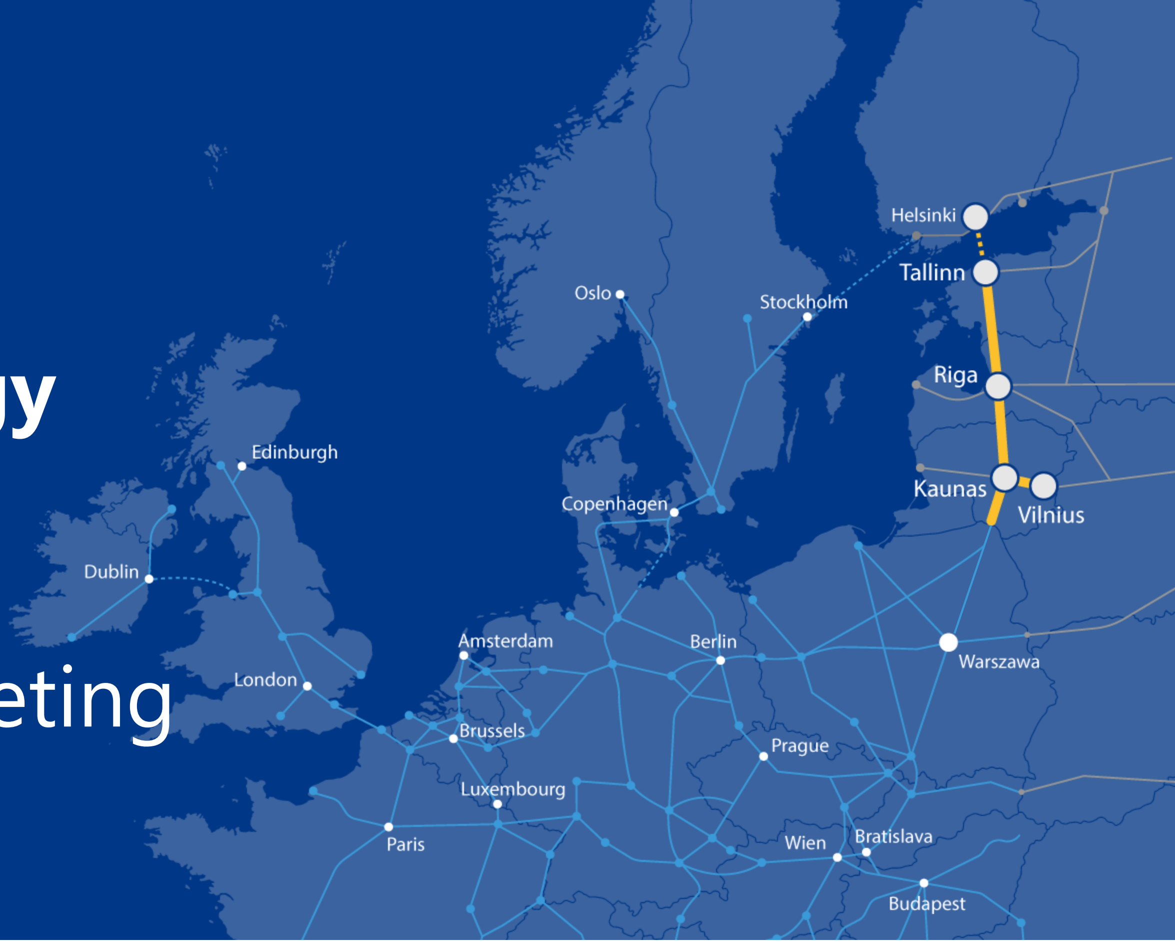
Rail Baltica

Rail Baltica energy deployment

ESEPE general meeting



Co-financed by the Connecting Europe Facility of the European Union

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RB Rail AS 15-10-2020

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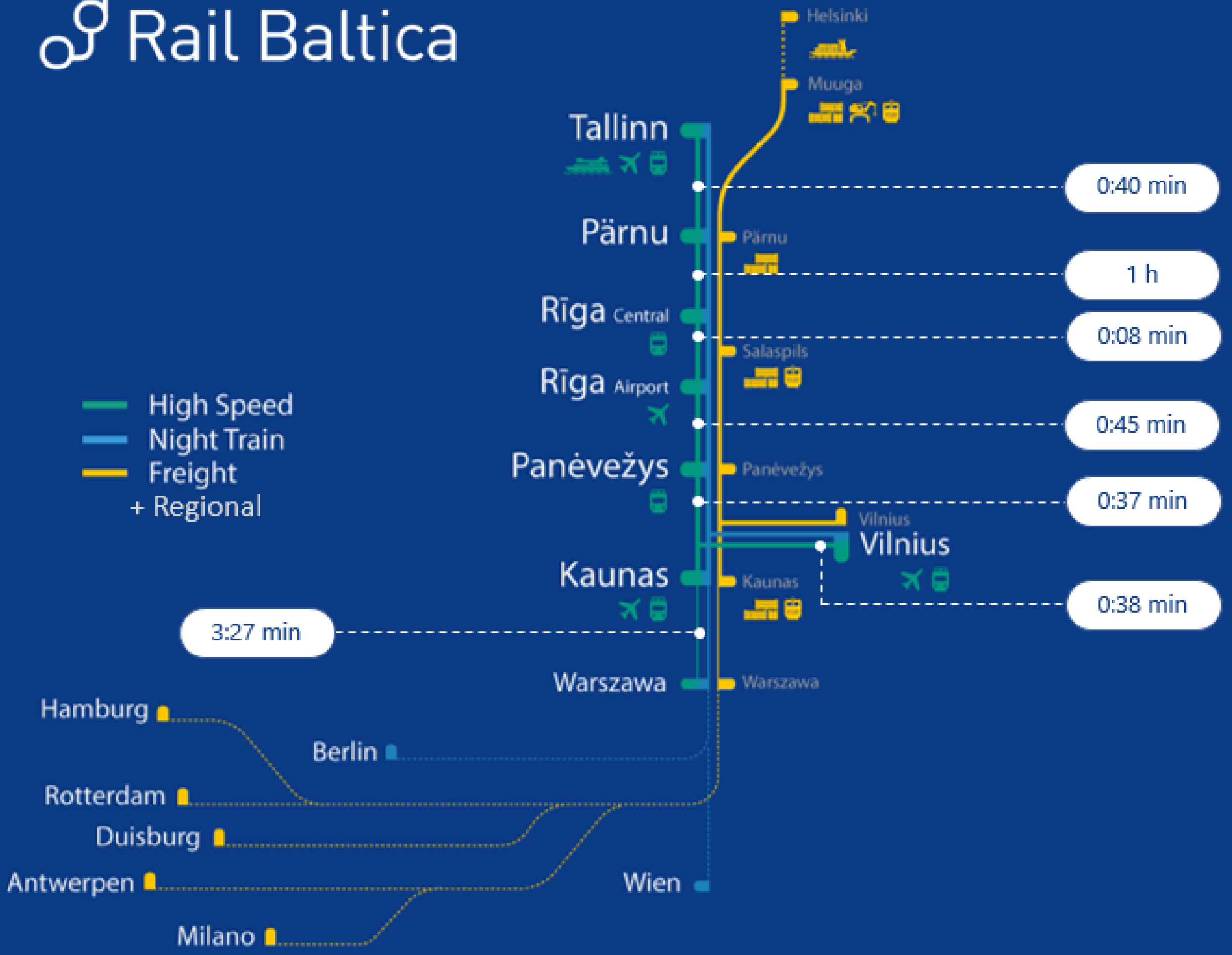


