

## Slovenia

*Information on the Slovene energy transition comes mainly from the updated Integrated National Energy and Climate Plan (NECP). However, the targets are somewhat nebulous, and the government seems to be wavering whether or not to build out more nuclear capacity, which they have solved by making several scenarios for the NECP.*

### Targets

Slovenia's main emission target is climate neutrality by 2050. Then the government also aims to reduce greenhouse gas emissions by at least 28% from 2005-levels by 2030.<sup>1</sup> However, the translation of this document is bad, and it says that Slovenia should reduce greenhouse gas emissions by 55% from 2005-levels by 2033,<sup>2</sup> which seems unlikely based on the 28% target for 2030.

The main renewable energy target for Slovenia is to achieve a 33% renewable end-use share of 33% by 2030, this is to be 30% for industry, and the share of renewables in electricity generation is 55%.<sup>3</sup> Slovenia has also set a target the final energy consumption should not exceed 50.2 TWh, and the primary energy consumption should not exceed 69.5 TWh.<sup>4</sup> Table 1 shows information on the expected share of renewables in final energy consumption, the share of wind and solar, and electricity use in transportation according to the 'With Additional Measures,' WAM, scenario. Since Slovenia has no possibility of installing offshore windfarms and has a spread-out rural population, the government does not expect wind to be a significant energy producer.<sup>5</sup> Slovenia will also have decided by 2028 whether or not it will build a new nuclear power plant.<sup>6</sup>

Slovenia has a 'With Existing Measures,' WEM, and 'With Additional Measures,' WAM, equivalent scenarios, called MA and DU. The MA scenario expects no new production capacity, while the DU scenario does. The DU scenario is again divided into a nuclear scenario (DU-JE) and a renewable scenario (DU-OVE) for 2040.<sup>7</sup> See Table 2 for more information on nuclear.

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<sup>1</sup> The Government of the Republic of Slovenia, 'Updated Integrated National Energy and Climate Plan of the Republic of Slovenia', 16.

<sup>2</sup> The Government of the Republic of Slovenia, 'Updated Integrated National Energy and Climate Plan of the Republic of Slovenia', 16.

<sup>3</sup> The Government of the Republic of Slovenia, 'Updated Integrated National Energy and Climate Plan of the Republic of Slovenia', 16.

<sup>4</sup> The Government of the Republic of Slovenia, 'Updated Integrated National Energy and Climate Plan of the Republic of Slovenia', 66.

<sup>5</sup> The Government of the Republic of Slovenia, 'Updated Integrated National Energy and Climate Plan of the Republic of Slovenia', 58.

<sup>6</sup> The Government of the Republic of Slovenia, 'Updated Integrated National Energy and Climate Plan of the Republic of Slovenia', 18.

<sup>7</sup> The Government of the Republic of Slovenia, 'Updated Integrated National Energy and Climate Plan of the Republic of Slovenia', 220 and 273-274.

Table 1: Estimated energy production for renewables (RES) [WAM]<sup>8</sup>

		WAM						WAM	WAM-nuclear
	GWh	2020	2022	2024	2026	2028	2030	2040	2040
Gross final energy consumption (RES)	Solar	488	854	1 595	2 319	3 086	3 853	7 871	8 997
	Wind	6	6	6	76	216	356	998	1 232
	Total	13 236	14 487	15 111	16 246	17 934	19 965	27 604	29 174
Gross electricity production (RES)	Solar	368	737	1 479	2 208	2 983	3 757		
	Wind	6	6	6	76	216	356		
	Total	5 228	5 595	6 254	7 066	8 092	9 462		
Electricity consumption in transportation	-	68	34	49	103	206	331		
RFNBO <sup>A</sup>		0	0	0	60	162	264		

A: Synthetic fuels and 'green' hydrogen, Renewable Fuels of Non-Biological Origin (RFNBO)

Table 2: Nuclear and renewable energy (ktoe)<sup>9</sup>

MA [WEM] (ktoe)					
	Nuclear	Renewables and waste	Final energy consumption	Primary energy consumption	Electricity
2021	1461	1095	4775	6377	1122
2030	1446	1374	5070	6709	1246
2040	1445	1355	4798	6117	1589
DU-OVE [WAM renewable] (ktoe)					
2021	1461	1095	4775	6377	1122
2030	1447	1792	4436	6097	1266
2040	1445	2412	3770	5313	1623
DU-JE [WAM nuclear] (ktoe)					
2021	1461	1095	4775	6377	1122
2030	1447	1792	4436	6097	1266
2040	3552	2295	3770	6769	1623

<sup>8</sup> The Government of the Republic of Slovenia, 'Updated Integrated National Energy and Climate Plan of the Republic of Slovenia', 51–52.

<sup>9</sup> The Government of the Republic of Slovenia, 'Updated Integrated National Energy and Climate Plan of the Republic of Slovenia', 261.

## Energy demand projections

The Slovene government projects the energy demand to rise from 2020 before it starts to fall in 2026 because of energy saving measures.<sup>10</sup> A breakdown of the estimates can be seen in Table 2. These are divided into a ‘With Existing Measures,’ WEM, and a WAM-scenario, and measured in kilo-tonne of oil equivalents.

