

# **The Potential of Renewable Energy Sources and Integrated Energy in the ENTSO-E**

**A Techno-Economic Potential Analysis within an Energy  
Balance Assessment**

## **Compendium**

Von der Fakultät für Maschinenbau, Elektro- und Energiesysteme  
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M.Sc.

Mark Sebastian Kuprat

geboren am 11. Mai 1983 in Berlin

Vorsitzender: Prof. Dr.-Ing. Georg Möhlenkamp

Gutachter: Prof. Dr.-Ing. Harald Schwarz

Gutachter: Prof. Dr.-Ing. Harald Fien

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## Abstract

The compendium is intended to serve as a complementary and comprehensive reference guide for the main body. The compendium comprises the energy flow diagrams of 2016 and 2050, based on the Sankey scheme. The Sankey diagrams are a means to visualize the energy composition of current and future energy systems. Therefore, the diagrams are depicted for all 35 ENTSO-E countries and for the ENTSO-E entity. The diagrams are created in reference to the methodology of **Chapter 2.4** of the main body. The resulting Sankey diagrams for the year 2016 are depicted in **Fig. 1–36** of the compendium. The Sankey diagrams for the year 2050 are based on the Integrated Energy System (IES) model results as presented in **Chapter 5** of the main body. The Sankey diagrams 2050 are depicted in **Fig. 37–72**. The year 2050 represents the reference year of a low-emission energy system, as it is envisaged by current stipulations and regulatory frameworks. The energy flow diagrams demonstrate the significant changes of the energy systems 2016 and 2050. In reference to Sankey, the energy systems 2016 and 2050 methodologies are elaborated in **Chapter 2.4** and **Chapter 5.7.2**. The Sankey methodology implies to read the energy flow diagrams from left to right, whereas the number attributed to each stage always indicates the energy input. The 35 ENTSO-E countries and the corresponding ISO country codes are depicted in **Tab. 1**.

**Tab. 1** ENTSO-E countries and ISO country codes

ISO Code	Country	ISO Code	Country
AL	Albania	IS	Iceland
AT	Austria	IT	Italy
BA	Bosnia and Herzegovina	LT	Lithuania
BE	Belgium	LU	Luxembourg
BG	Bulgaria	LV	Latvia
CH	Switzerland	ME	Montenegro
CY	Cyprus	MK	Macedonia
CZ	Czech Republic	NL	Netherlands
DE	Germany	NO	Norway
DK	Denmark	PL	Poland
EE	Estonia	PT	Portugal
ES	Spain	RO	Romania
FI	Finland	RS	Serbia
FR	France	SE	Sweden
GR	Greece	SI	Slovenia
HR	Croatia	SK	Slovakia
HU	Hungary	UK	United Kingdom
IE	Ireland	-	-





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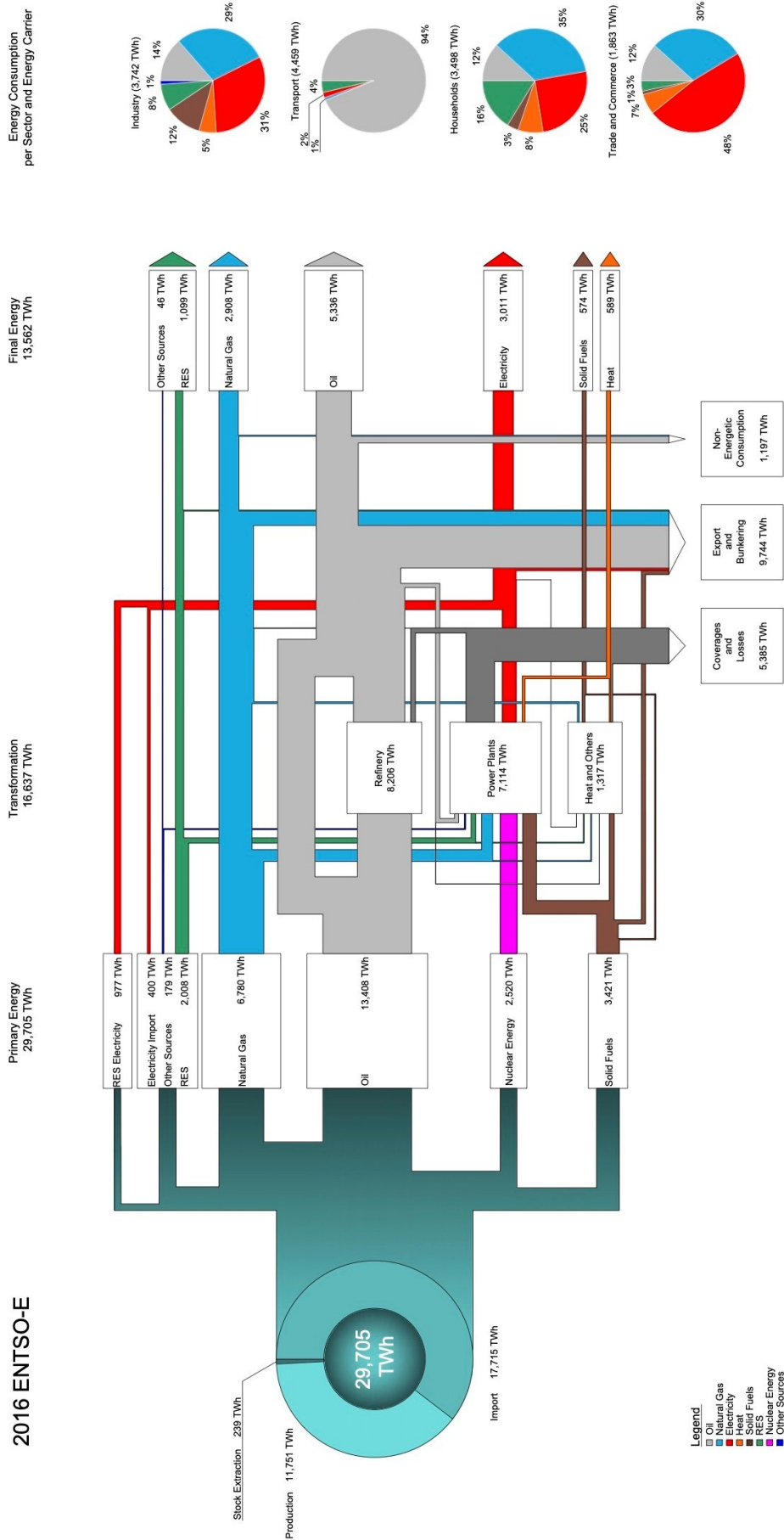