870 km greenfield railway infrastructure

1435 mm Double track

ERTMS Level 2

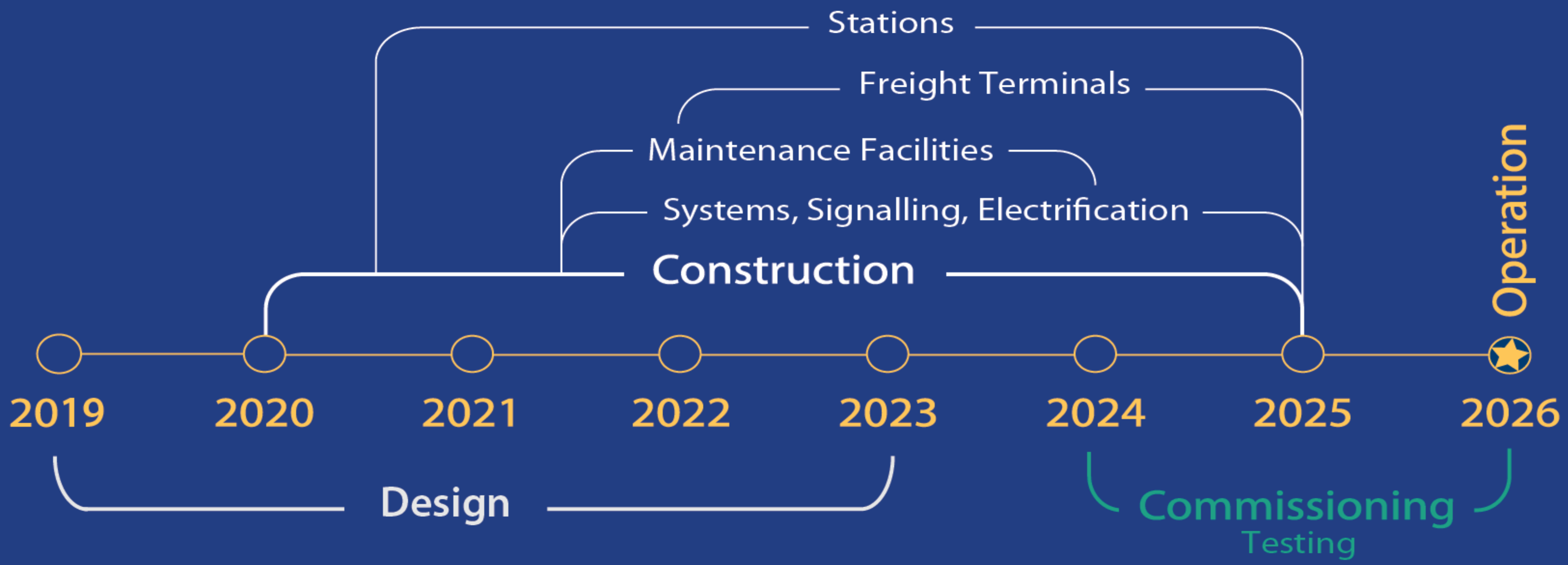
Electrified 2x25kV AC

Maximum length of freight trains: 1050m

Axle load 25t

Design speed:
249 km/h for passenger trains
120 km/h for freight trains

SE-C (Swedish) loading gauge


Rail Baltica
Stations
Freight Terminals
Maintenance Facilities
Systems, Signalling, Electrification
Construction
Operation
2019
2020
2021
2022
2023
2024
2025
2026
Design
Commissioning
Testing

Detailed Technical Design in Estonia

Sections:

- Tallinn to Rapla
- Rapla to Pärnu
- Pärnu to Estonian/Latvian border

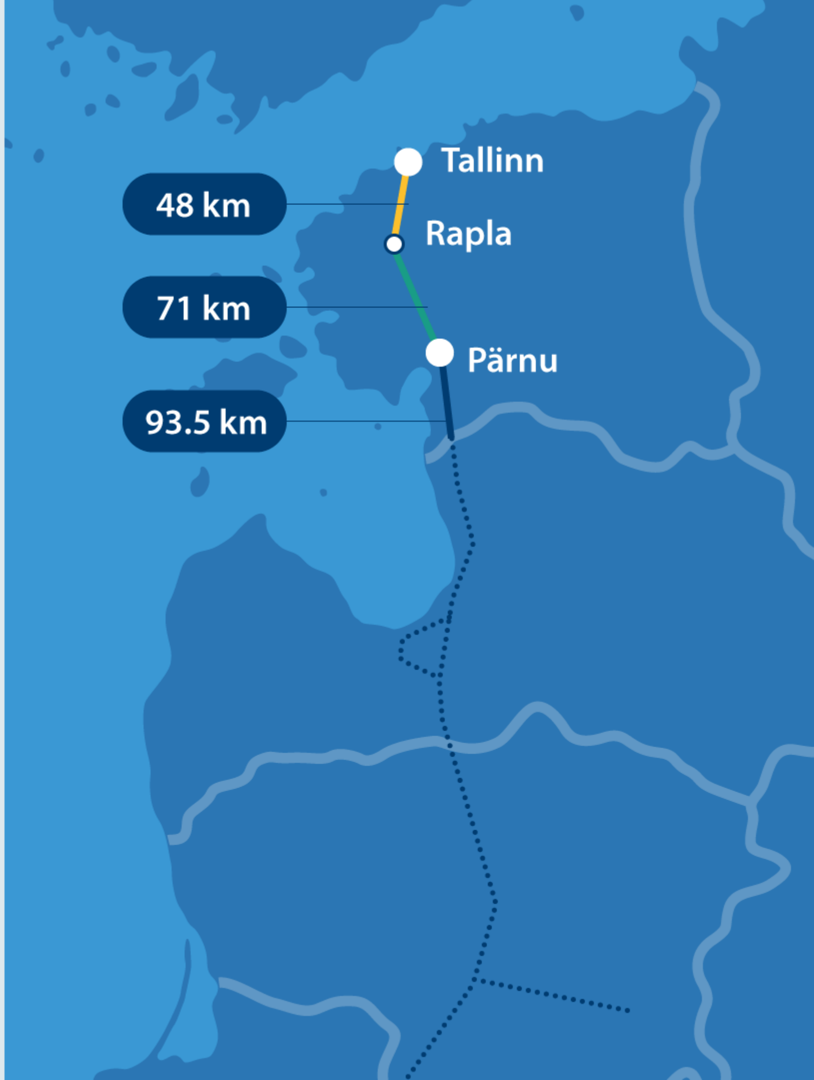
Indicative scope of works:

15 bridges

24 railway viaducts

40 road viaducts

24 ecoducts



Rail Baltica

Project status in Estonia 2020

Tallinn

Pärnu

Design works ongoing in the whole Rail Baltica line in Estonia.

