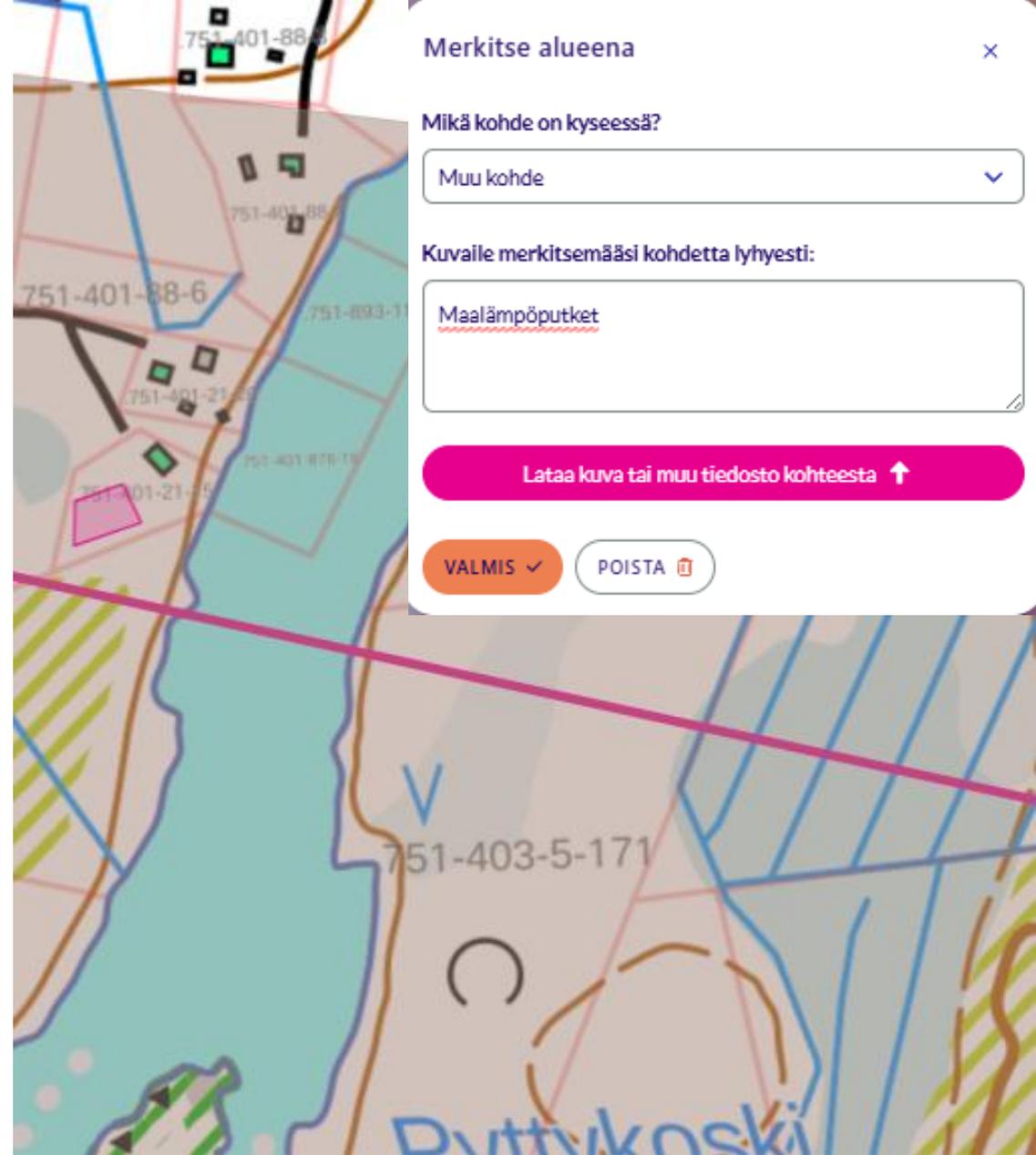


# 1. ROUTING & PERMITTING

## Feedback Survey for Landowners on the H2 route

- Online map survey for landowner feedback ensuring landowner input in planning process
- Information saved directly on planning system and accessible to designers
- Feedback for route optimization to achieve best possible outcome
- <http://bit.ly/4mRbCDx>



## EIA Process ongoing



### SUUNNITTELU JA RAKENTAMINEN

1

#### Alustava reittisuunnittelu

- Markkinatarpeen selvitys
- Reittisuunnittelun reunaehtojen määrittely
- Reittivaihtoehtojen alustava suunnittelu

3

#### Yksityiskohtainen suunnittelu

- Jatkosuunnitteluun valittavan reitin valinta ja tarkempi suunnittelu
- Rakentamisen vaiheistamisen suunnittelu