Fig. 1 ENTSO-E 2016

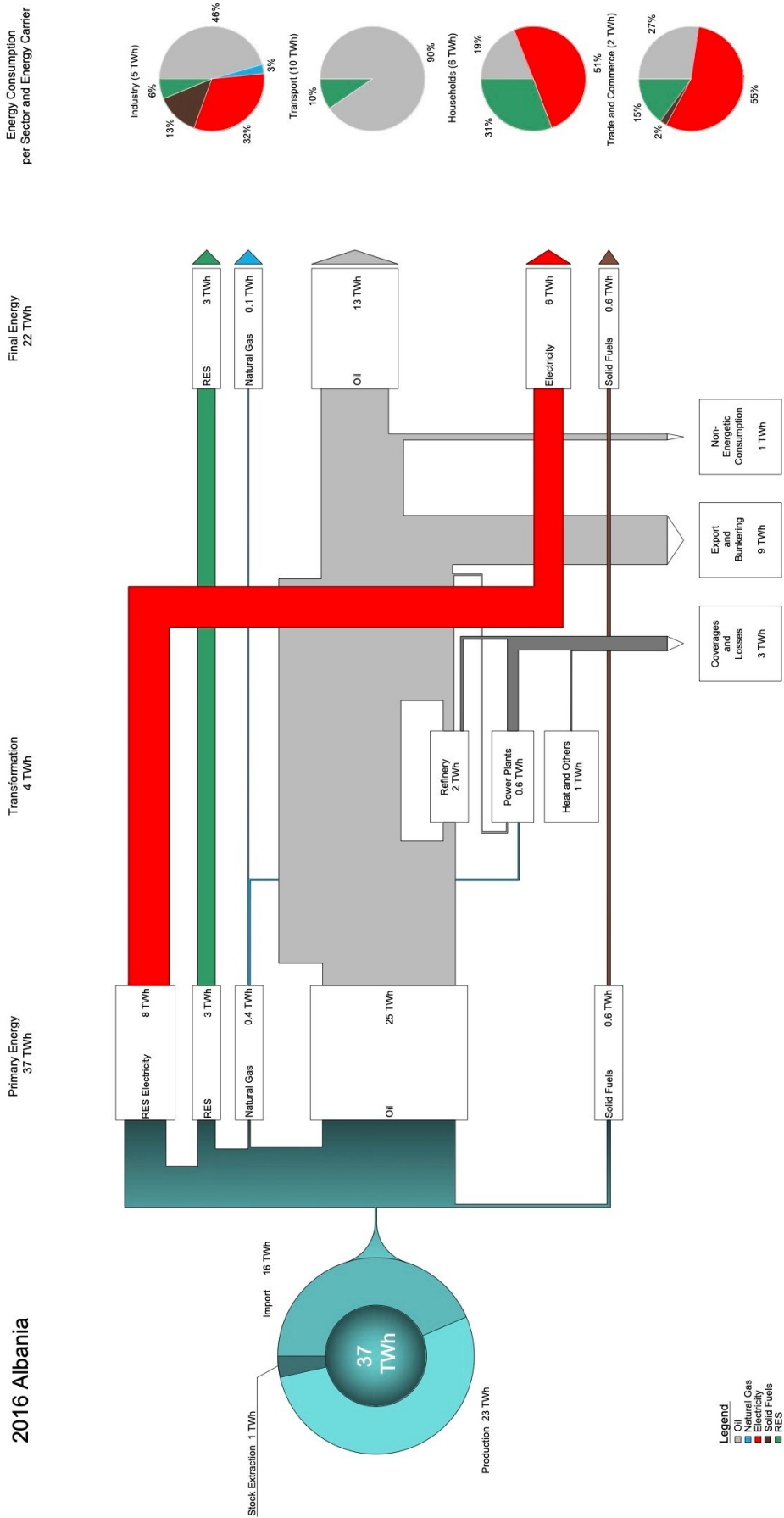


Fig. 2 Albania 2016

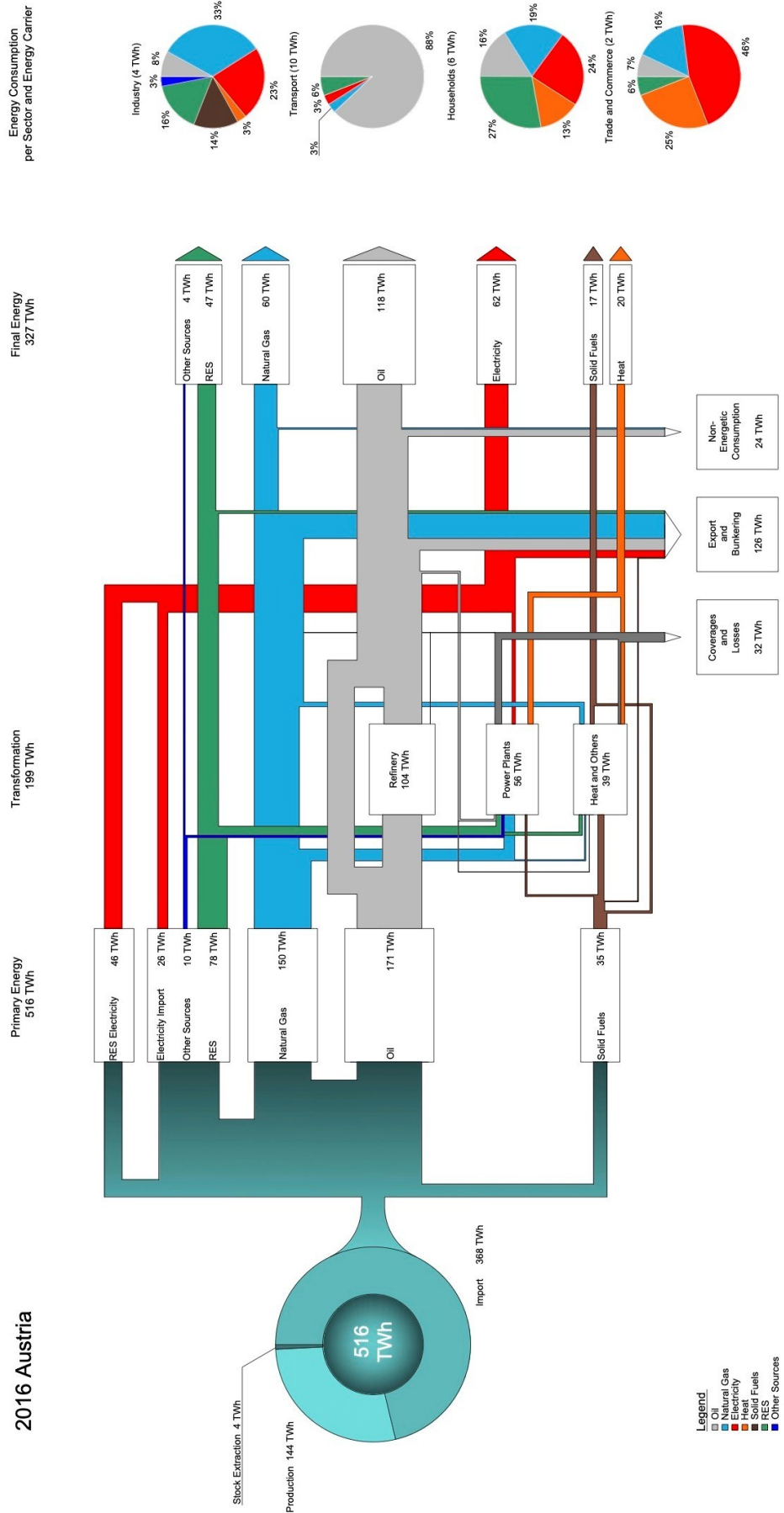


Fig. 3 Austria 2016

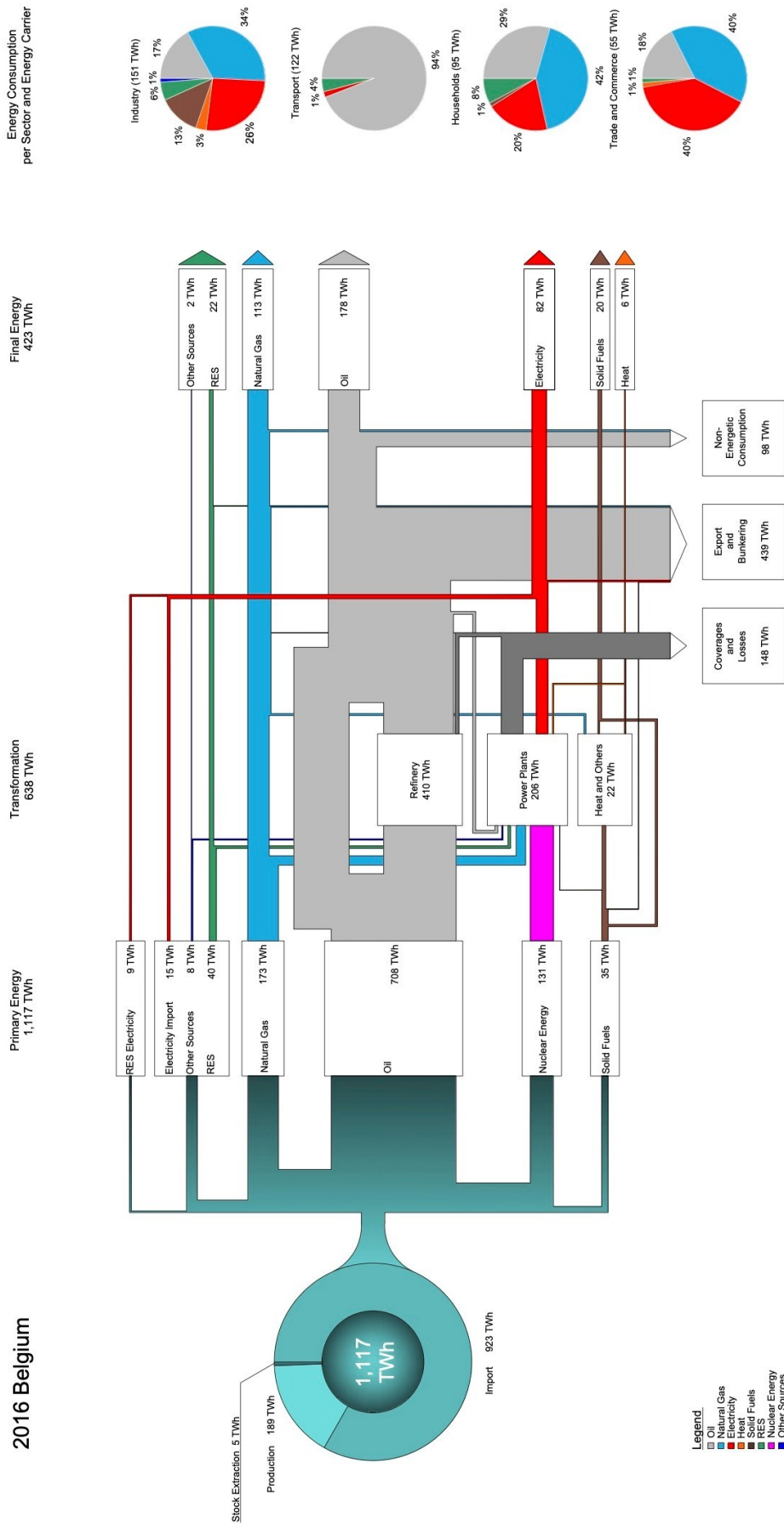


Fig. 4 Belgium 2016

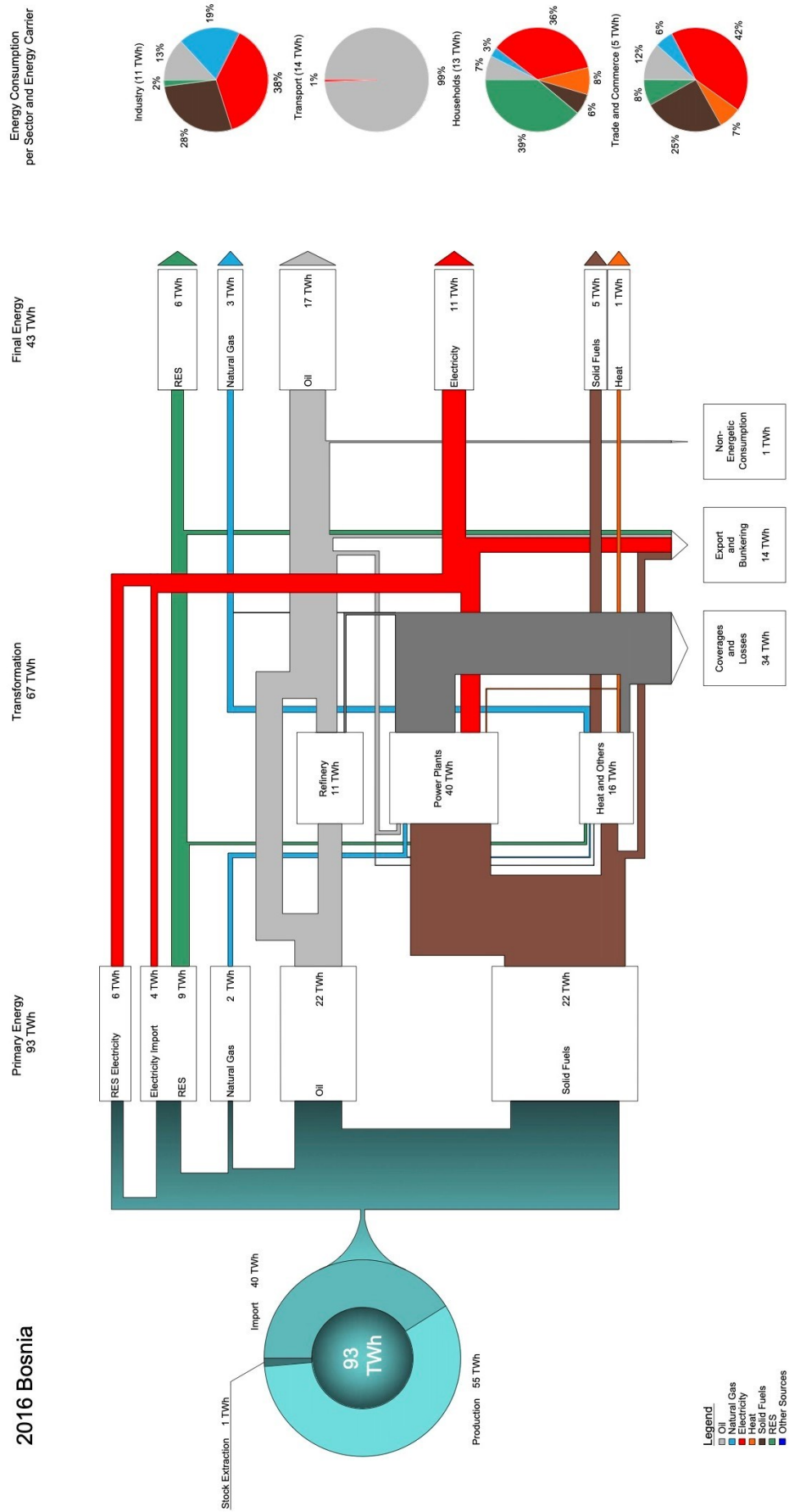


Fig. 5 Bosnia 2016