- Construction works have started on the first object on the main line of Rail Baltica in Estonia at Saustinõmme.
- Design contracts signed for Ülemiste and Pärnu passenger terminals.
- Rail Baltica Muuga freight terminal development ongoing, procurement to be launched.

Land acquisition process ongoing. In 34 areas archeological studies and mappings were conducted.

According to public opinion poll 67% of Estonian residents support Rail Baltica project.

Tallinn- Pärnu	0:40
Tallinn-Rīga	1:42
Tallinn-Vilnius	3:38
Tallinn-Warsaw	6:47

Find out more about project status here:
http://www.railbaltica.org/info

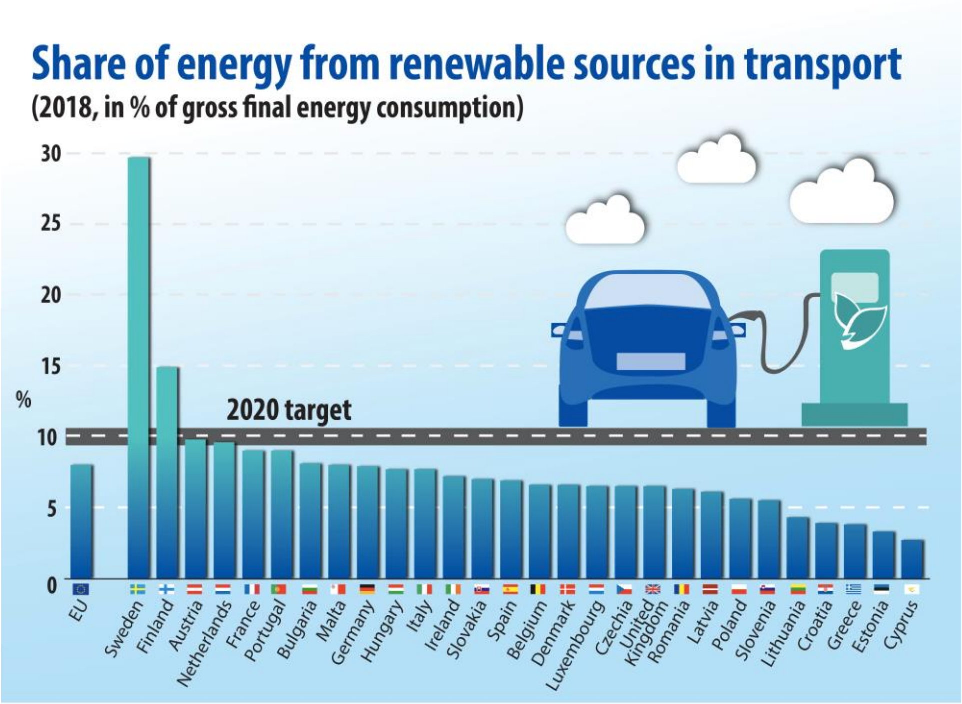
Railway crossings with utility lines (preliminary list) and Master Design deadlines

Rail Baltica

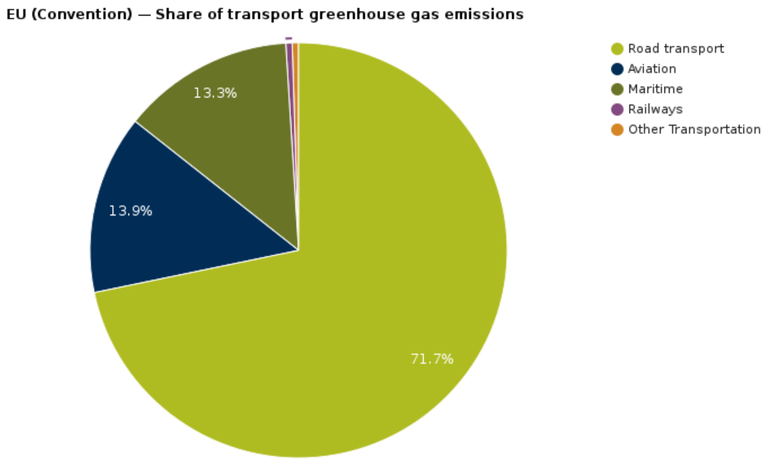
Design sections	Electricity	Pipelines	Communication
Tallinn-Rapla (DS2)	132	55	71
Rapla-Pärnu (DS1)	41	7	25
Pärnu-EE/LV (DS3)	67	19	23

Design sections	Master Design completion deadlines
Tallinn-Rapla (DS2)	II quarter 2021
Rapla-Pärnu (DS1)	III quarter 2021
Pärnu-EE/LV (DS3)	III quarter 2022