5

#### Rakentaminen

### LUVITUSPROSESSI

2

#### Ympäristövaikutusten arviointimenettely (YVA)

- Arviointiohjelma ja selostus
- Selvitykset (mm. luontoselvitykset) ja vaikutusten arviointi
- Sidosryhmäyhteistyö ja palautteet

4

#### Lupaprosessit ja niihin liittyvät tutkimukset

- Vesiluvat
- Lunastusluvat (putkireitin käyttöoikeus)
- Muut tarvittavat luvat

6

#### Lunastusmenettely

- Lunastustoimitus
- Lunastuskorvaukset

## 2. LARGE-SCALE INFRASTRUCTURE PROJECTS

# 2. LARGE-SCALE INFRASTRUCTURE PROJECTS

- Nordic Hydrogen Route Bothnian Bay (NHR)
- Nordic-Baltic Hydrogen Corridor
- .... Baltic Sea Hydrogen Collector (BHC)



Co-funded by the European Union

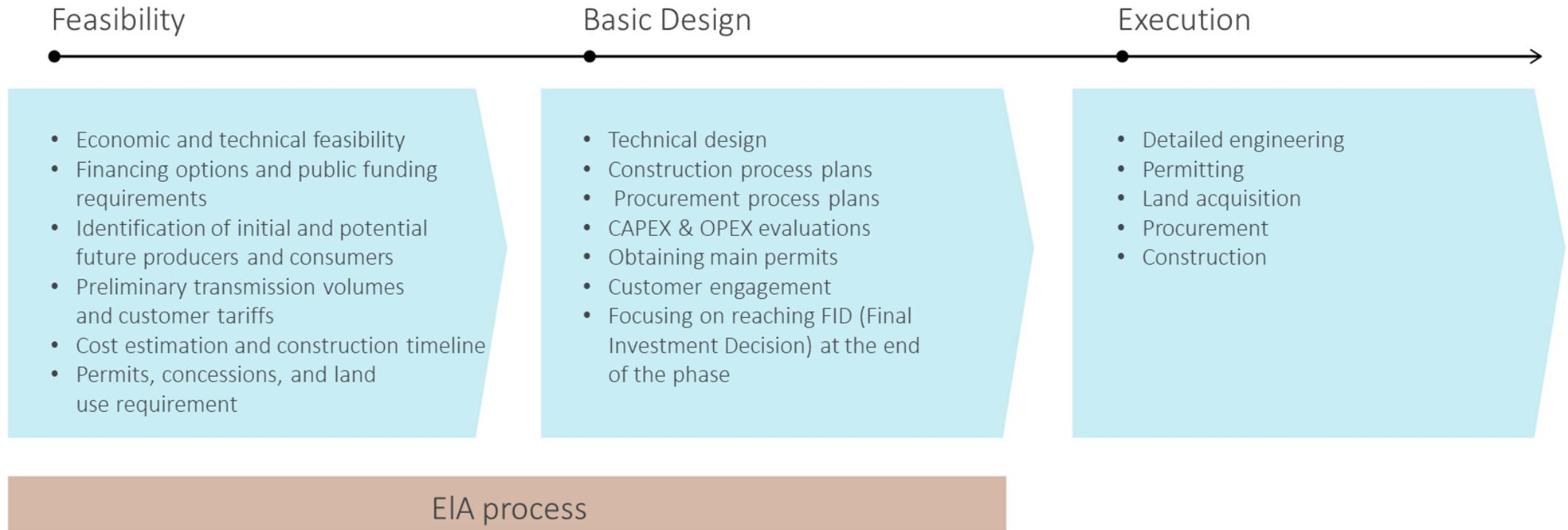


# PCI projects support Finnish hydrogen transmission network development

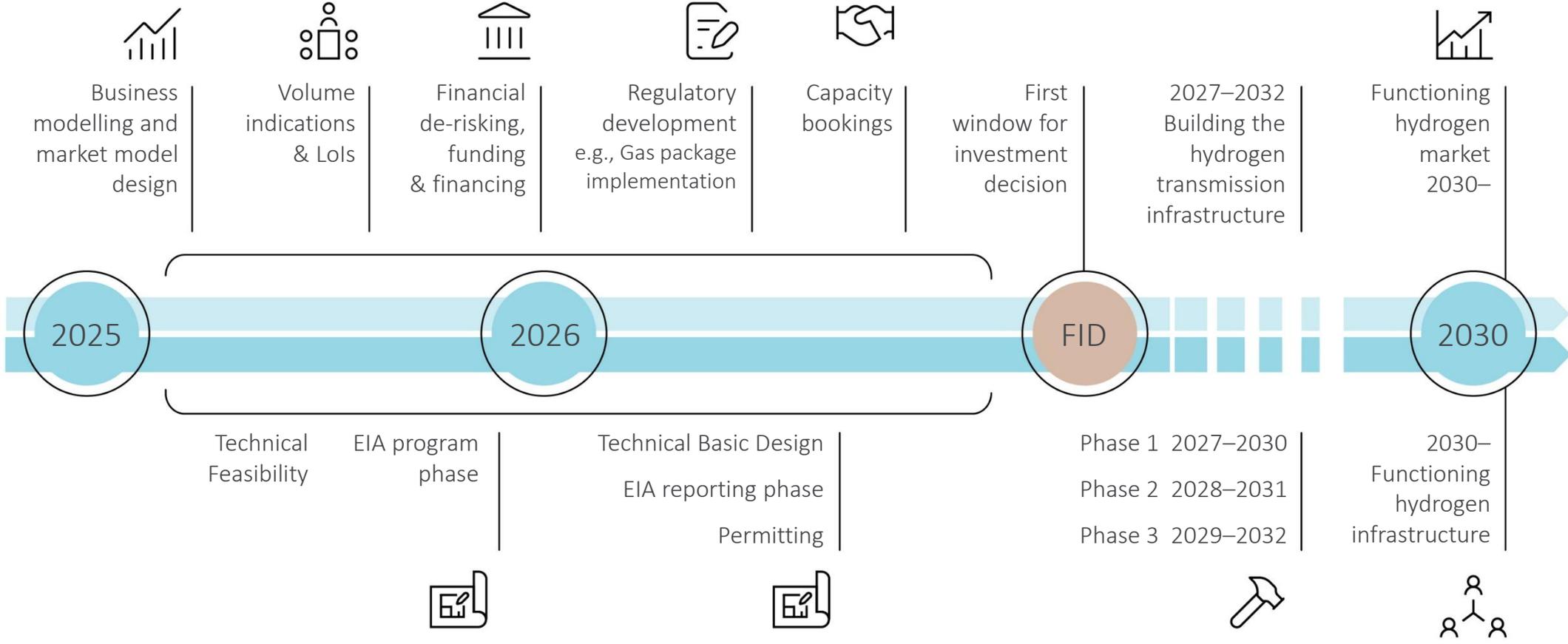
- Technical planning, permitting activities and customer connection development coordinated within Gasgrid
- The plan includes a few optional routes for EIA process, and branches designed to connect hydrogen producers and end users to the network
- Length of the Finnish hydrogen transmission network in approximately 1 100km without options



