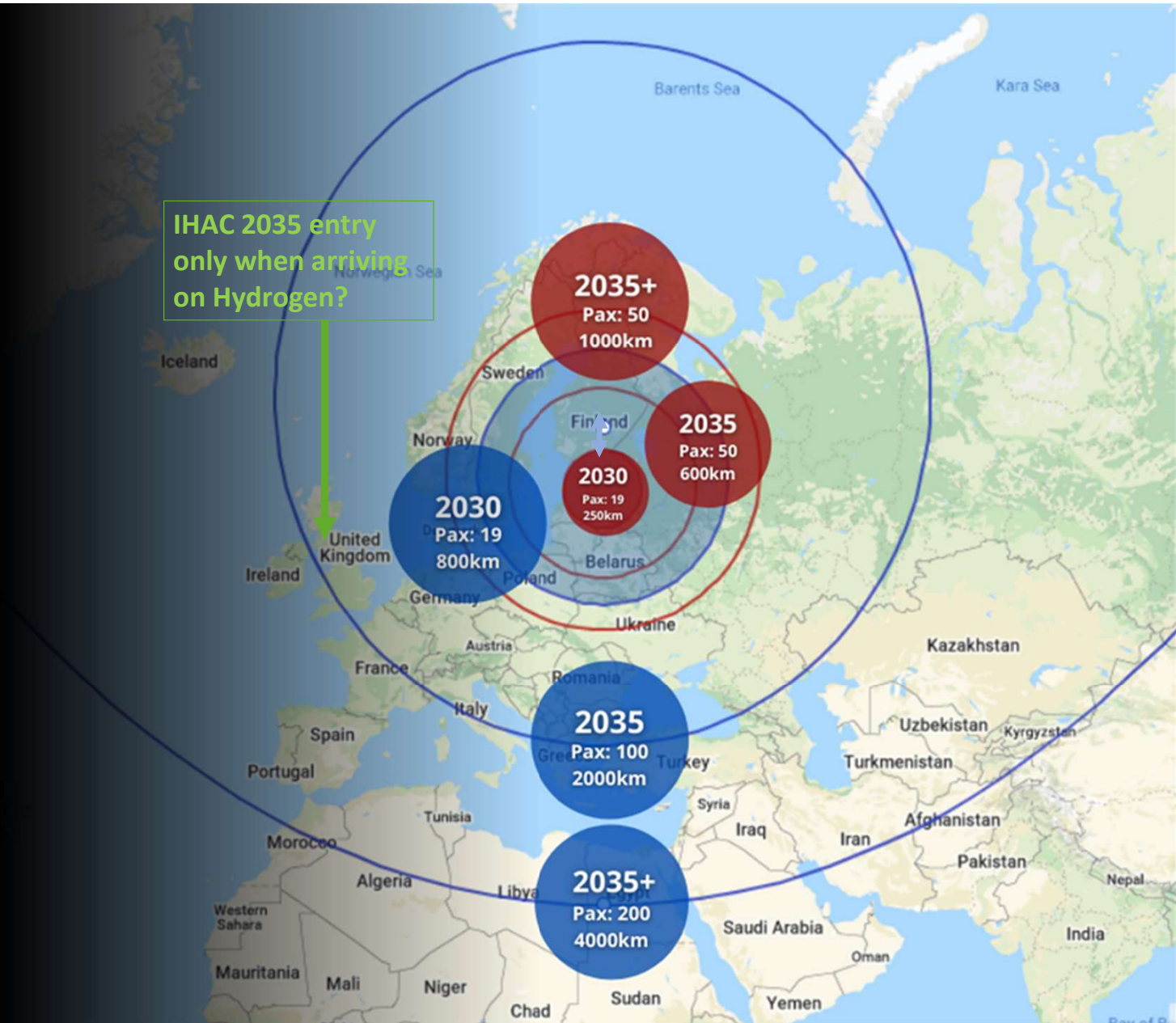


Input
to the
National
H₂ Valley
&
Valley
Strategy

Airport coverage from Estonia

- Battery electric aircraft
- Hydrogen aircraft

Estonia can have zero-emission domestic air travel by 2030



Towards a fully holistic aerial ecosystem of the future



International Hydrogen
Aviation Association

European Clean
Hydrogen Alliance

Kick-starting the EU Hydrogen Industry to
achieve the EU climate goals



Marek Alliksoo - CEO / Co-Founder of SKYCORP
+372 56 729 717
www.sky-corp.eu
Marek.Alliksoo@SKY-CORP.eu



Estonian Association of
Hydrogen Technologies