Zero energy impact strategy



ec.europa.eu/eurostat



Share of transport greenhouse gas emissions, EU-28, 2017

Rail Baltica

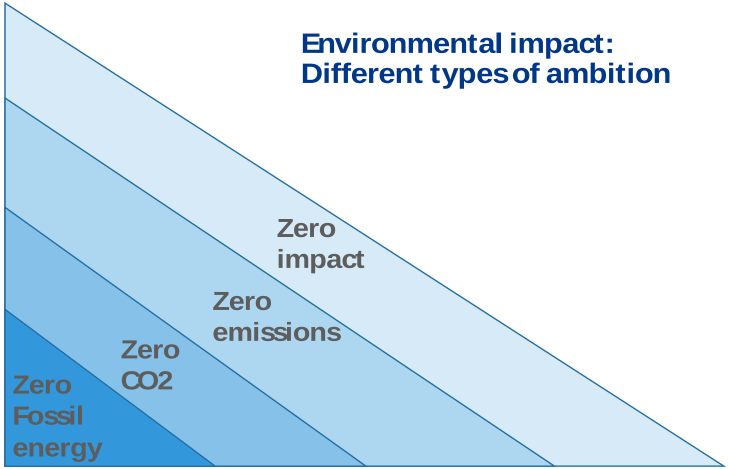
Zero energy impact strategy

Zero environmental impact strategy

Rail Baltica

2

Rail Baltica



The levels of ambition on Rail Baltica Zero Impact Strategy

Estimated consumption of Rail Baltica electrification is estimated to 3-4% of national electricity consumption:
Lithuania: 375 000 MW.h/year
Latvia: 284 000 MW.h/year
Estonia: 263 000 MW.h/year