# Projects currently in Feasibility phase

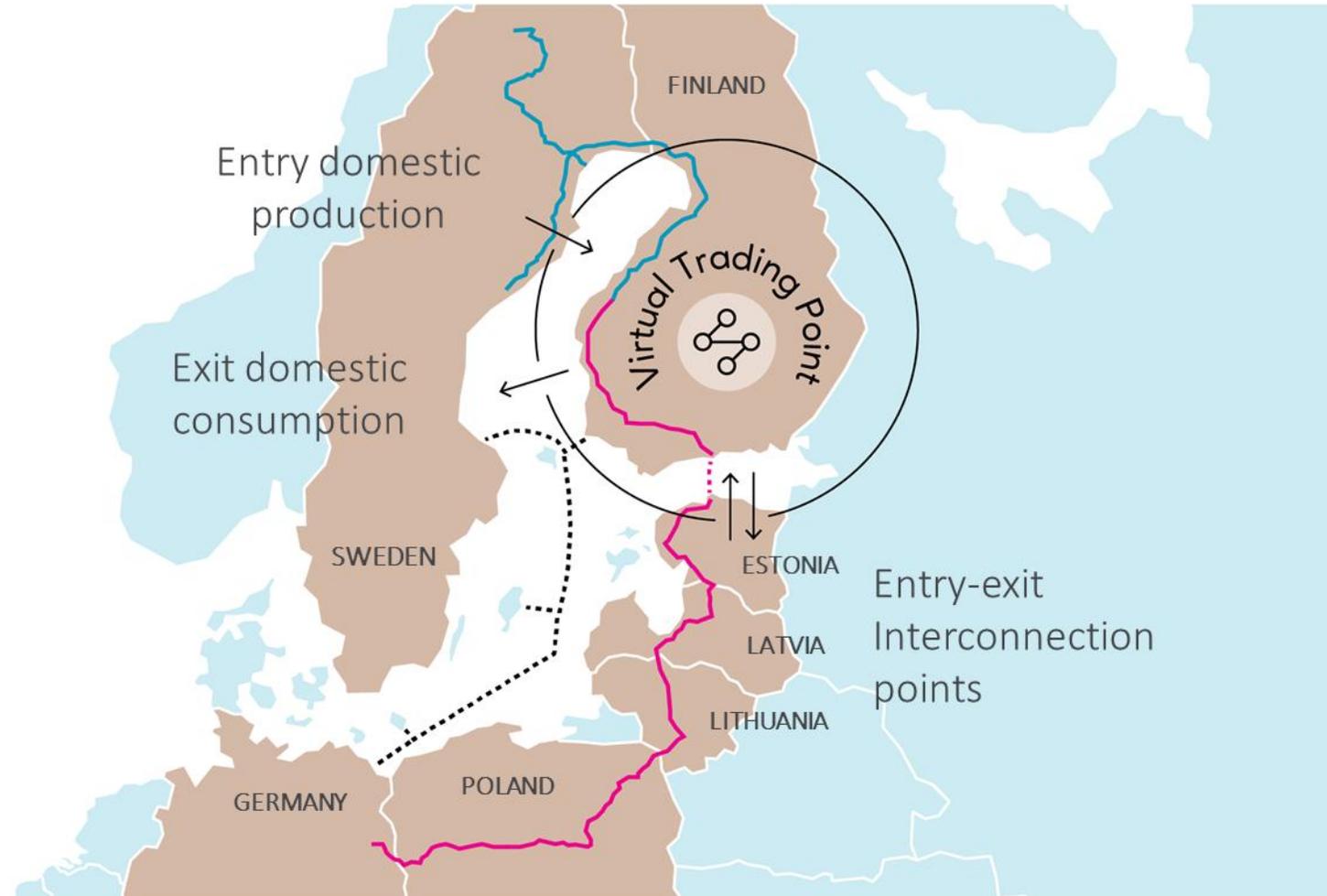


# Project schedule

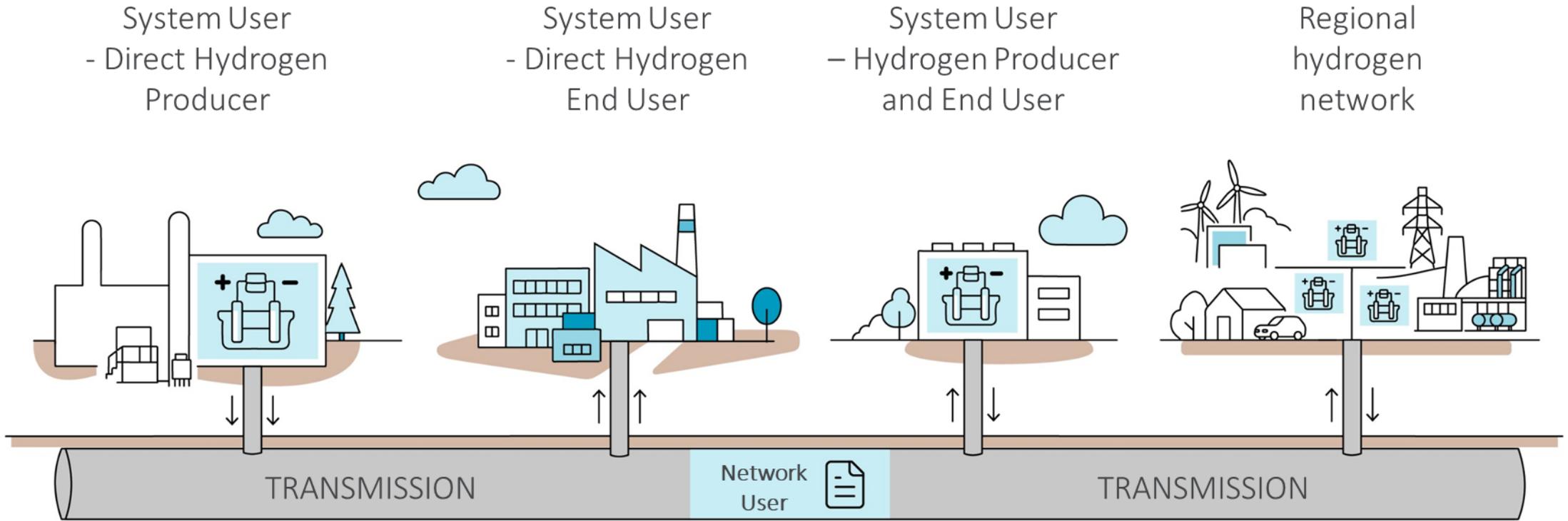


# 3. MARKET MODEL & REGULATION

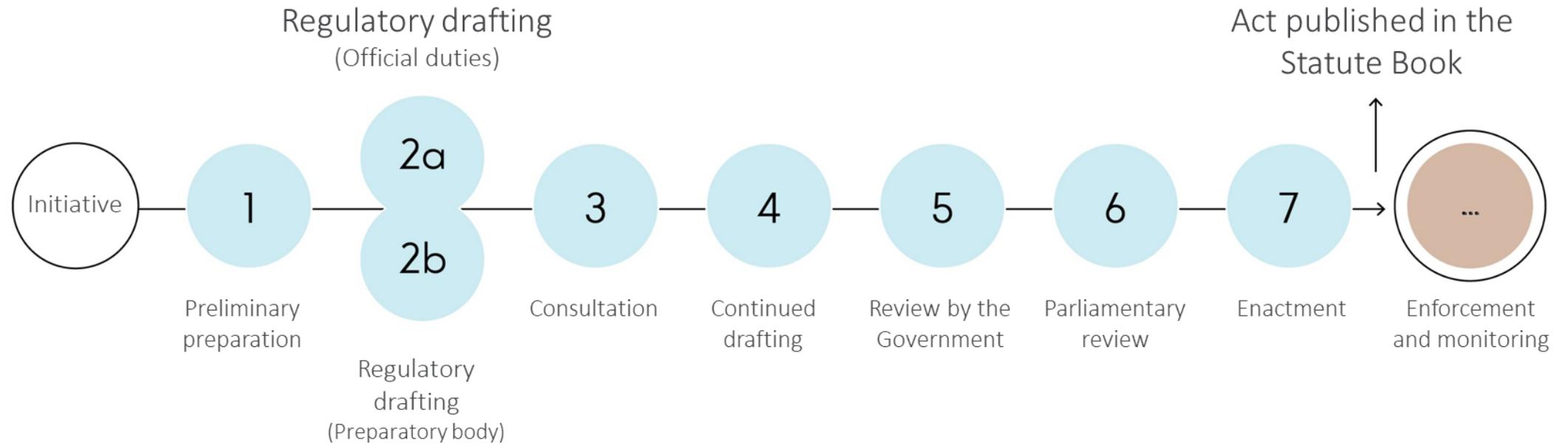
# Finnish H2 network organised as an entry-exit system



# Market model defines the roles of market participants



# Hydrogen Market Act



# 4. TECHNICAL SOLUTIONS & SAFETY

# Basis of Design

Parameter		