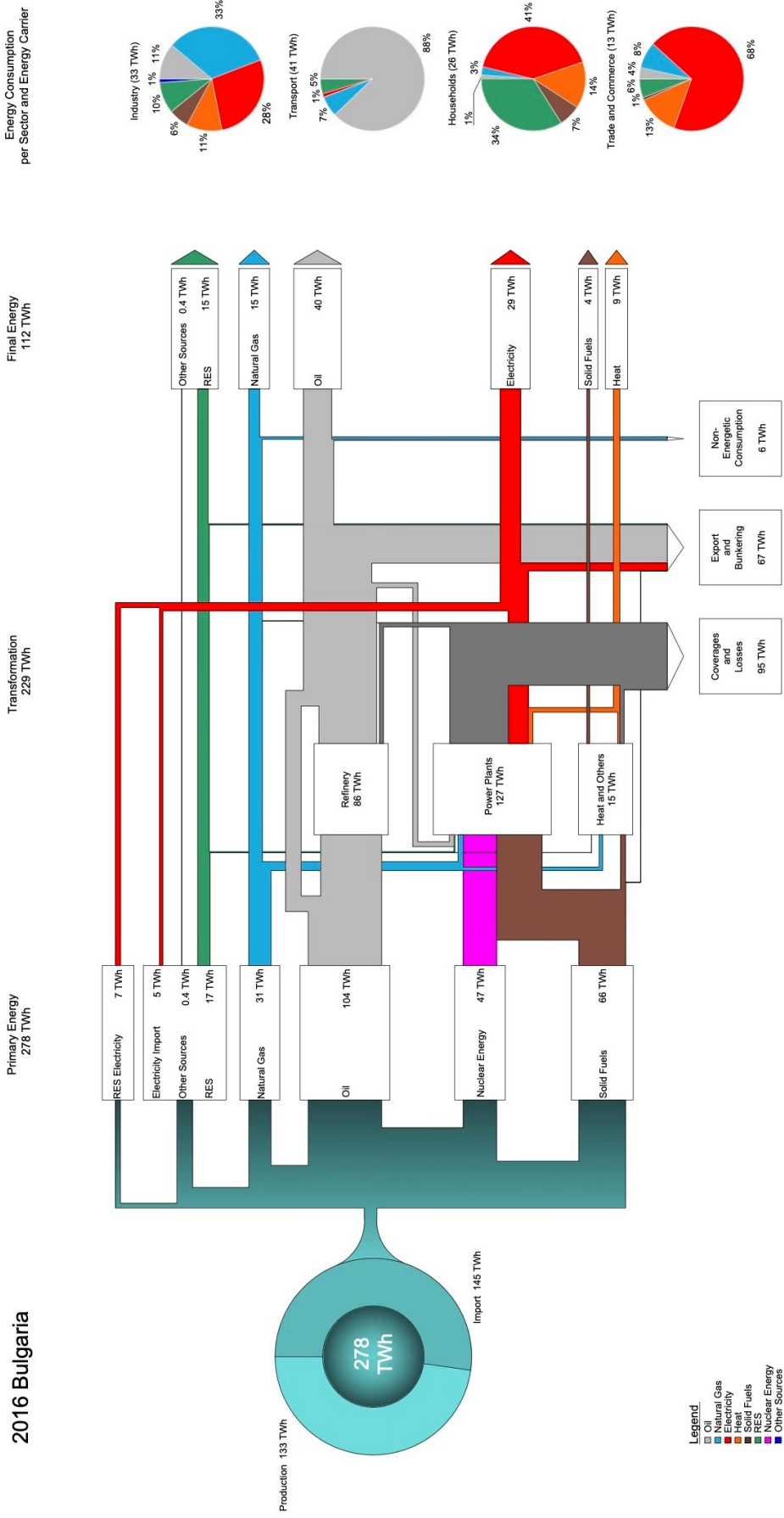


Fig. 6 Bulgaria 2016



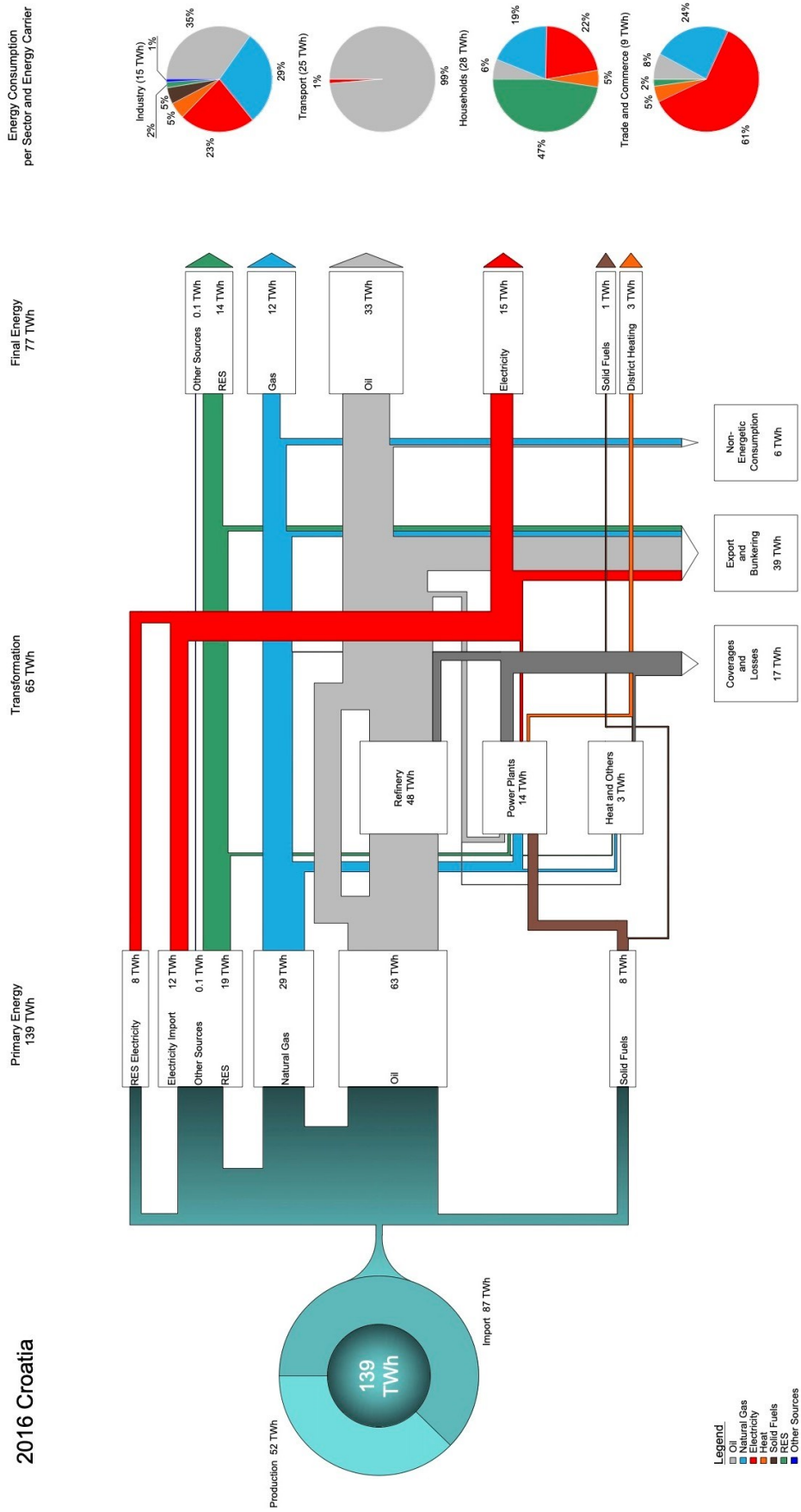


Fig. 7 Croatia 2016

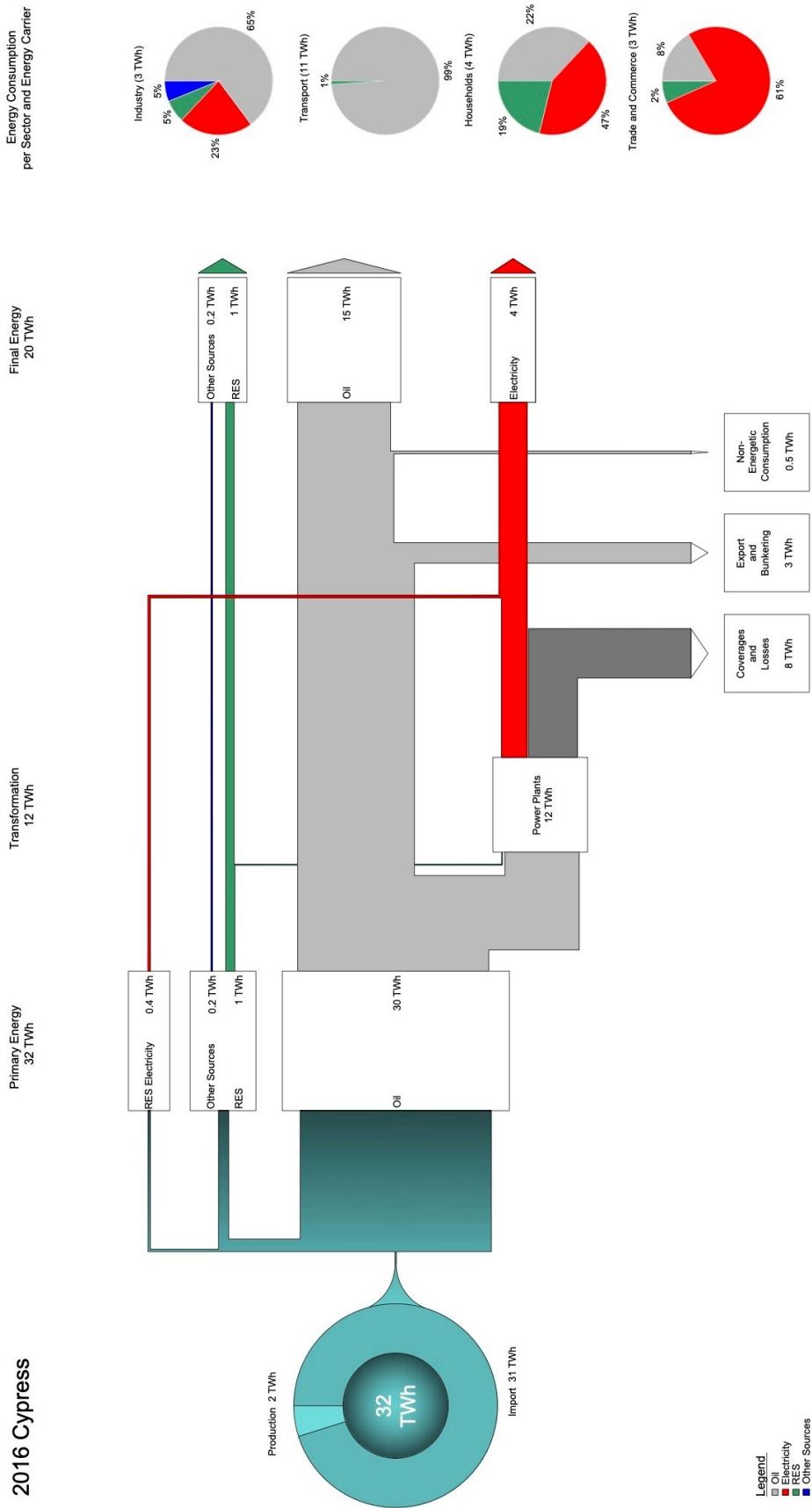


Fig. 8 Cyprus 2016

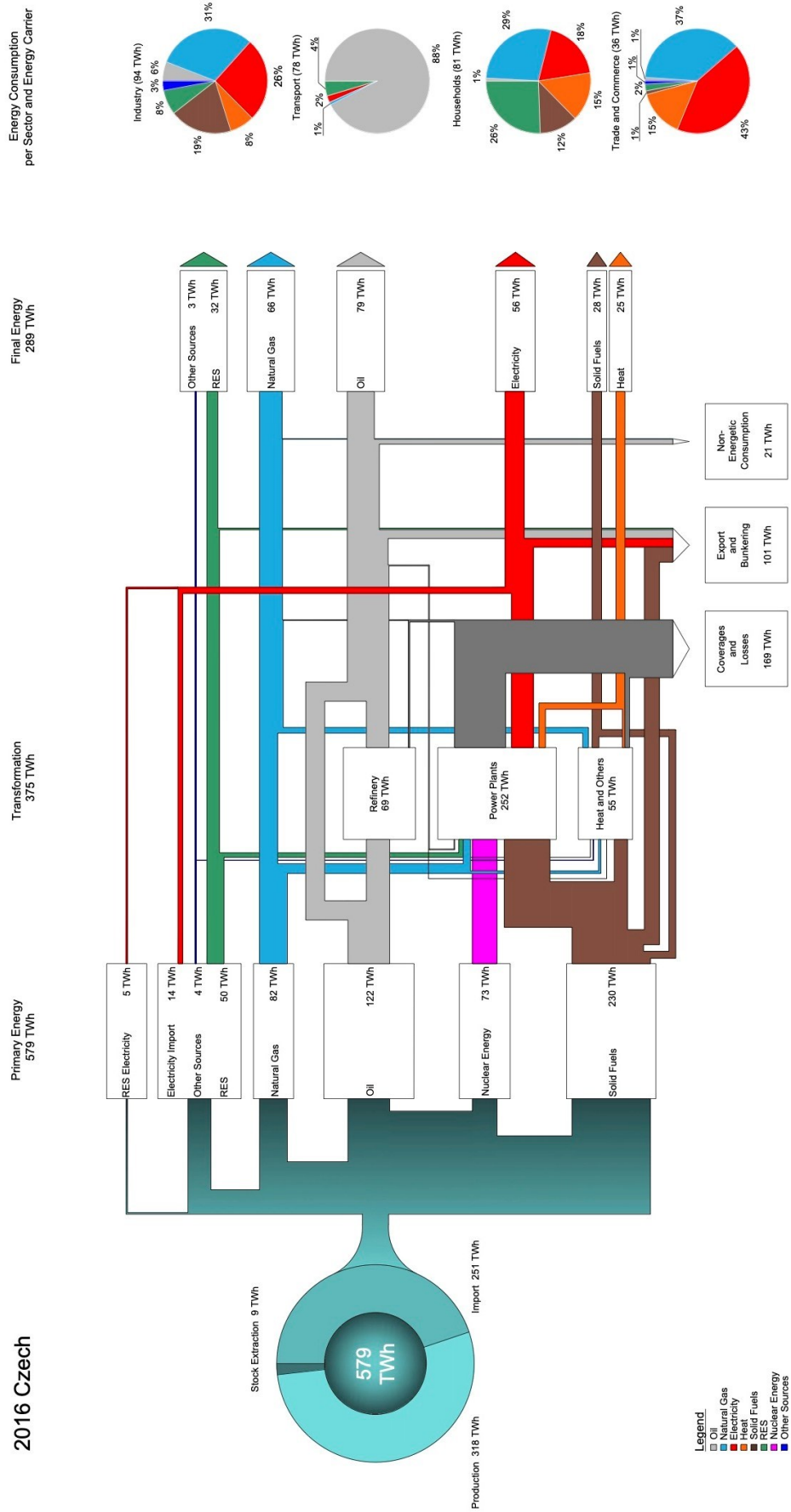


Fig. 9 Czechia 2016

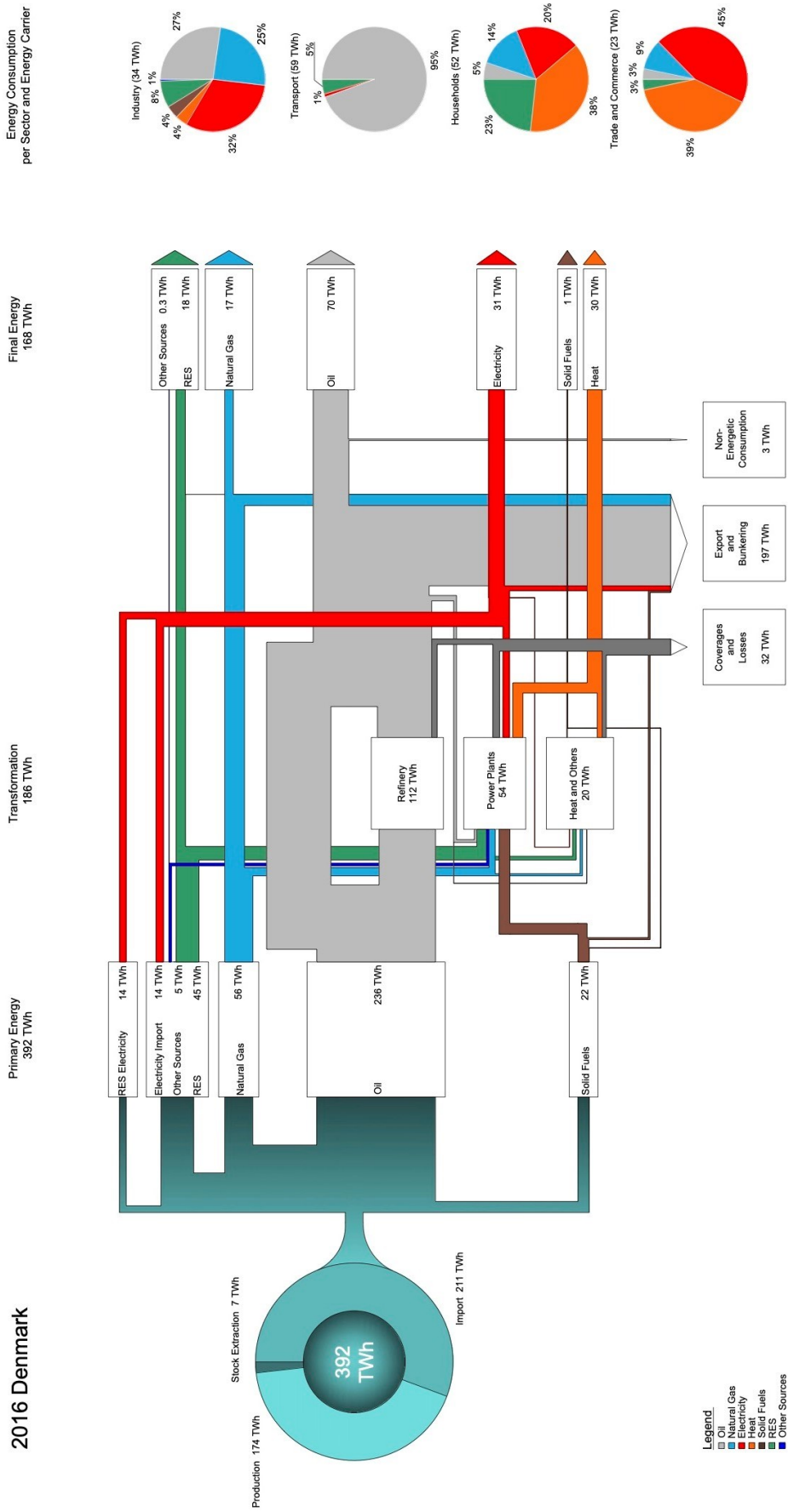