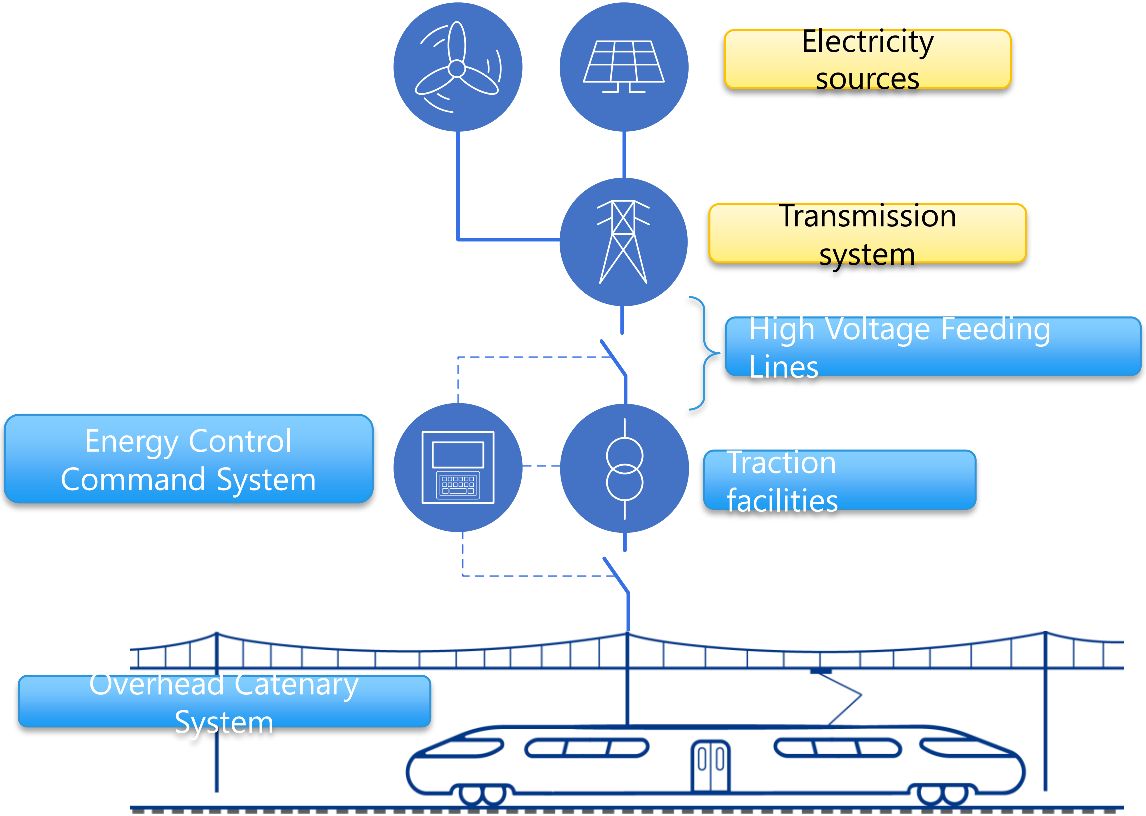
Rail Baltica

Zero energy impact strategy

Country	Estonia				Latvia				Lithuania ***			
Year	2018		2019		2018		2019		2018		2019 **	
Production by source/ volume and share	MW.h	%	MW.h	%	MW.h	%	MW.h	%	MW.h	%	MW.h	%
Renewable energy, incl.	1,662,000	16%	1,946,000	30%	3,326,454	51%	2,972,322	48%	2,613,000	81%		
Hydropower energy	19,000	0%	22,000	0%	2,417,065	37%	2,095,892	34%	426,000	13%		
Wind energy	591,000	6%	692,000	11%	120,840	2%	152,489	2%	1,139,000	35%		
Biomass energy	1,039,000	10%	1,179,000	18%	438,150	7%	399,627	6%	240,000	7%		
Biogas energy					349,122	5%	322,780	5%	136,000	4%		
Solar energy		0%		0%	1,277	0%	1,534	0%	80,000	2%		
Waste energy		0%		0%		0%		0%	71,000	2%		
Other renewable energy*	13,000	0%	53,000	1%		0%		0%	521,000 *	16%		
Non-renewable energy, incl.	8,921,000	84%	4,501,000	70%	3,174,882	49%	3,206,656	52%	607,000	19%		
Thermal energy	8,921,000	84%	4,501,000	70%	2,712,652	42%	2,822,835	46%	607,000	19%		