Design Pressure	[barg]	80
Max. Operating Pressure	[barg]	<80
Min. Operating Pressure	[barg]	30
Max. Flow Velocity	[m/s]	<40
Pipeline size		from DN500 to DN1000
Design Life	[years]	>50
Operating Mode		Bi-directional
Hydraulic Roughness	[ $\mu\text{m}$ ]	12.5
Pipeline Design Factor		Acc. to location classes
Line Pipe Material		Subject for feasibility study (ongoing)
Hydrogen quality		<p>a) <math>\text{H}_2</math> composition per Kiwa/DNV (<math>\text{H}_2 \geq 99.5 \text{ mol}\%</math>): Used for pipeline design, compressor performance verification, and operational flexibility assessments.</p> <p>b) <math>\text{H}_2</math> composition per CGA G-5.3, Grade B (<math>\text{H}_2 \geq 99.95 \text{ mol}\%</math>): Used as the design basis for compressor selection and sizing.</p>



# Hydrogen Safety

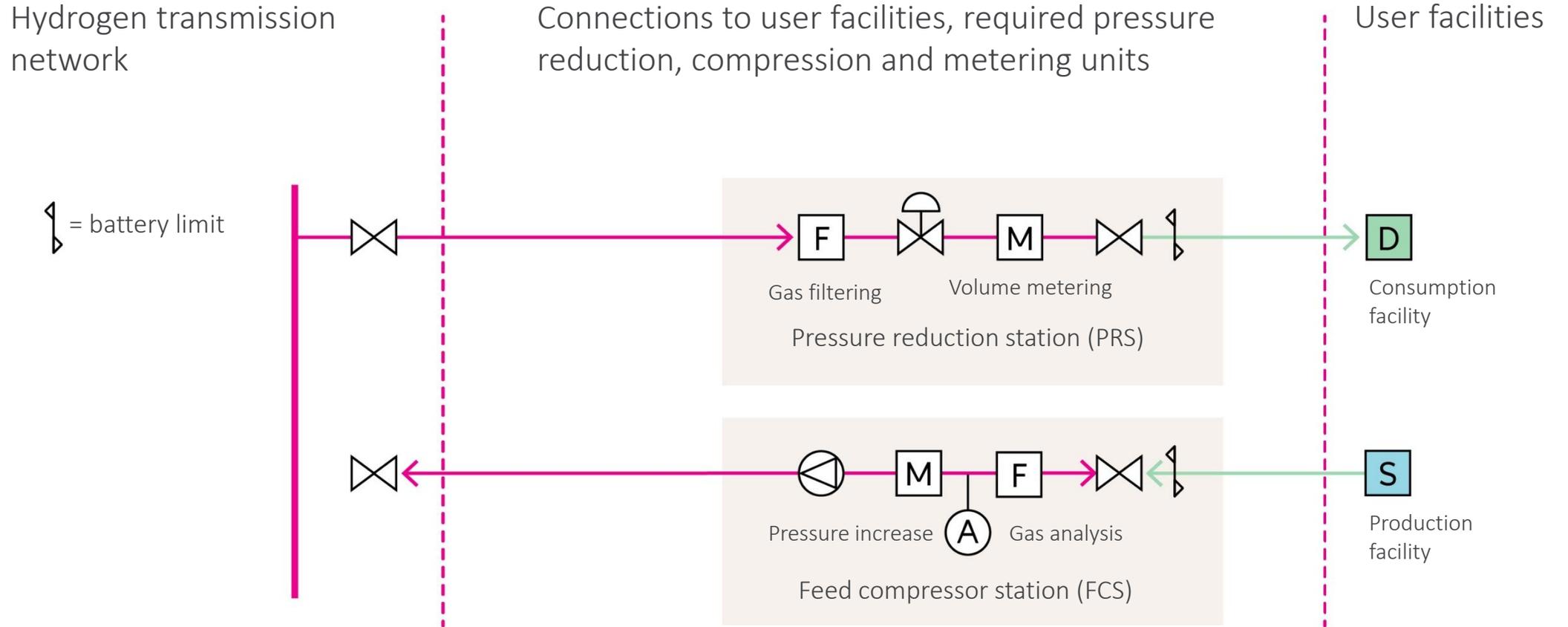
## Hierarchy of the chemical safety legislation