Fig. 10 Denmark 2016

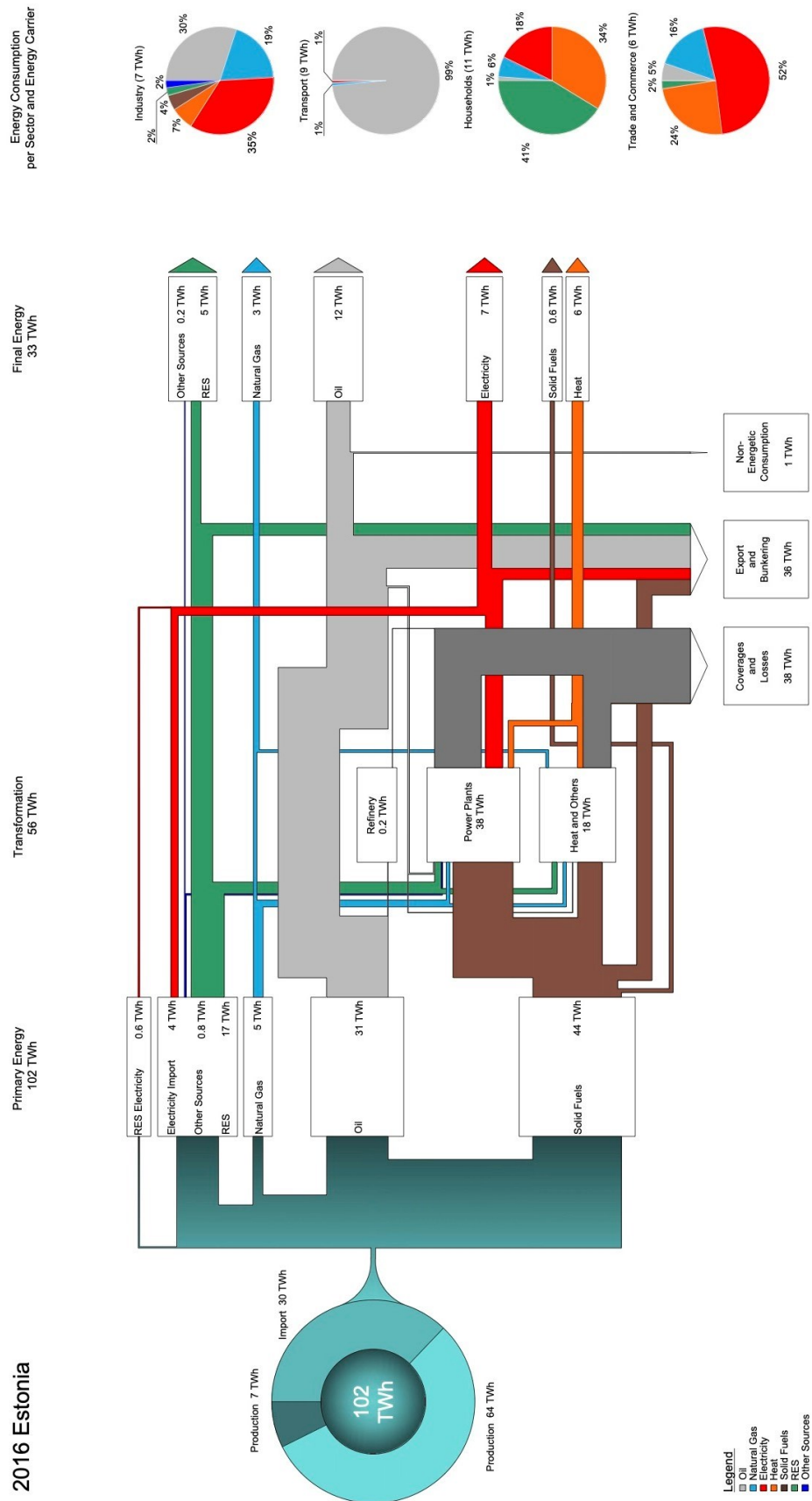


Fig. 11 Estonia 2016

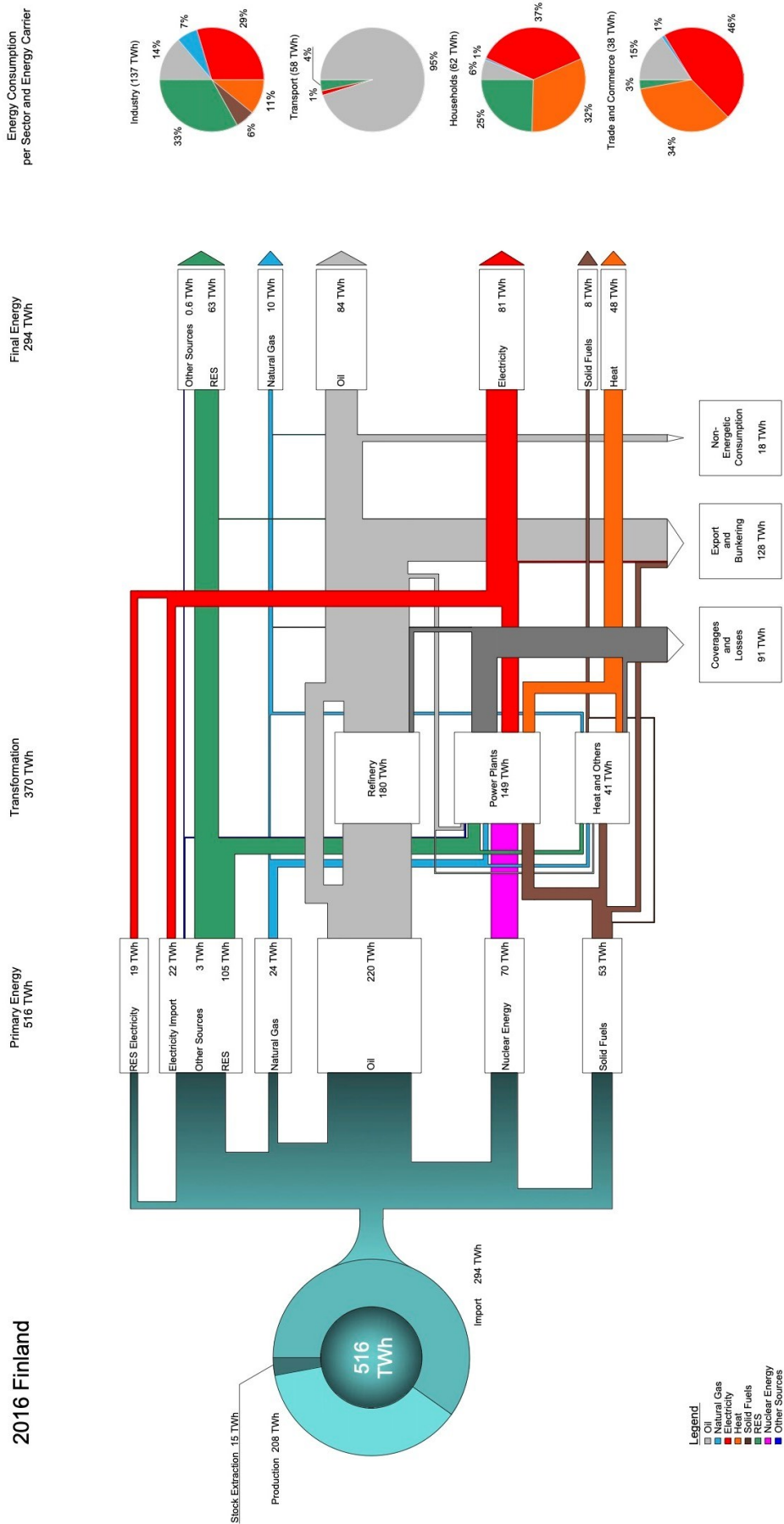


Fig. 12 Finland 2016

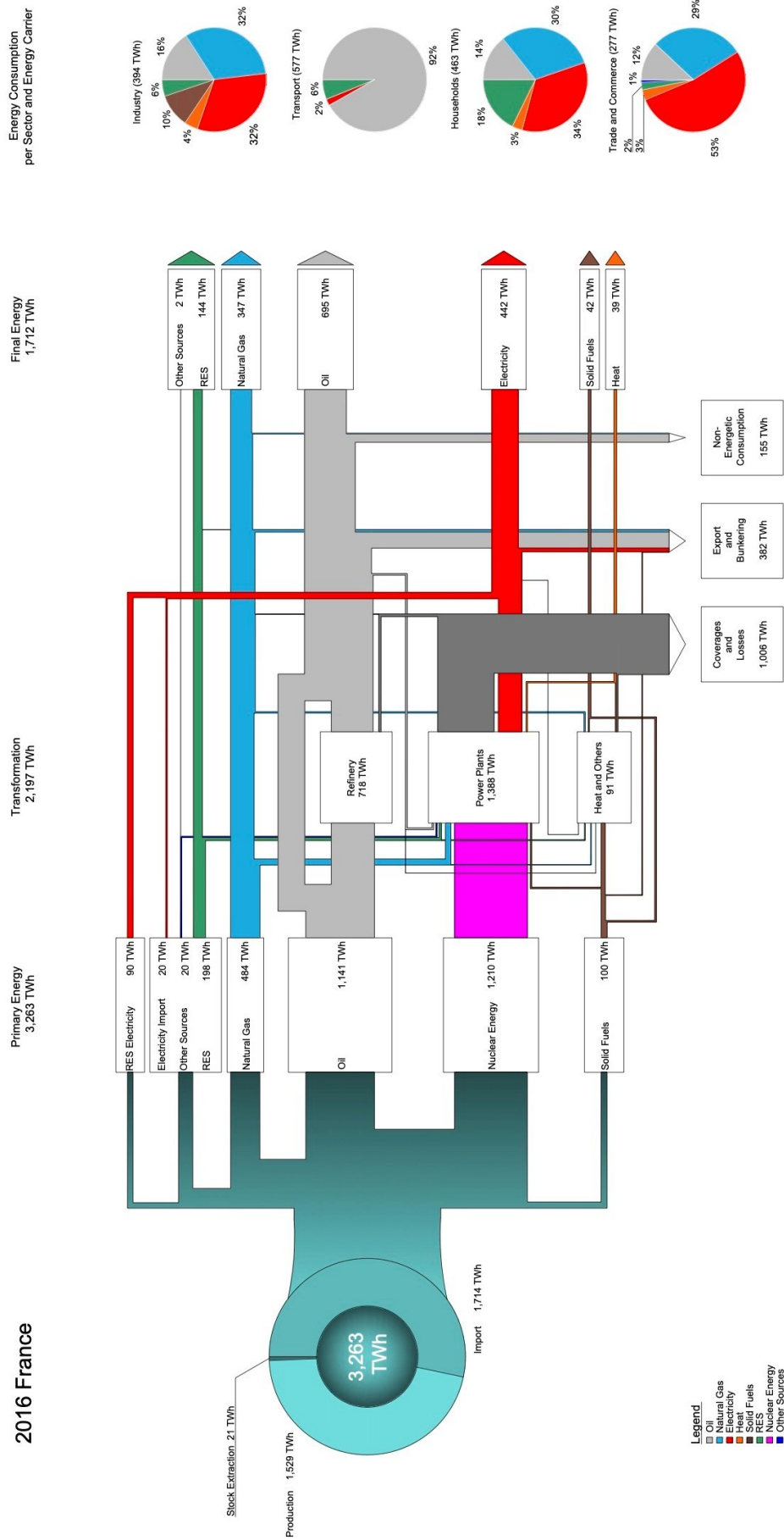


Fig. 13 France 2016

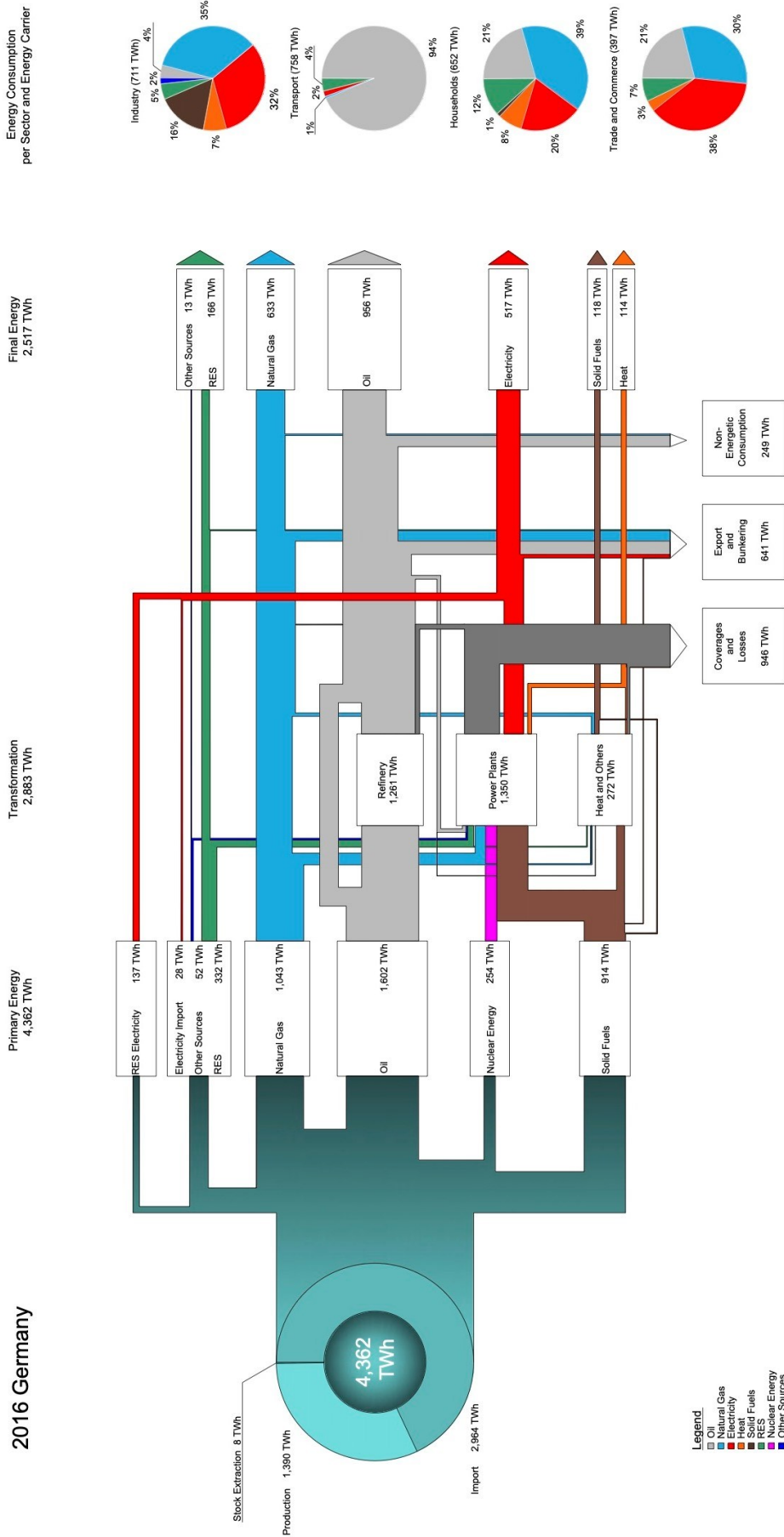


Fig. 14 Germany 2016