Co-generation energy		0%		0%	462,230	7%	383,821	6%		0%		
Total energy produced	10,583,000	100%	6,447,000	100%	6,501,336	100%	6,178,978	100%	3,220,000	100%		

Data sources:
Estonia: Elering https://elering.ee/eesti-elektritoodang-langes-eelmisel-aastal-39-protsenti-tarbimine-uhe-protsendi
Latvia: AS Augstsprieguma tīkls http://www.ast.lv/lv/electricity-market-review
Lithuania: Litgrid https://www.litgrid.eu/index.php/power-system/power-system-information/national-electricity-demand-and-generation/3523
Notes:
(*) Other renewable energy sources in Lithuania include electricity produced by Kruonis Pumped Storage Plant
(**) Lithuanian data for 2019 is not available yet
(***) Lithuania has a high renewable energy share in own electricity generation, however, around 70% is imported electricity, therefore total share in gross energy consumption is lower (around 20%), see Section 5.1.3.

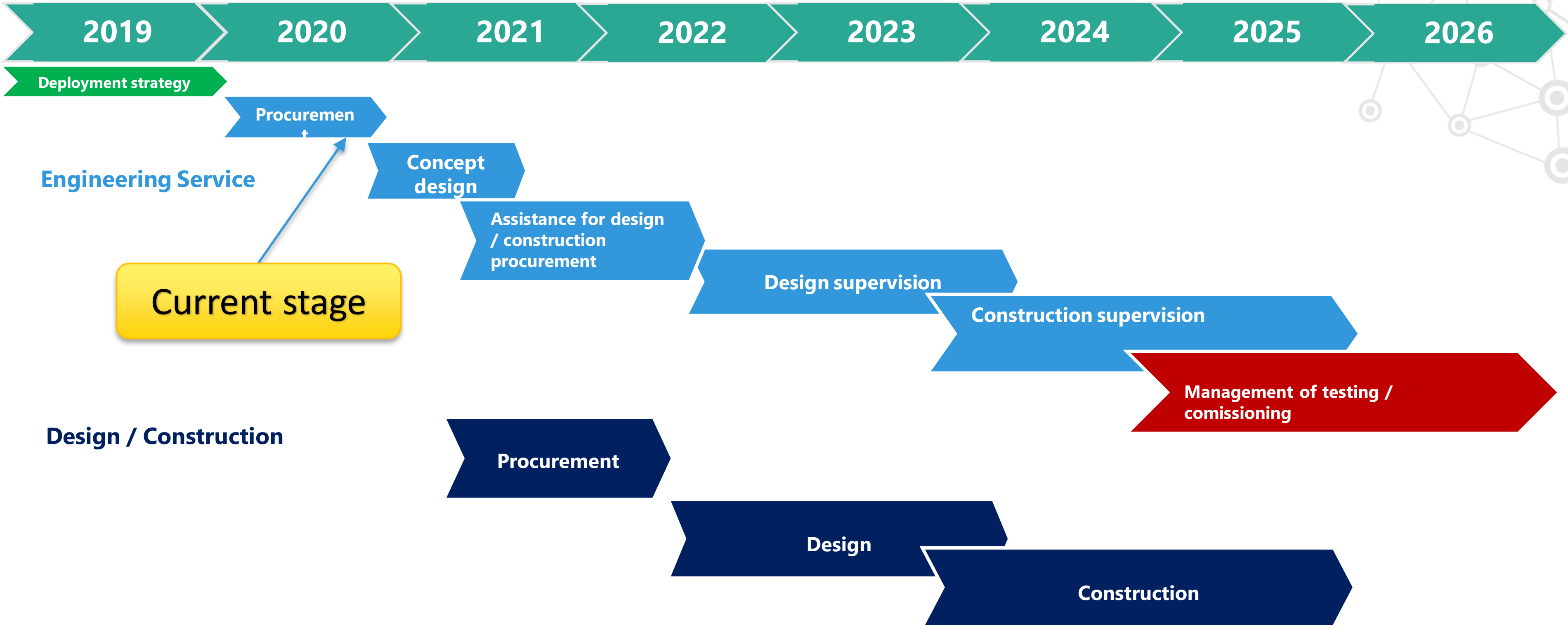
Energy subsystem – scope of the subject & Main targets