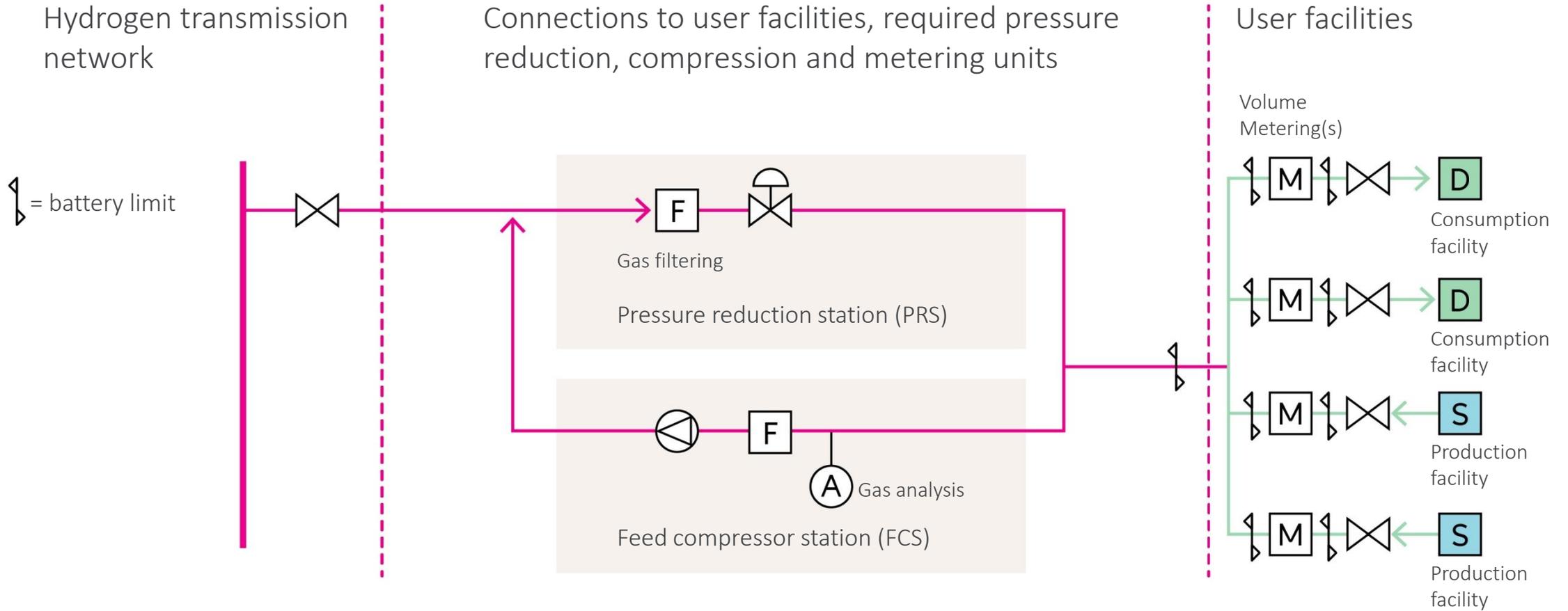
## Properties of hydrogen

Property	Hydrogen (H <sub>2</sub> )	Methane (CH <sub>4</sub> )	Notes
Density	0.09 kg/m <sup>3</sup>	0.73 kg/m <sup>3</sup>	Hydrogen is significantly lighter
Relative density to air	14 times lighter	1.7 times lighter	Hydrogen rises faster in the atmosphere
Boiling point	-253 °C	-162 °C	Both remain gaseous under standard pipeline conditions
Energy content	10.8 MJ/m <sup>3</sup>	36 MJ/m <sup>3</sup>	Hydrogen's energy content is approximately three times lower
Min. ignition energy in air	0.017 mJ	0.3 mJ	Hydrogen ignites more easily
Laminar combustion rate	2.7 m/s	0.4 m/s	Hydrogen exhibits a higher reactivity
Ignition range, concentration in air	4-75%	5-15%	Hydrogen has a significantly broader range for combustion
Hazard classification	Extremely flammable gas	Extremely flammable gas	Both gases share the same classification