Table 2: Energy balance projections (ktoe)<sup>11</sup>

ktoe		OBS <sup>A</sup>	WEM				WAM		
		2022	2025	2030	2040	2025	2030	2040	
Industry	Electricity	473	511	550	607	532	583	680	
	Total	1 180	1 344	1 427	1 537	1 300	1 344	1 373	
Transportation	Electricity	24	30	60	281	32	75	302	
	Total	1 975	2 091	2 196	1 906	2 049	1 694	1 133	
Households	Electricity	321	319	334	358	318	332	354	
	Total	1 046	967	876	767	957	859	746	
Services and Agriculture	Electricity	304	288	302	342	275	276	287	
	Total	574	569	572	589	553	539	518	
Final energy consumption	Electricity	1 122	1 148	1 246	1 589	1 156	1 266	1 623	
	Total	4 775	4 972	5 070	4 798	4 859	4 436	3 770	

A: Observed value

## Transportation

Whether aviation and maritime transportation is included in Slovenia’s definition of the transport sector is unclear, however, mentions of navigation and aviation on pages 232 and 251 of the NECP makes me assume it does. Saying this, the main focus is on roads and rail, especially since roads road transport stood for 99.6% of transport sector emissions in 2022.<sup>12</sup> Slovenia is aiming for EVs to play a greater role in the transportation

<sup>10</sup> The Government of the Republic of Slovenia, ‘Updated Integrated National Energy and Climate Plan of the Republic of Slovenia’, 67.

<sup>11</sup> The Government of the Republic of Slovenia, ‘Updated Integrated National Energy and Climate Plan of the Republic of Slovenia’, 259–60.

<sup>12</sup> The Government of the Republic of Slovenia, ‘Updated Integrated National Energy and Climate Plan of the Republic of Slovenia’, 231–32.

sector with a continuation of financial incentives. The target is that EVs (Battery Electric Vehicles [BEV], Plug-in Hybrid Electric Vehicles [PHEV], and Fuel Cell Electric Vehicles [FCEV]) should comprise 55% of newly registered passenger cars, 45% of newly registered light goods vehicles and 25% of newly registered buses. The shares for the fleet as a whole is 12%, 10%, and 10% respectively.<sup>13</sup> The expected energy and electricity consumption for the transport sector can be seen in Table 2.

## Heat pumps

Heat pumps is an important way that Slovenia plans to save energy and features prominently in the NECP. However, there are no concrete targets for installations.

## Hydrogen and batteries

Hydrogen features prominently in Slovenia's energy transition, with the NECP focusing on the build-out of capacity and interconnectivity. There are no concrete targets, but the NECP projects the capacity to be 5 MW in 2025, 100 MW in 2030, 300 MW in 2035, 400 MW in 2040, 500 MW in 2045, and 660 MW in 2050.<sup>14</sup> A breakdown can be seen in Table 3.

There are developed sub-targets, however these are nebulous and somewhat hard to interpret, probably because of the machine translation.

- (1) Accelerated construction of EE storage systems (SHEE): pumped power plants, batteries, hydrogen converters, and other others, to ensure that the share of their capacity (in GWh) in daily EE use is higher than the share of the total annual production of solar and wind power plants in the annual use of EE.<sup>15</sup>
- (2) To ensure the incorporation of SHEE into new large SEs providing at least 25% of their rated power (kW).
- (3) Incentivising the installation of heat storage tanks into heat pumps, in DSHS, and others, to encourage the construction of at least two larger electrolysis units to store peaks of electricity produced in hydrogen and to explore storage options.<sup>16</sup>

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<sup>13</sup> The Government of the Republic of Slovenia, 'Updated Integrated National Energy and Climate Plan of the Republic of Slovenia', 179.

<sup>14</sup> The Government of the Republic of Slovenia, 'Updated Integrated National Energy and Climate Plan of the Republic of Slovenia', 294–95.

<sup>15</sup> The average daily use of EE is equal to the sum of the annual end-use of electricity and annual losses on the transmission and distribution network divided by the number of days in the year. The SHEE capacity shall be equal to the sum of all nominal capacities (GWh) of storage tanks at all voltage levels in the EES. The capacity of hydrogen converters shall be equal to the energy value of the average daily hydrogen production (The Government of the Republic of Slovenia, 'Updated Integrated National Energy and Climate Plan of the Republic of Slovenia', 74.)

<sup>16</sup> The Government of the Republic of Slovenia, 'Updated Integrated National Energy and Climate Plan of the Republic of Slovenia', 71.

In the NCEP there is also a forecast of 1 157 GWh of hydrogen by 2030 according to ENTSOG and ENTSO-E model.<sup>17</sup> This is much higher than the projections on pages 294-295 (which estimate 236 GWh). This might be hydrogen from all sources. Batteries are also mentioned but receives far less attention.

*Table 3: Hydrogen production<sup>18</sup>*

	<b>2025</b>	<b>2030</b>	<b>2035</b>	<b>2040</b>	<b>2045</b>	<b>2050</b>
<i>Capacity [MW]</i>	5	100	300	400	500	660
<i>Total energy [GWh]</i>	5	236	502	813	1897	2465
<i>Renewable S1<sup>A</sup> [GWh]</i>	5	61	495	813	1897	2465
<i>Renewable S2<sup>B</sup> [GWh]</i>	5	61	431	732	548	509
<i>Nuclear S1<sup>A</sup> [GWh]</i>	0	175	7	0	0	0
<i>Nuclear S2<sup>B</sup> [GWh]</i>	0	175	71	81	1349	1956

A: Scenario 1, without new nuclear.

B: Scenario 2, with new nuclear.

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<sup>17</sup> The Government of the Republic of Slovenia, 'Updated Integrated National Energy and Climate Plan of the Republic of Slovenia', 47.

<sup>18</sup> The Government of the Republic of Slovenia, 'Updated Integrated National Energy and Climate Plan of the Republic of Slovenia', 294–95.