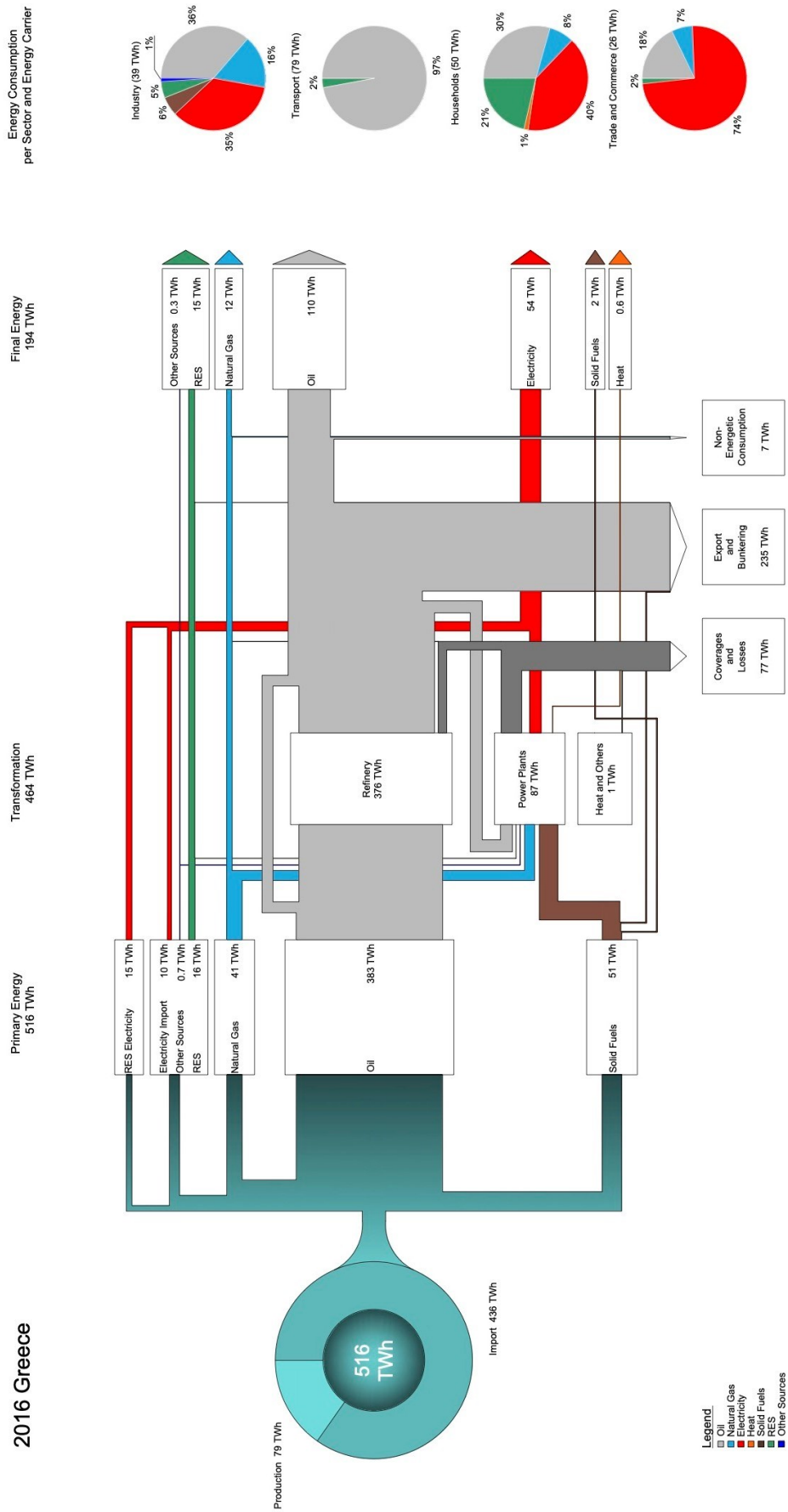


Fig. 15 Greece 2016

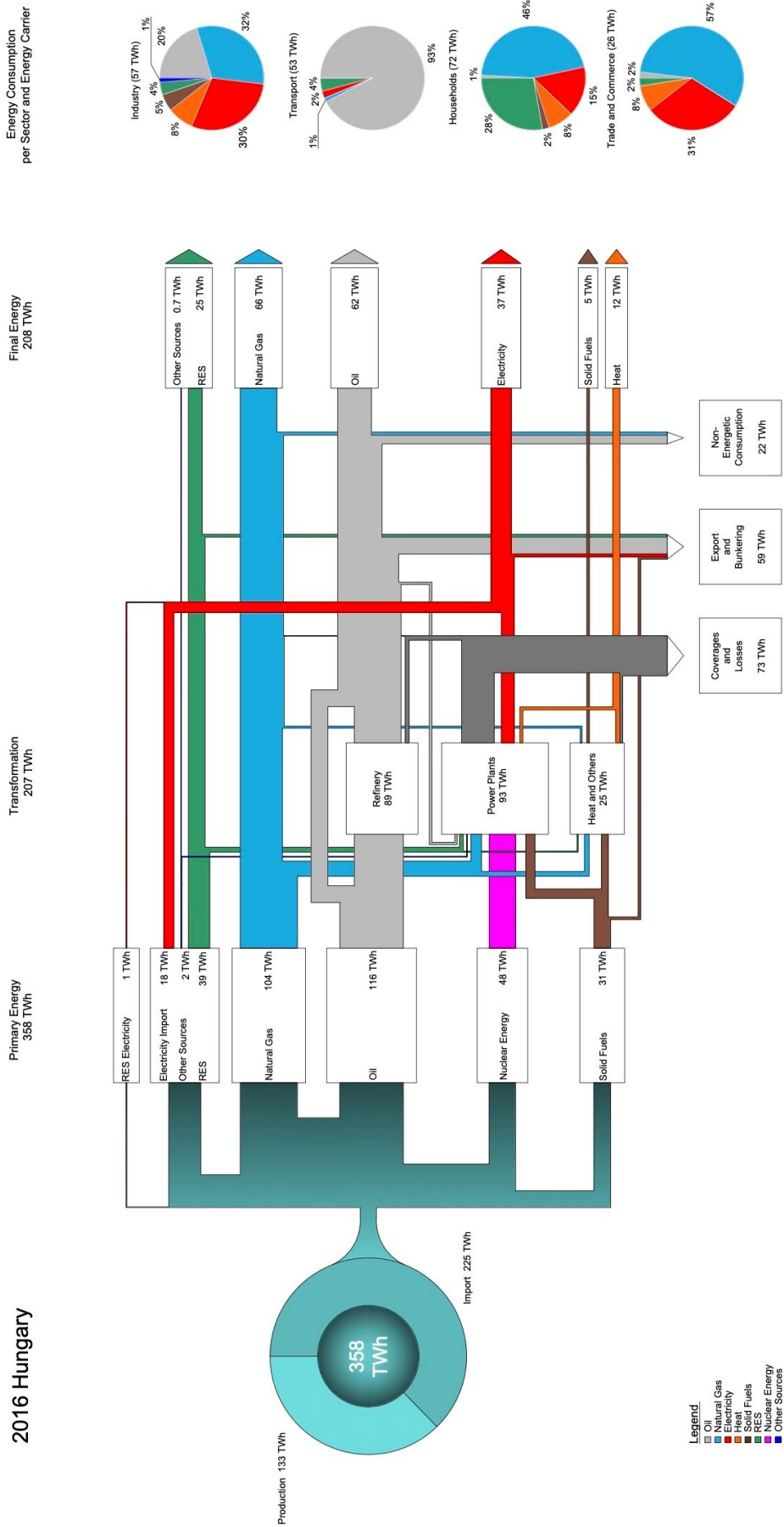


Fig. 16 Hungary 2016

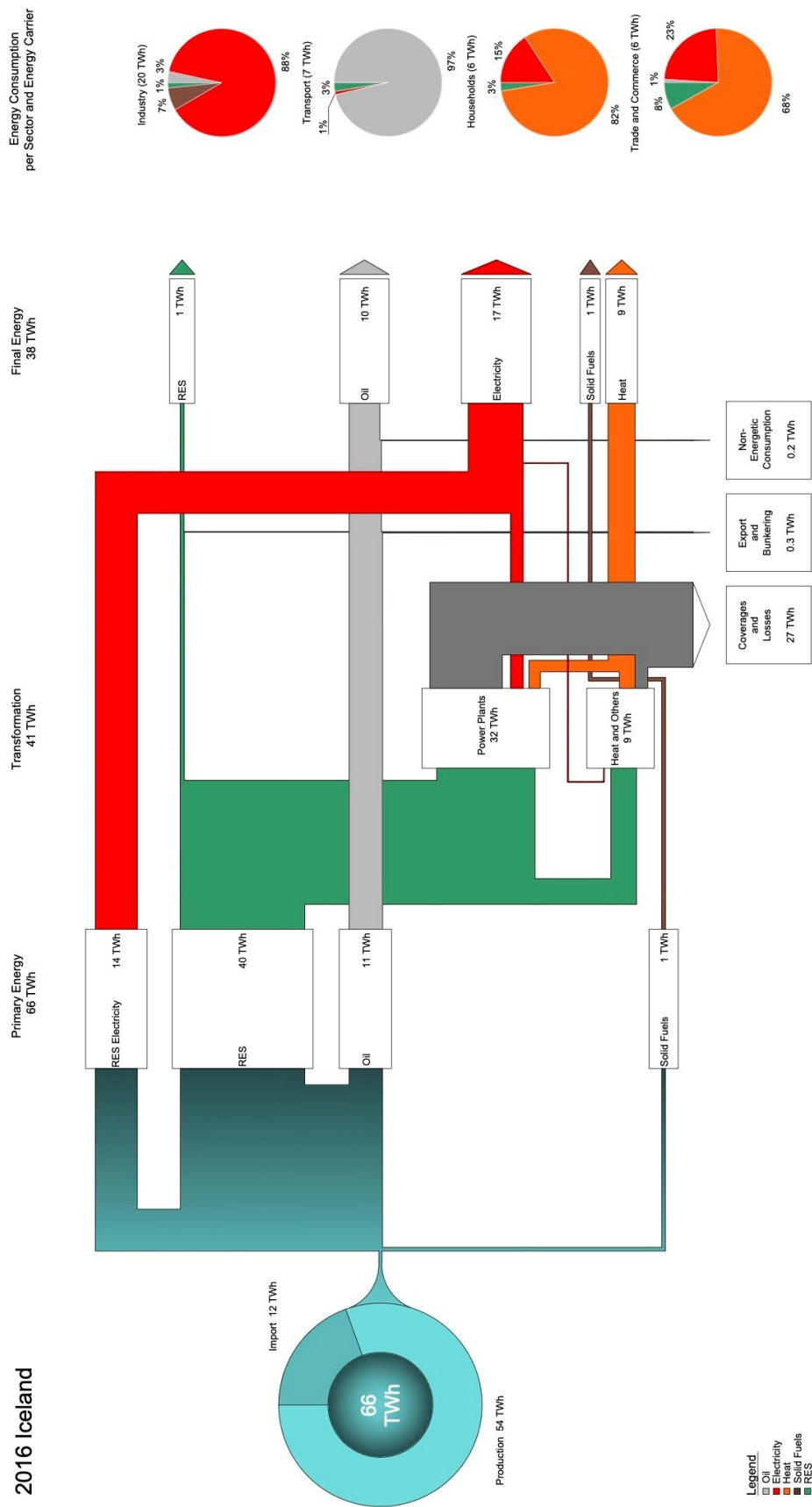


Fig. 17 Iceland 2016

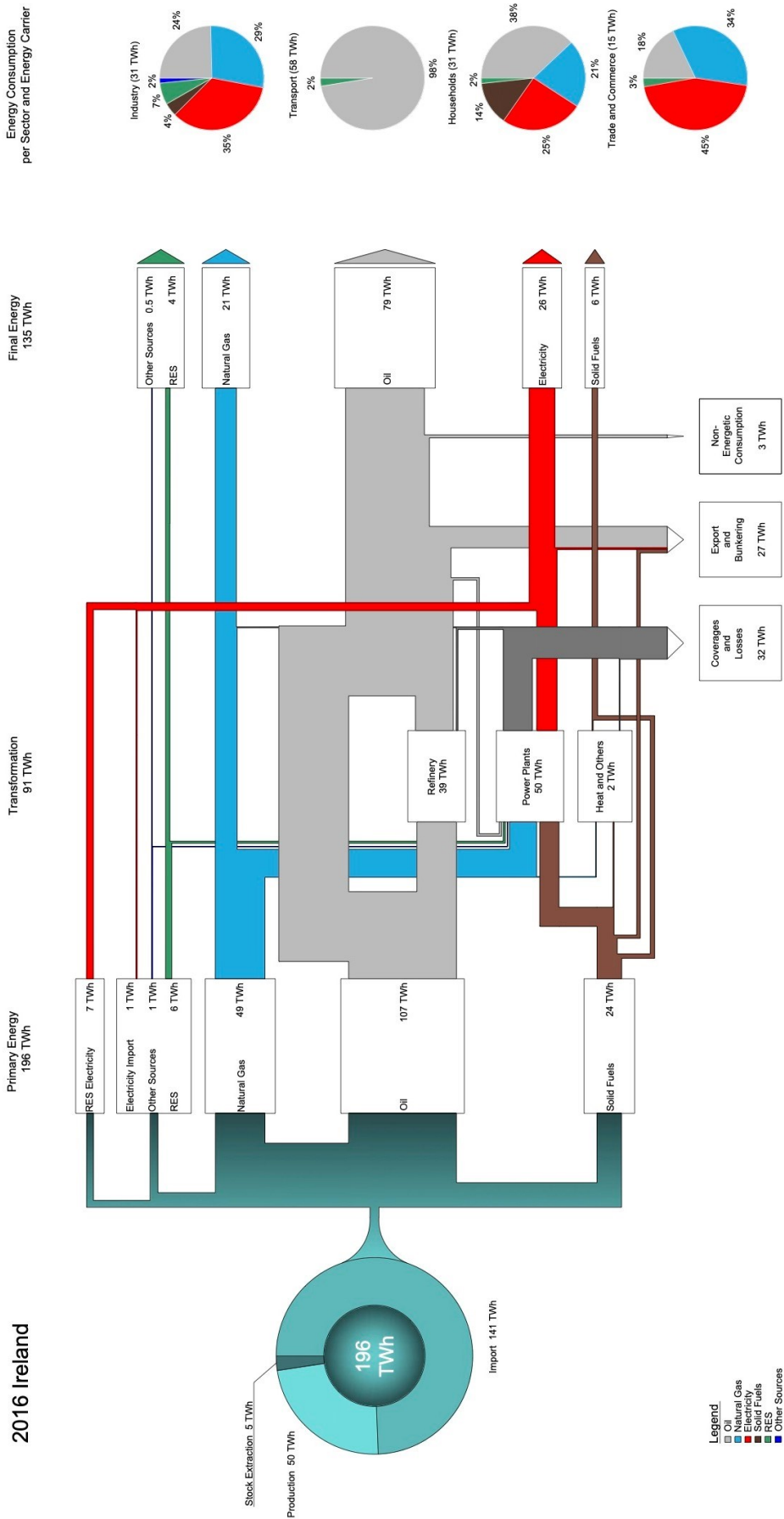


Fig. 18 Ireland 2016

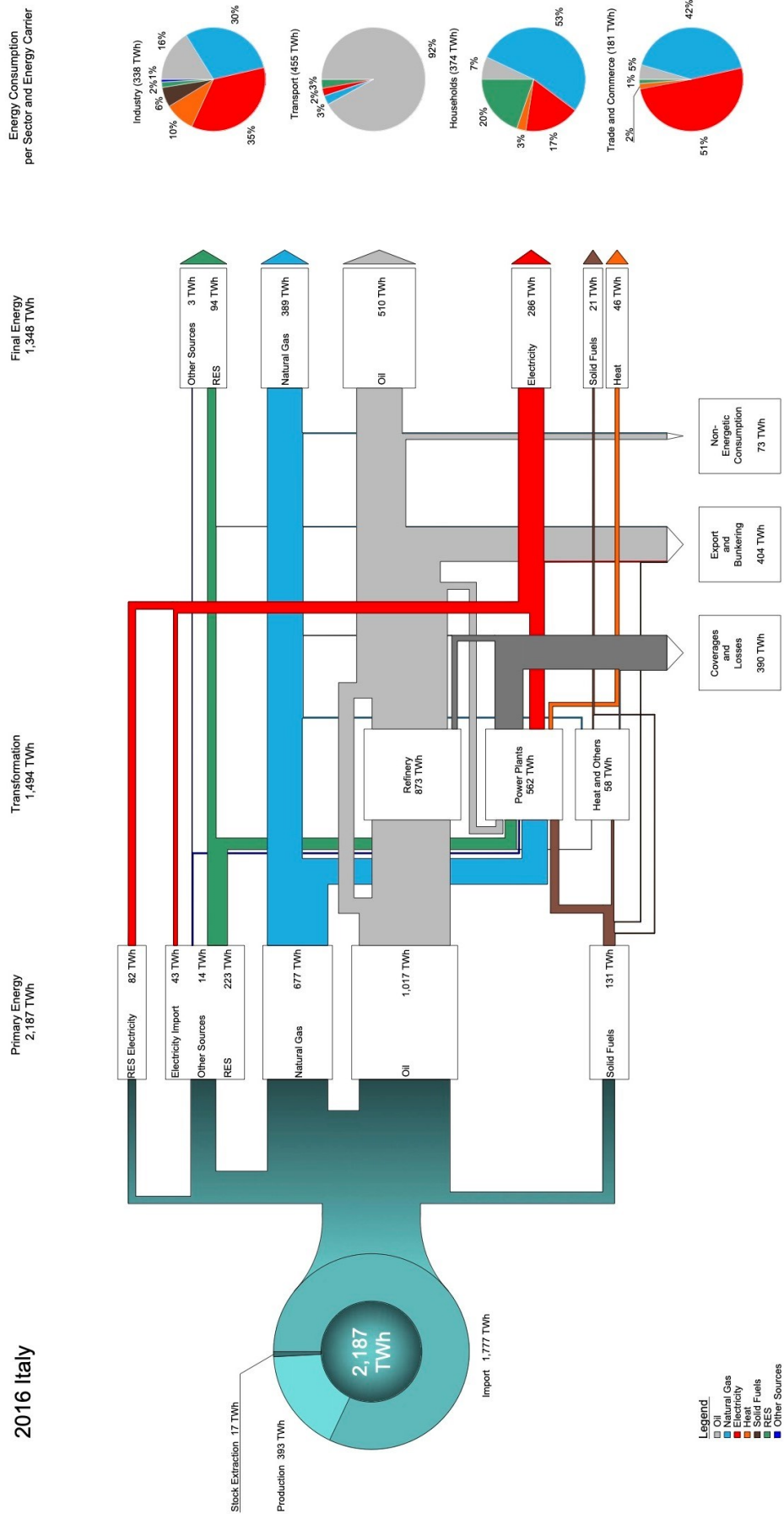