# Connection of production and consumption facilities



# Connecting to a regional hydrogen network



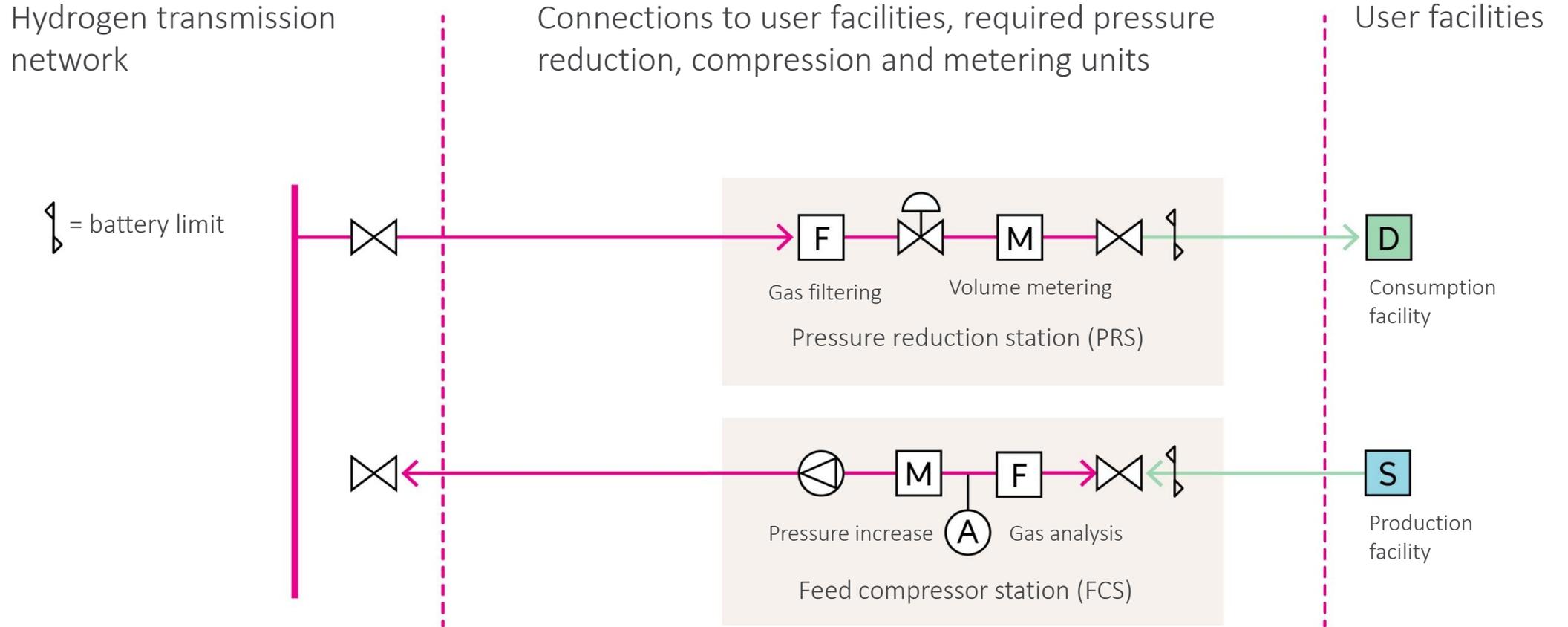
# 5. REGIONAL DEVELOPMENT & CONNECTIONS

# Connecting to the H2 transmission network

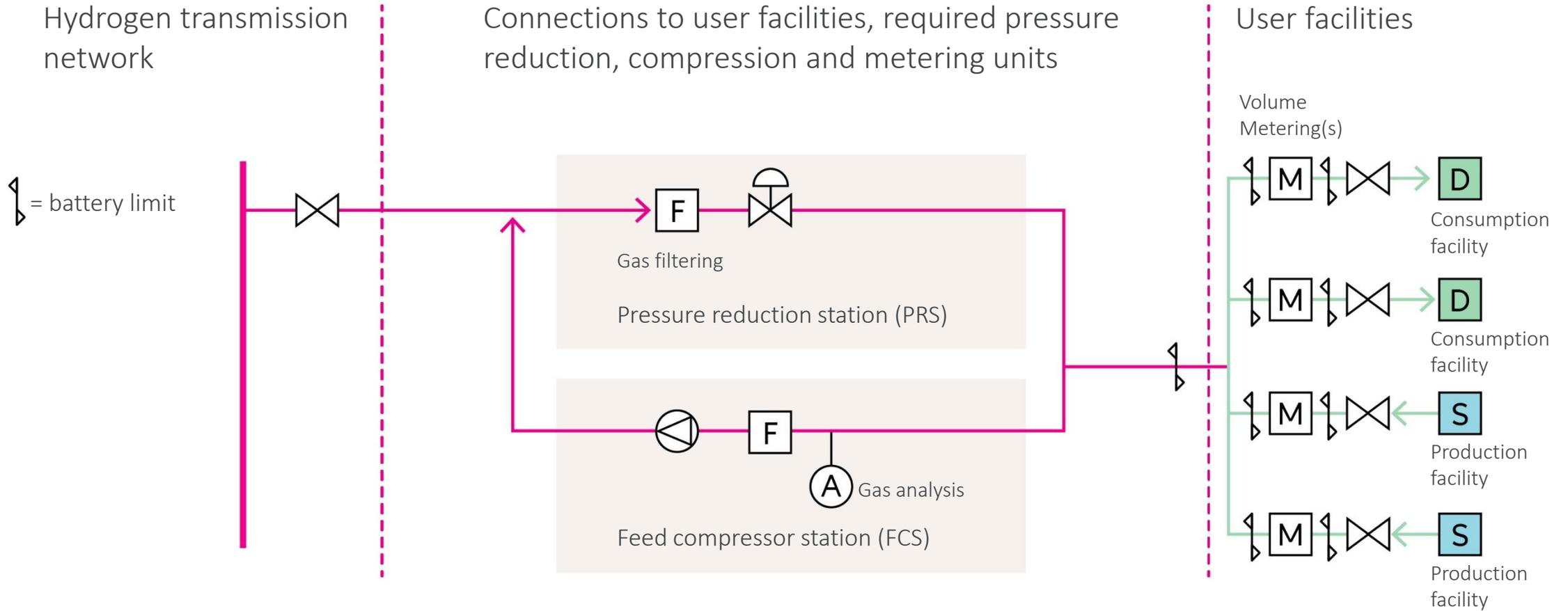
	Indications	Reservations	Contracts for FID	Contracts for operation	
	<b>Mutual indication of interest</b>	<b>Co-operative planning</b>	<b>Committed collaboration</b>	<b>Execution of joint plans</b>	
<b>Value for customer</b>	<ul style="list-style-type: none"> <li>• <b>Market survey</b></li> <li>• <b>Connection evaluation:</b> <ul style="list-style-type: none"> <li>• Connection concept</li> <li>• Initial routing plan</li> <li>• Prel. timeline</li> </ul> </li> <li>• <b>Pre-feasibility study:</b> potential further optimisation needs</li> </ul>	<ul style="list-style-type: none"> <li>• Capacity booking procedure</li> <li>• Prel. connection principles</li> <li>• Joint timelines &amp; milestones</li> <li>• Indications on tariff, market design and operative models</li> <li>• <b>Feasibility and basic design engineering phases</b> deepening the planning</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Detailed connection principles</b></li> <li>• <b>Tariffs, market design and operative model for FID</b></li> <li>• <b>Jointly agreed connection design and execution model</b> <ul style="list-style-type: none"> <li>• Connection timeline</li> <li>• Engineering details</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• <b>Construction and commissioning</b></li> </ul>	
<b>Customer input</b>	<ul style="list-style-type: none"> <li>• Participation into market survey</li> <li>• Letter of Intent</li> </ul>	<ul style="list-style-type: none"> <li>• Preliminary capacity booking</li> <li>• Timeline</li> <li>• Detailed basis of design</li> </ul>	<ul style="list-style-type: none"> <li>• Binding capacity booking</li> <li>• Detailed timeline</li> <li>• Design data locked</li> </ul>	<ul style="list-style-type: none"> <li>• Fixed timelines provided</li> <li>• Operative model and services agreed</li> <li>• Ownership structure agreed</li> <li>• Transfer fees and cost sharing agreed</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Collaboration during construction and commissioning</b></li> </ul>
<b>Contractual status</b>	NDA, Non-binding LOI	Binding COA Capacity bookings	Binding project contract Prel. connection agreement	Binding Framework and Connection agreements	

COA – Co-Operation Agreement, FID – Final Investment Decision, LOI – Letter of Intent, NDA – Non-Disclosure Agreement

# Connection of production and consumption facilities



# Connecting to a regional hydrogen network



# Regional development supporting national H2 development ramp-up

Strong stakeholder co-operation with various interest groups



Regional development model