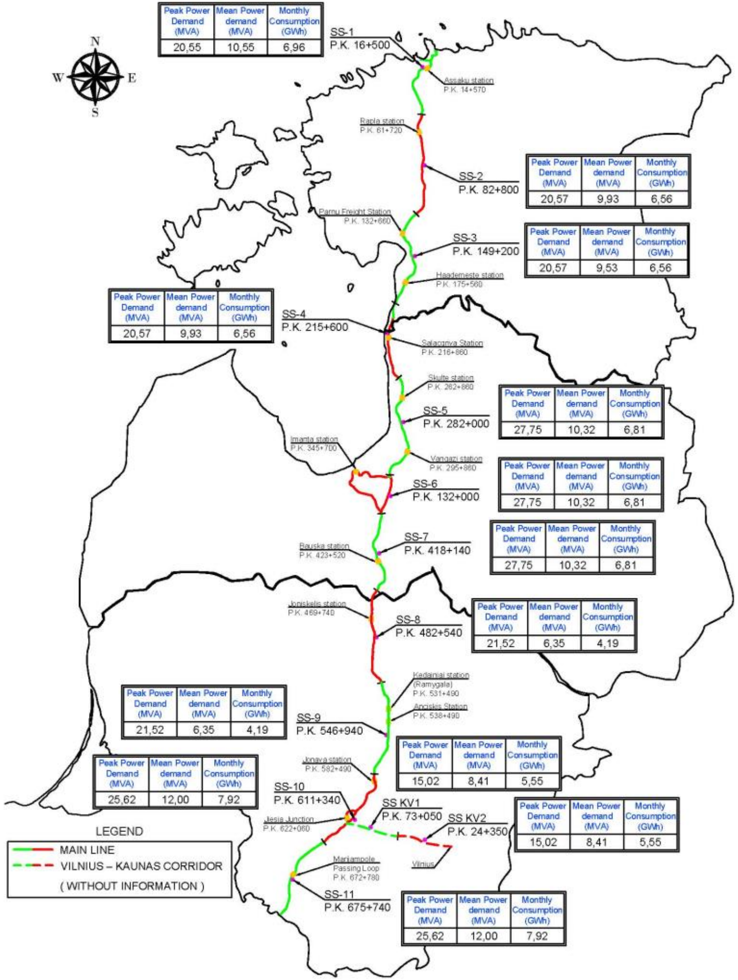
- **Main targets**
- Safety
- Environmental impact minimisation
- Life cycle costs
- Railway Operation needs
- Railway Maintenance needs
- Efficiency of energy consumption

Rail Baltica Energy Subsystem deployment timeline

Rail Baltica



Rail Baltica Energy Subsystem - deployment strategy analysis



- **870 km of double track, ~2 000 km of catenary , ~5 000 masts**
- CAPEX 512,4 M€; OPEX 12M€ (by 2030) - (CBA 2017 – E&Y)
- 13 Traction substations estimated (3 EE, 4 LV, 6 LT) for 2x25 kV technology:

Country	Energy consuption Total		Estimated for Rail Baltica		Country + RB	Increase (%)
	current (2017) (GWh)	foreseen for 2025 (GWh)	monthly (GWh)	annual (GWh)	foreseen (including RB) (GWh)	
EE	8 410	9 107	21,93	263	9 370	2,9%
LV	7 410	8 024	23,63	284	8 308	3,5%
LT	12 149	13 156	31,29	375	13 531	2,9%

- 3 other traction supply technologies (1x25 kV, SFC 1x25 kV, SFC 2x25 kV) considered