Fig. 19 Italy 2016

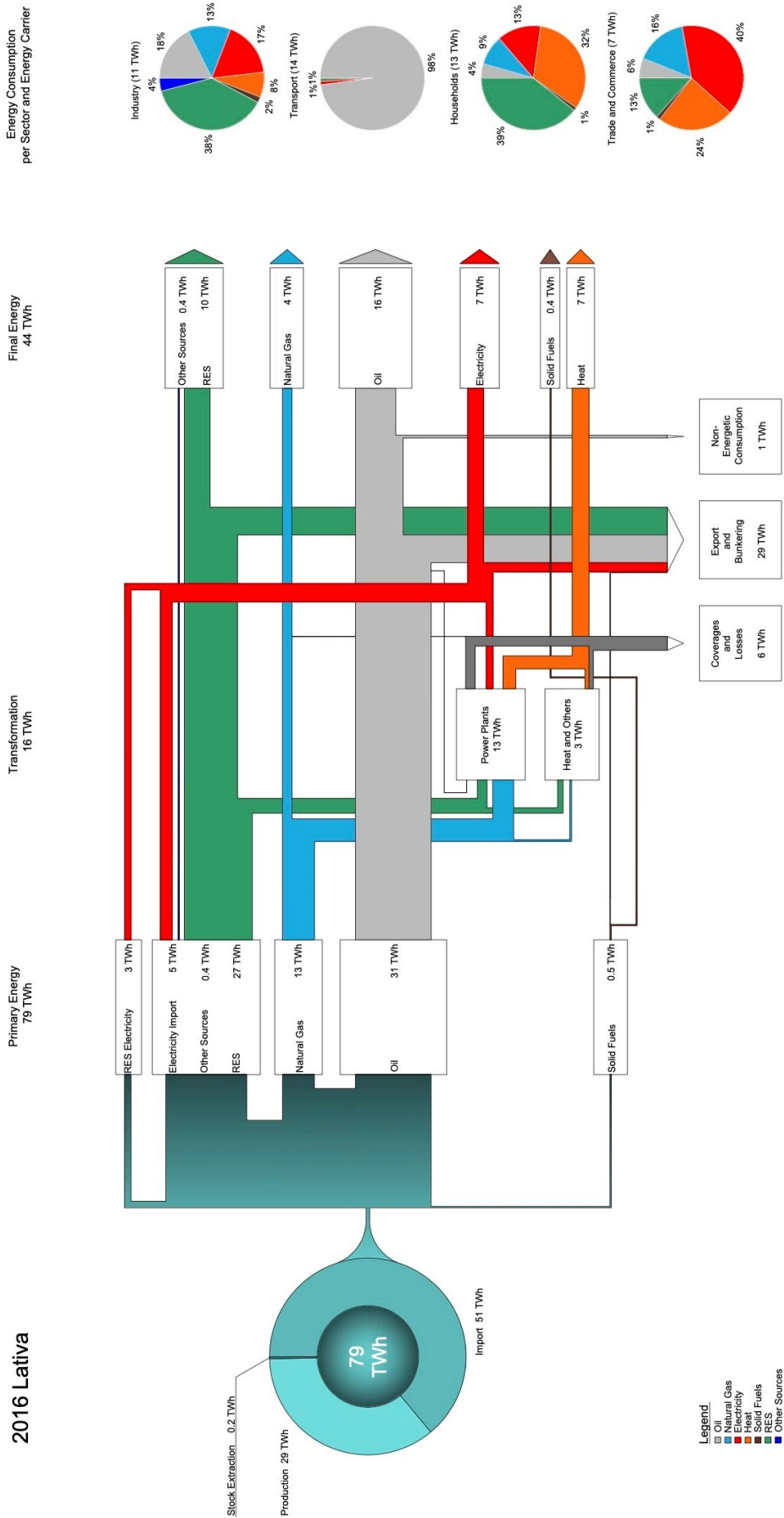


Fig. 20 Latvia 2016

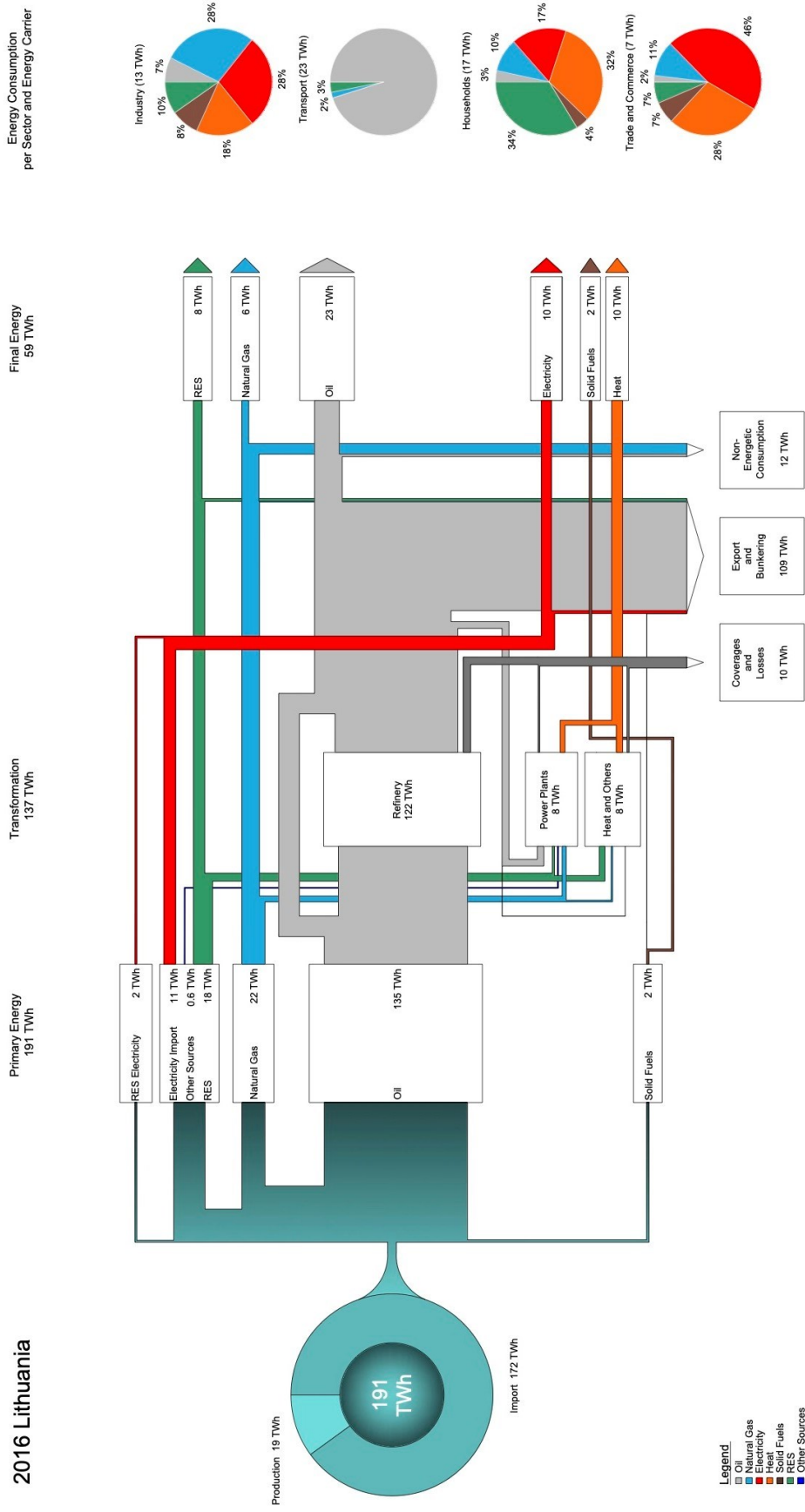


Fig. 21 Lithuania 2016

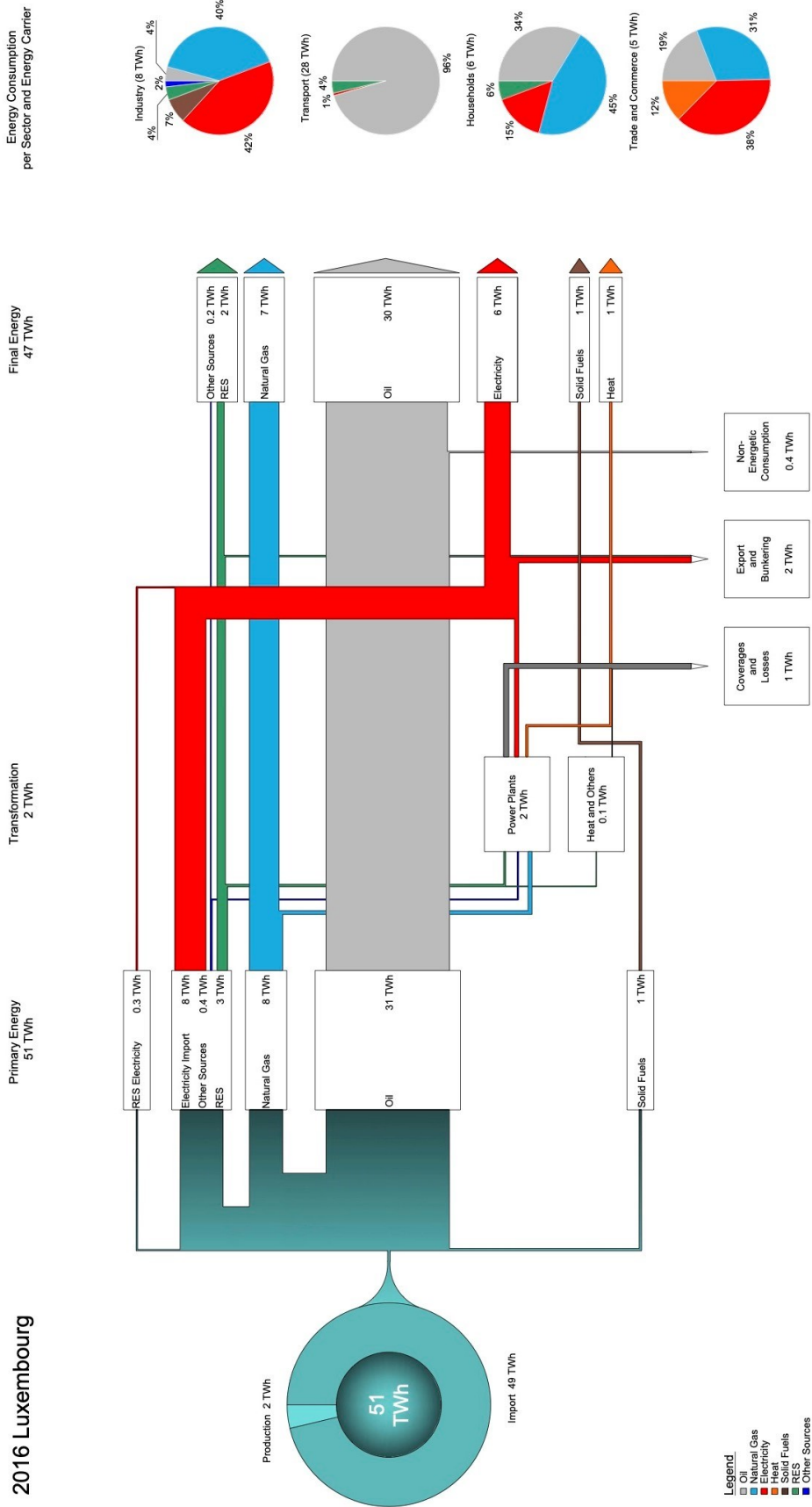


Fig. 22 Luxembourg 2016



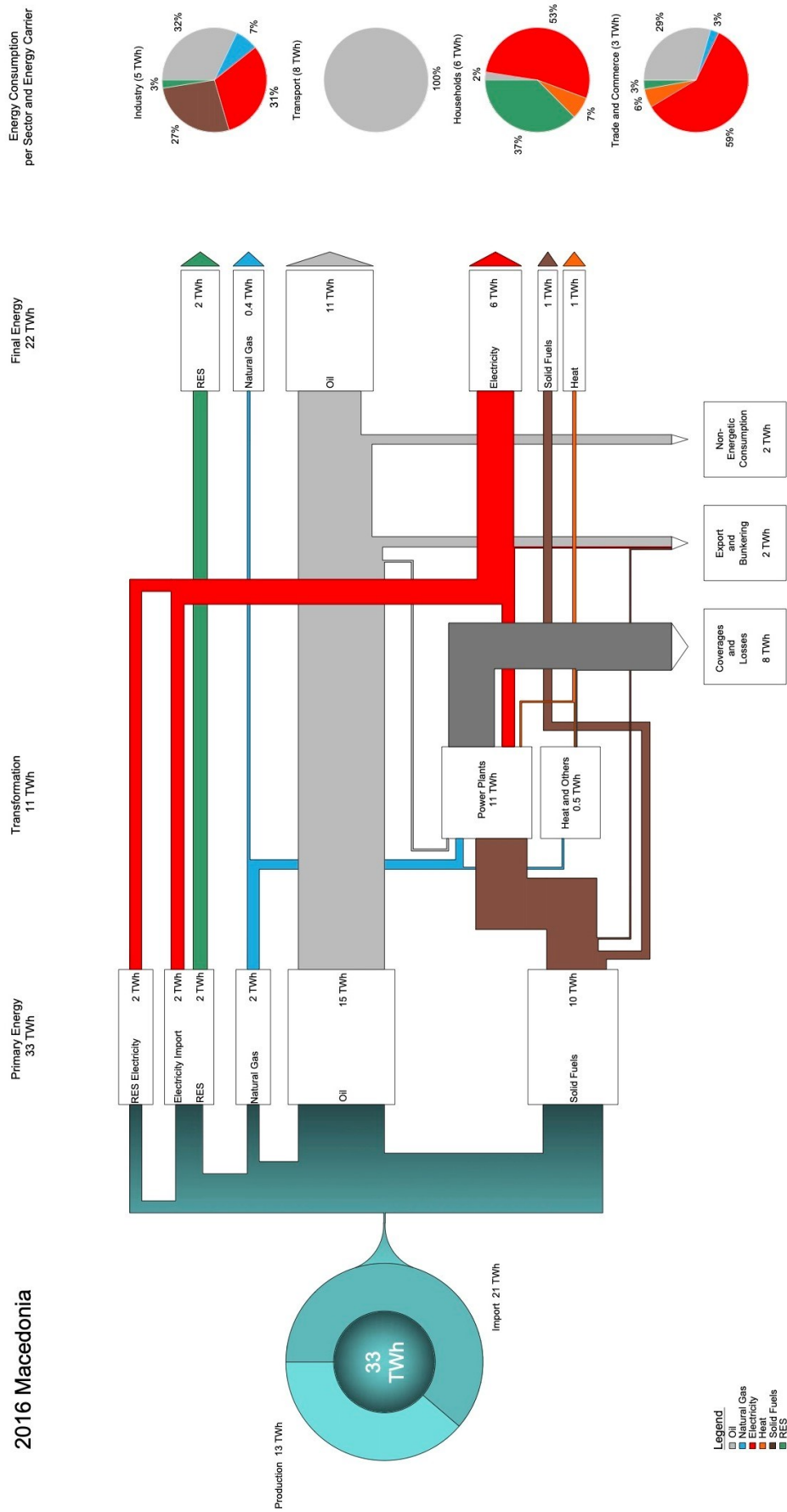


Fig. 23 North Macedonia 2016

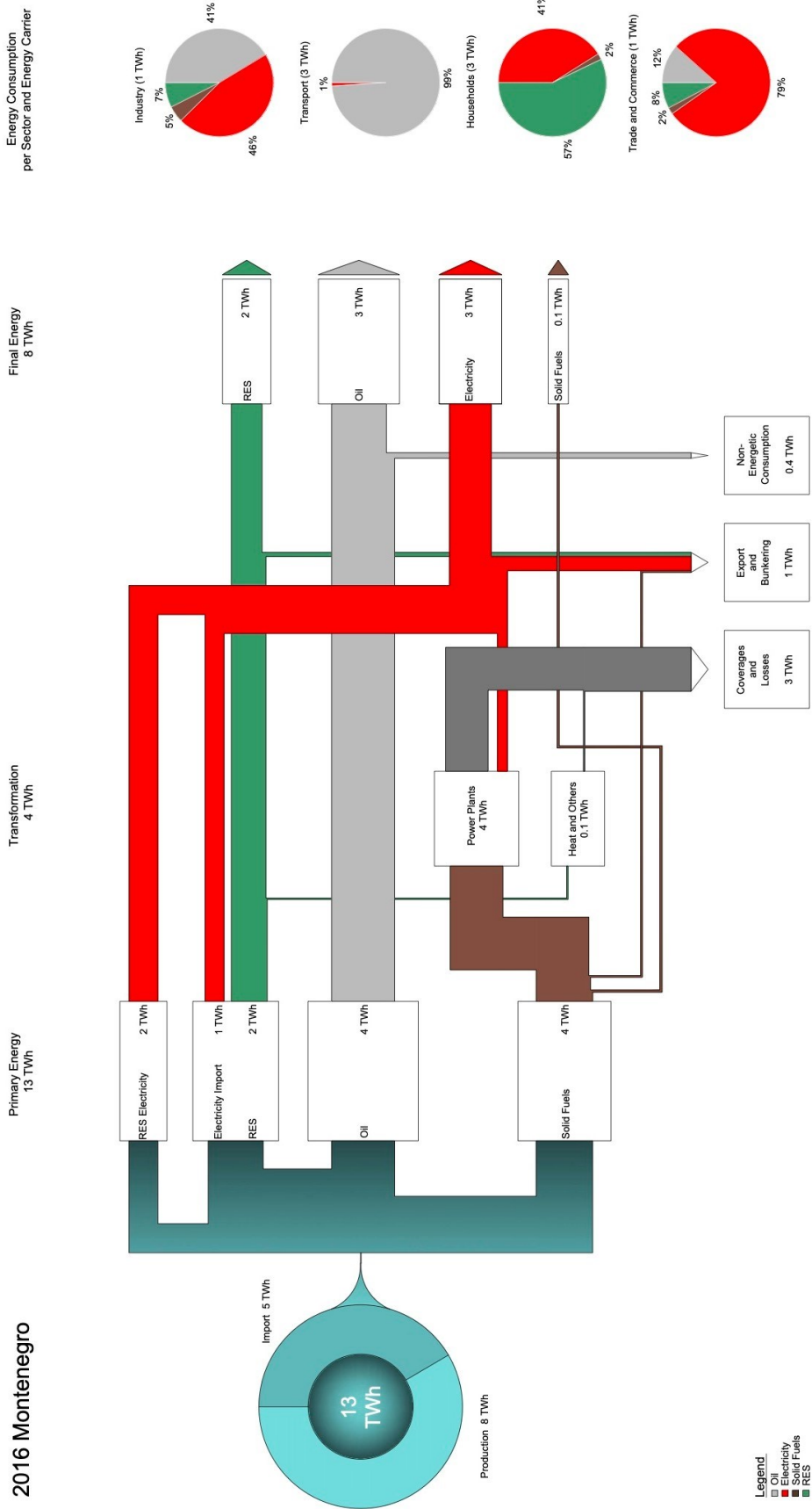


Fig. 24 Montenegro 2016

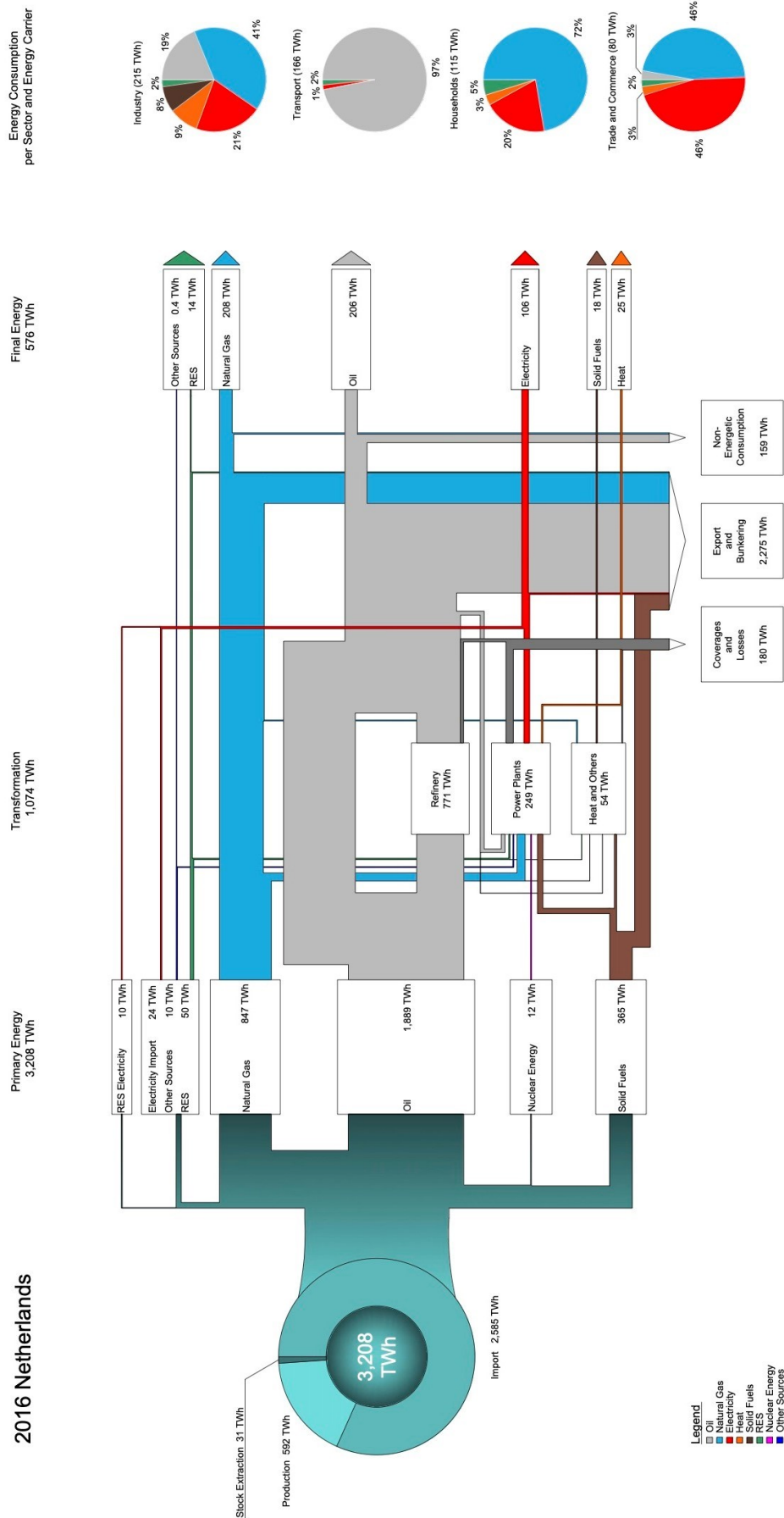


Fig. 25 Netherlands 2016

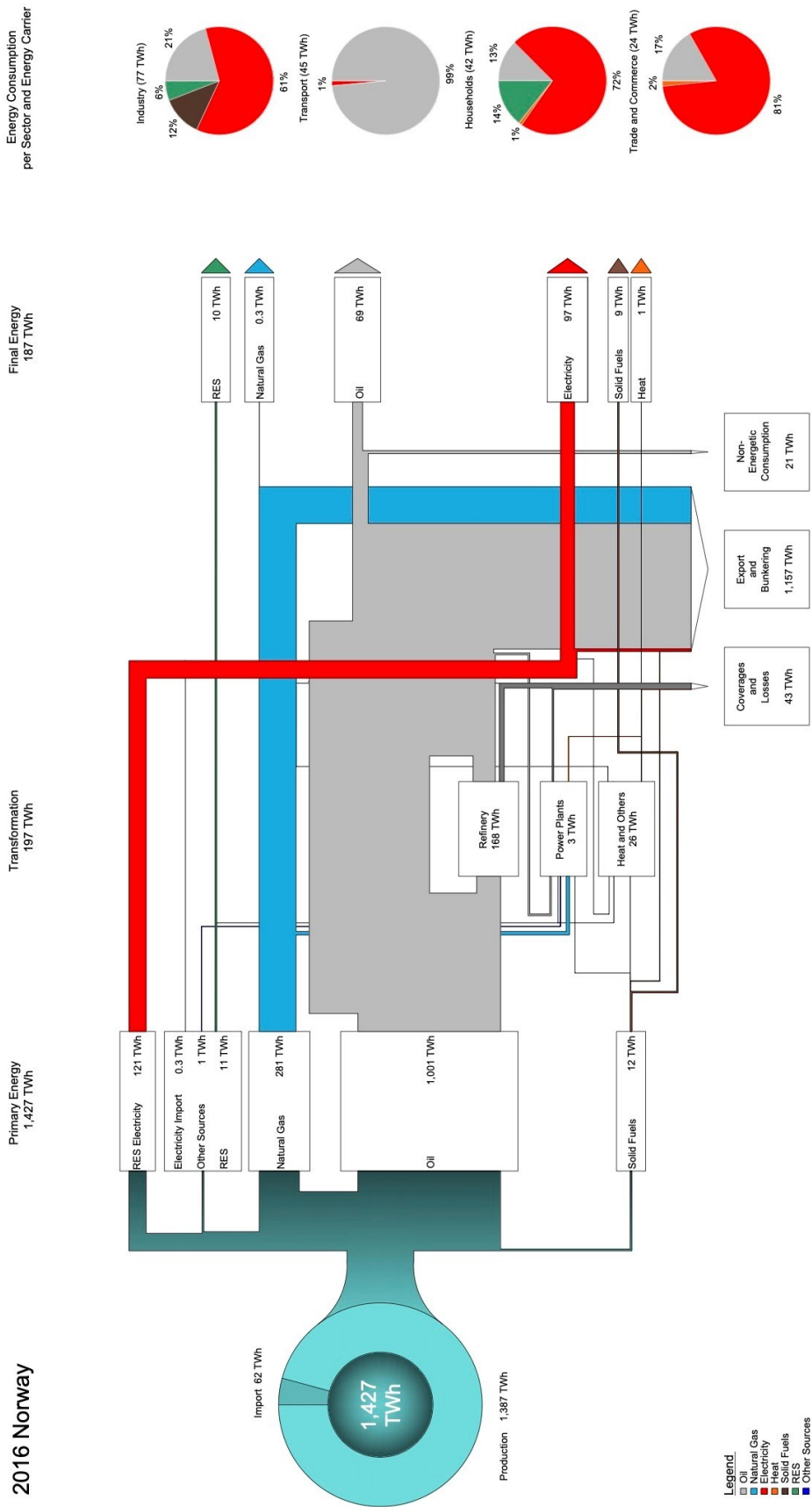


Fig. 26 Norway 2016

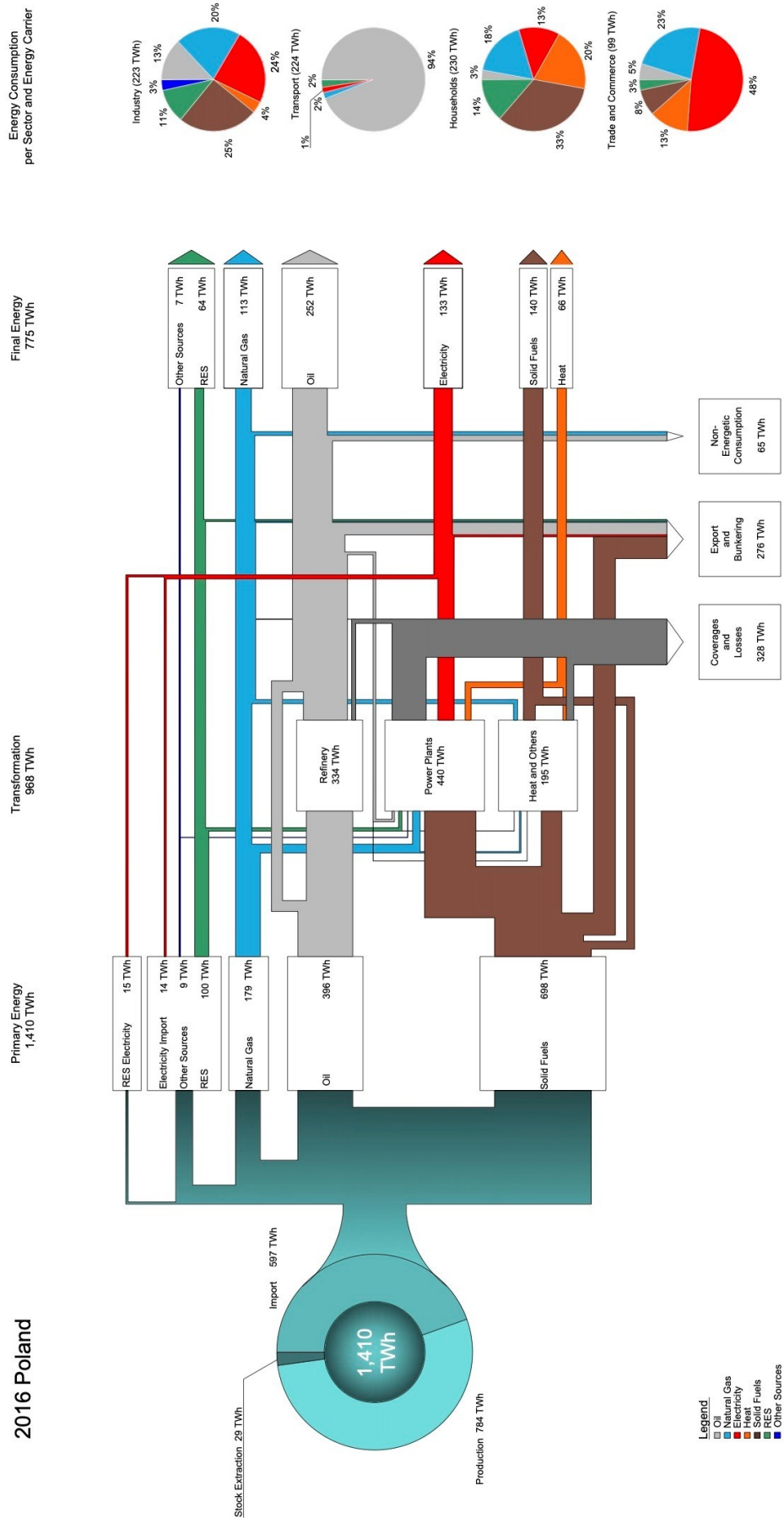


Fig. 27 Poland 2016

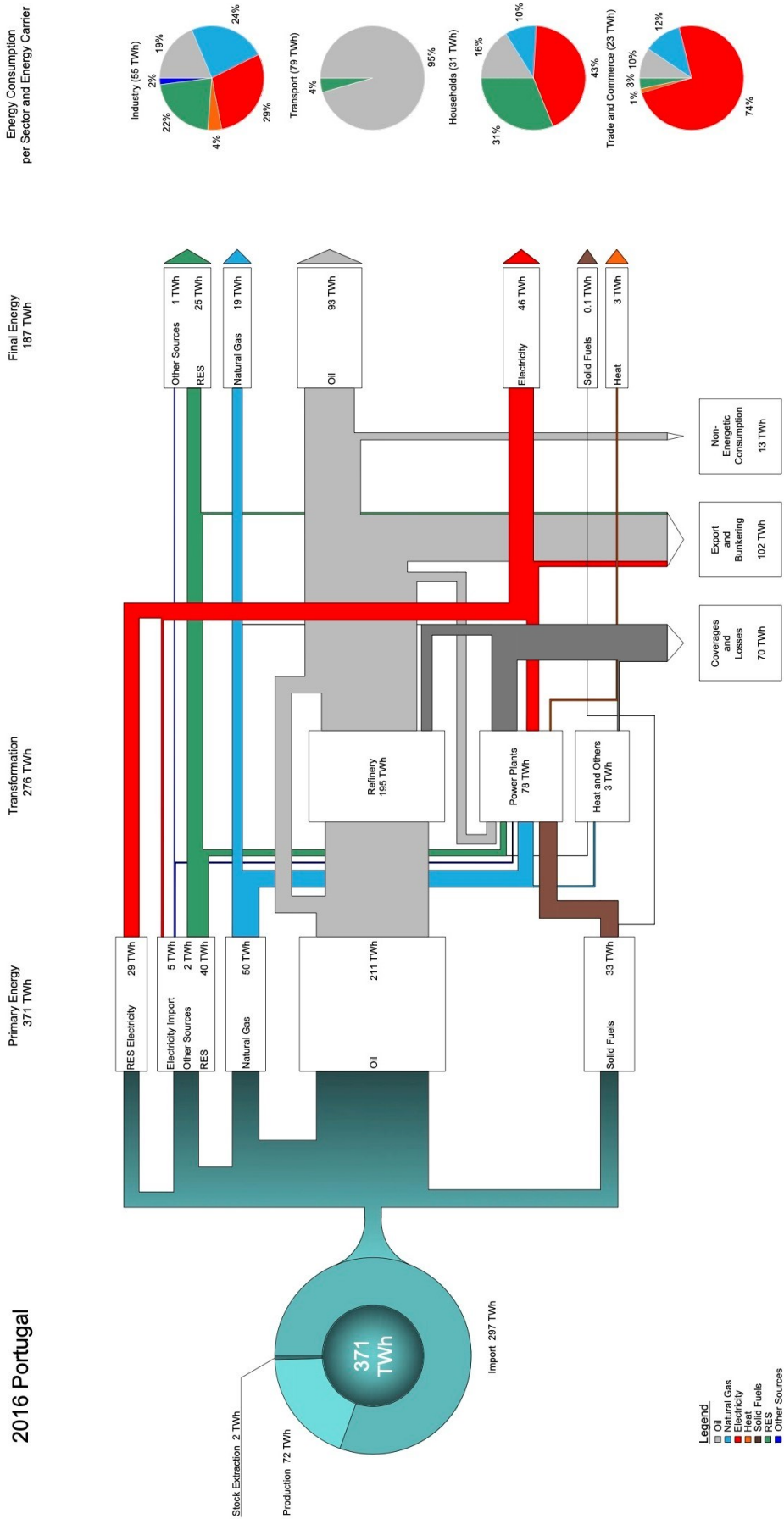