Different traction supply technologies compared

CRITERION	WEIGHTS	TR -SS 1 X 25 kV	TR -SS 1 X 25 Kv (weighted)	TR -SS 2 X 25 kV	TR-SS 2 X 25 kV (weighted)	SFC 1x25 kV	SFC-SS 1x25 kV (weighted)	SFC 2x25 kV	SFC-SS 2x25 kV (weighted)
		SCORES							
1. TECHNICAL	35%		7,78		18,08		28,12		33,68
1.1 Unbalance	10,5%	1	2,1	0	0	5	10,5	5	10,5
1.2 Electromagnetic perturbances	12,5%	0	0	4	10	3	7,5	5	12,5
1.3 Overload capacity	1,4%	4	1,12	5	1,4	4	1,12	4	1,12
1.4 Voltage and current hamornics in the ETG coupling poi	1,4%	1	0,28	2	0,56	5	1,4	5	1,4
1.5 Output voltage quality	1,4%	1	0,28	2	0,56	5	1,4	5	1,4
1.7 Distance between Sub-Stations	1,4%	2	0,56	4	1,12	3	0,84	5	1,4
1.8 Energy Losses	0,8%	4	0,64	5	0,8	2	0,32	2	0,32
1.9 Capacity expansion	1,4%	2	0,56	2	0,56	4	1,12	4	1,12
1.10 Ability to adapt the power supply scheme to increase t	1,4%	0	0	3	0,84	5	1,4	5	1,4
1.11 Efficiency of regenerative braking	1,4%	3	0,84	3	0,84	5	1,4	5	1,4
1.13 RAMS	1,4%	5	1,4	5	1,4	4	1,12	4	1,12
2. IMPLEMENTATION	15%		13		15		6		6
2.1 Proven technology	5,0%	3	3	5	5	2	2	2	2
2.2 Market Situation	5,0%	5	5	5	5	2	2	2	2
2.3 Ease of deployment	5,0%	5	5	5	5	2	2	2	2
3. OPERATION AND MAINTENANCE	10,0%		10		10		2		2
3.1 Ease of operation	5,0%	5	5	5	5	1	1	1	1
3.2 Ease of maintenance	5,0%	5	5	5	5	1	1	1	1
4. ENVIRONMENTAL AND CLIMATE CHANGE	5%		3,8		3,8		4,4		4,4
4.1 Noise	3,0%	5	3	5	3	4	2,4	4	2,4
4.3 Oil generation	2,0%	2	0,8	2	0,8	5	2	5	2
7. ECONOMICAL	35%		35		28,5		22		7
7.1 CAPEX	12,5%	5	12,5	4	10	4	10	1	2,5
7.2 OPEX	12,5%	5	12,5	5	12,5	4	10	1	2,5
7.3 LCC (infrastructure and buildings)	10,0%	5	10	3	6	1	2	1	2
TOTAL	100,0%		69,58		75,38		62,52		53,08

Traction supply technology priorities to consider for further ENE Subsystem deployment stages

Rail Baltica

Traction supply technology option	Conditions to verify during ENE Engineering Services	What if traction technology is not feasible to be implemented?
2x25 kV traction supply technology	No public power grid capacity restrictions, no location related restrictions	2x25 traction technology shall be suplemented with load balancing facilities in the critical connection points to the public grids
2x25 kV traction supply technology with load balancing facilities	Additional costs of load balancing facilities in comparison with the SFC technology	SFC technology shall be proposed
Static Frequency Converter (SFC) traction supply technology	-	-

Scope of ENE Engineering services – main scope

Rail Baltica

- **Full management** of ENE Deployment process

- the identification of economically optimized ENE subsystem solution (from the Life Cycle Costs point of view) – **ENE Concept Design preparation:**
  - power demand simulation
  - analysis of possible Connection Points to HV public network
  - analysis of different traction technologies
  - fixing the number and capacity of Traction Substations
  - Preparing Technical Specifications for all ENE components (HV feeding lines, Traction Substations, Overhead Catenary System etc.)

- support to RB Rail during ENE Design/Construction procurement process

- FIDIC supervision of the design/construction and defect notification period

- supervision of the Testing and Commissioning phase

Rail Baltica

ENE Engineering Service scope of services

Project Management Office services

QUALITY ASSURANCE MANAGEMENT, TECHNICAL INTERFACE MANAGEMENT, RISK MANAGEMENT, COST MANAGEMENT, TECHNICAL COMPLIANCE MANAGEMENT, ENE DEPLOYMENT PROGRAMME CONTROL

PREPARATORY PHASE

- INITIAL DATA COLLECTION
- SIMULATIONS
- CONCEPT DESIGN PREPARATION
- PROCUREMENT STRATEGY
- MARKET CONSOLATION
- ASSISTANCE DURING WORKS PROCUREMENT PROCESS

WORKS IMPLEMENTATION PHASE

- DESIGN SUPERVISION
- CONSTRUCTION SUPERVISION
- COMMISSIONING AND TESTING SUPERVISION
- DEFECT NOTIFICATION PERIOD SUPERVISION
- PERFORMANCE CERTIFICATES DELIVERY

Thank you!