Fig. 28 Portugal 2016

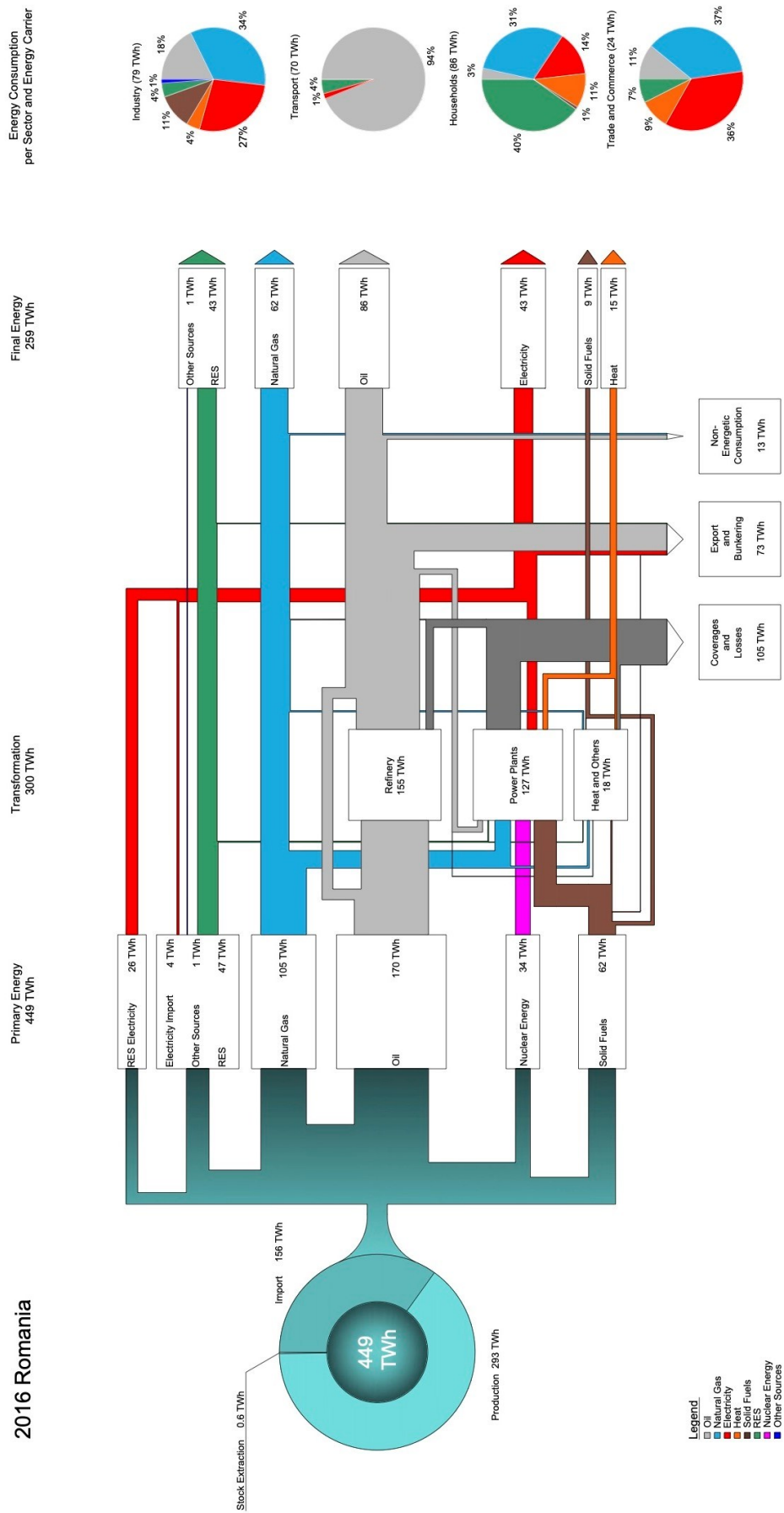


Fig. 29 Romania 2016

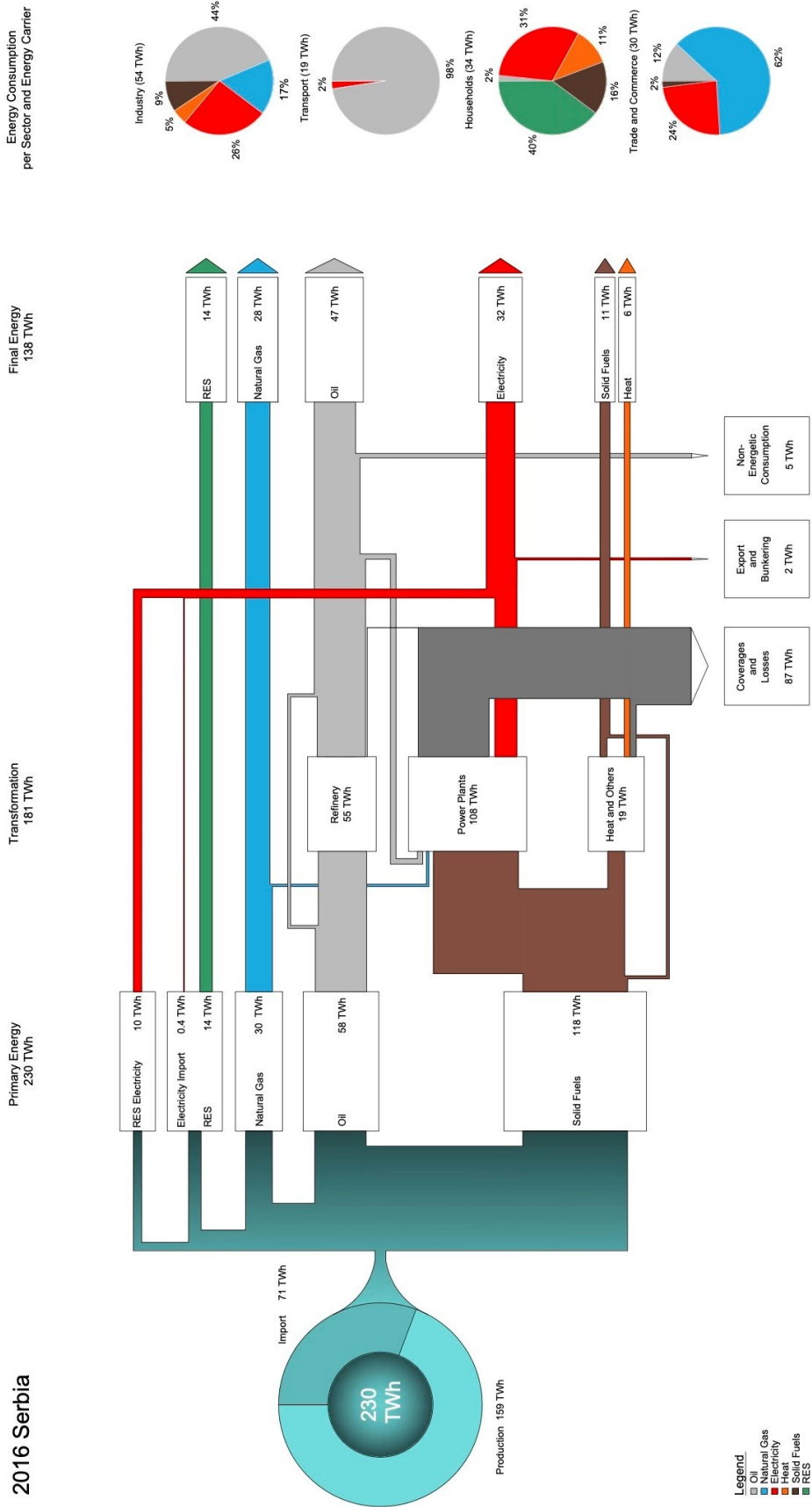


Fig. 30 Serbia 2016



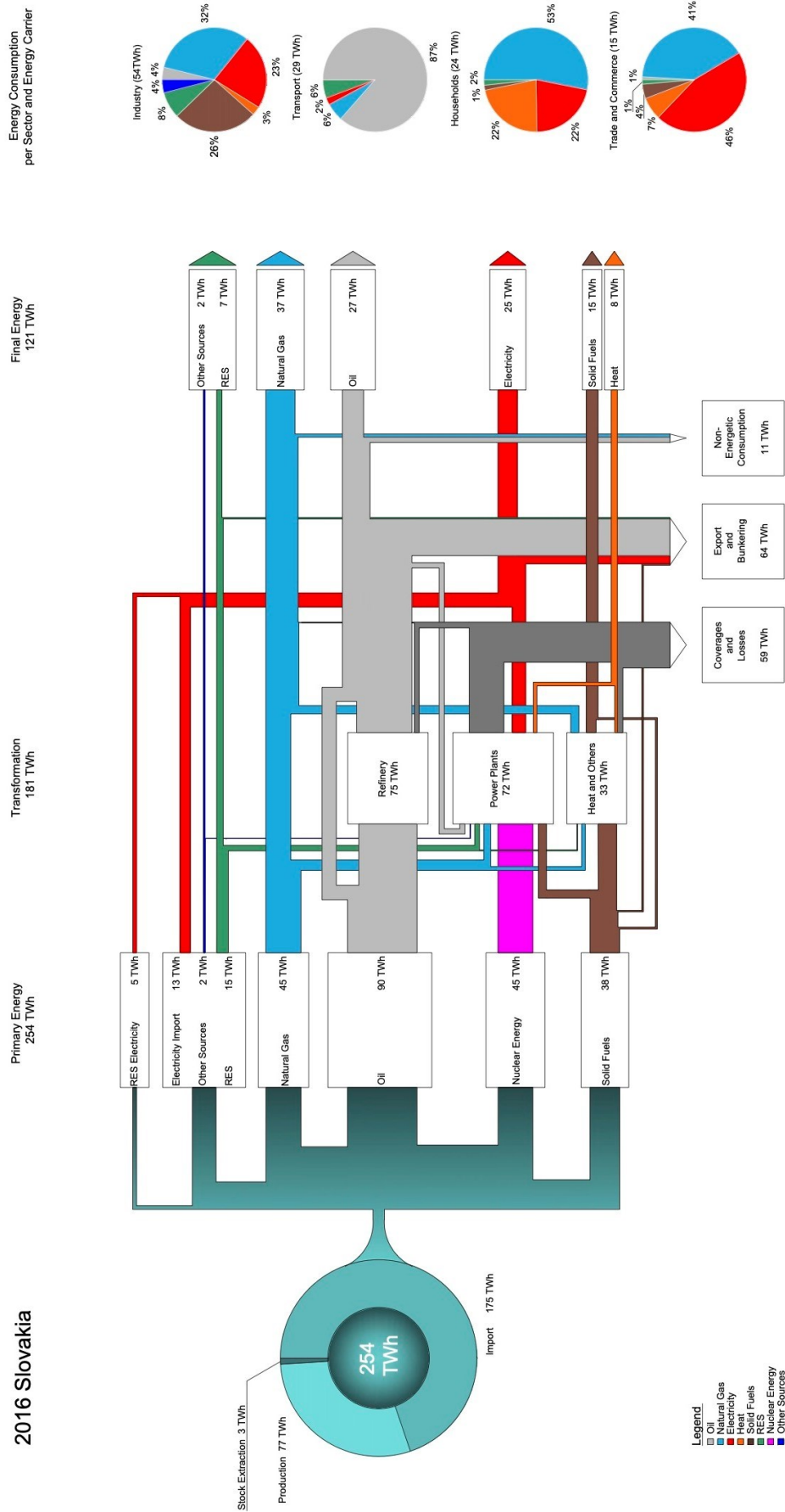


Fig. 31 Slovakia 2016

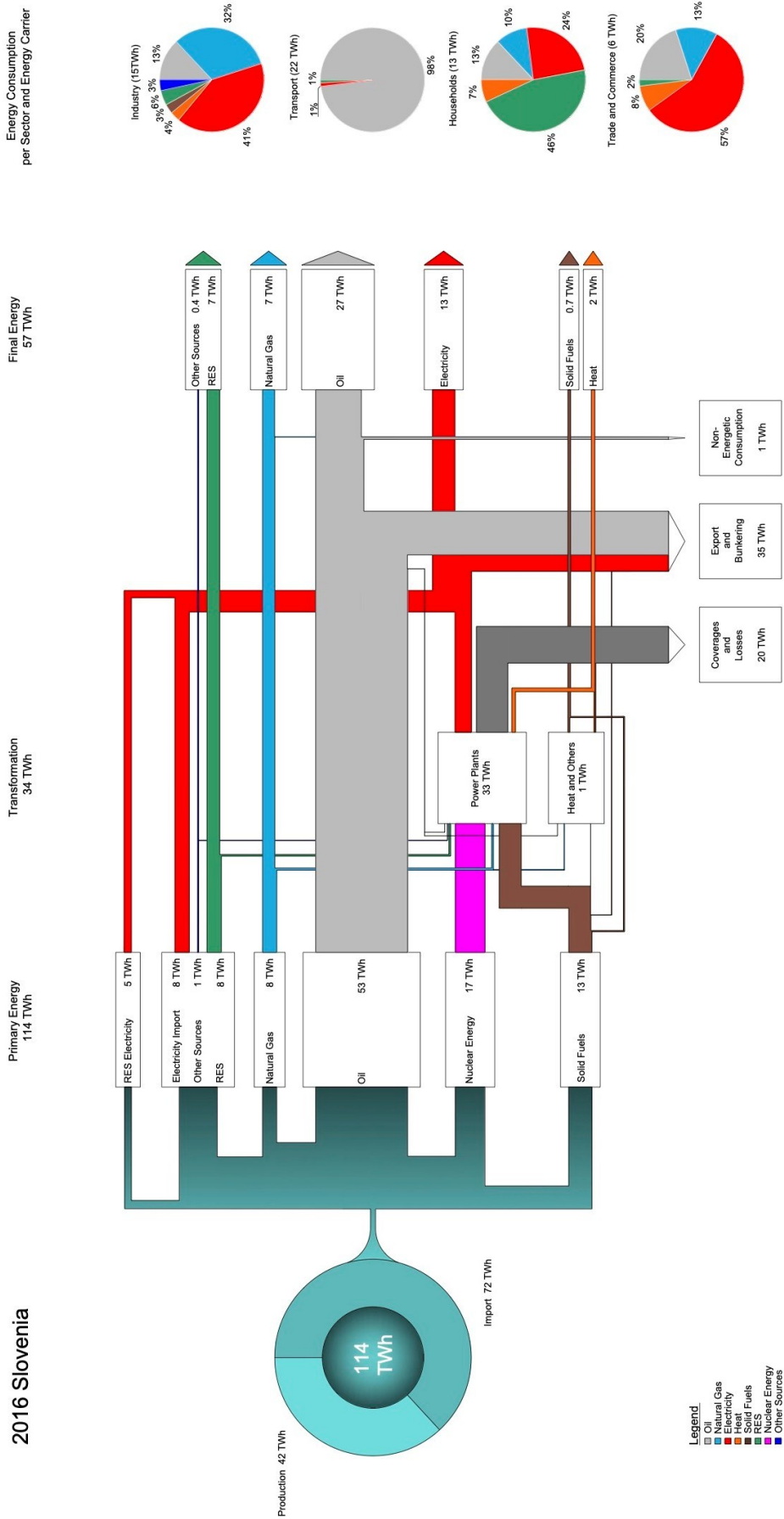


Fig. 32 Slovenia 2016

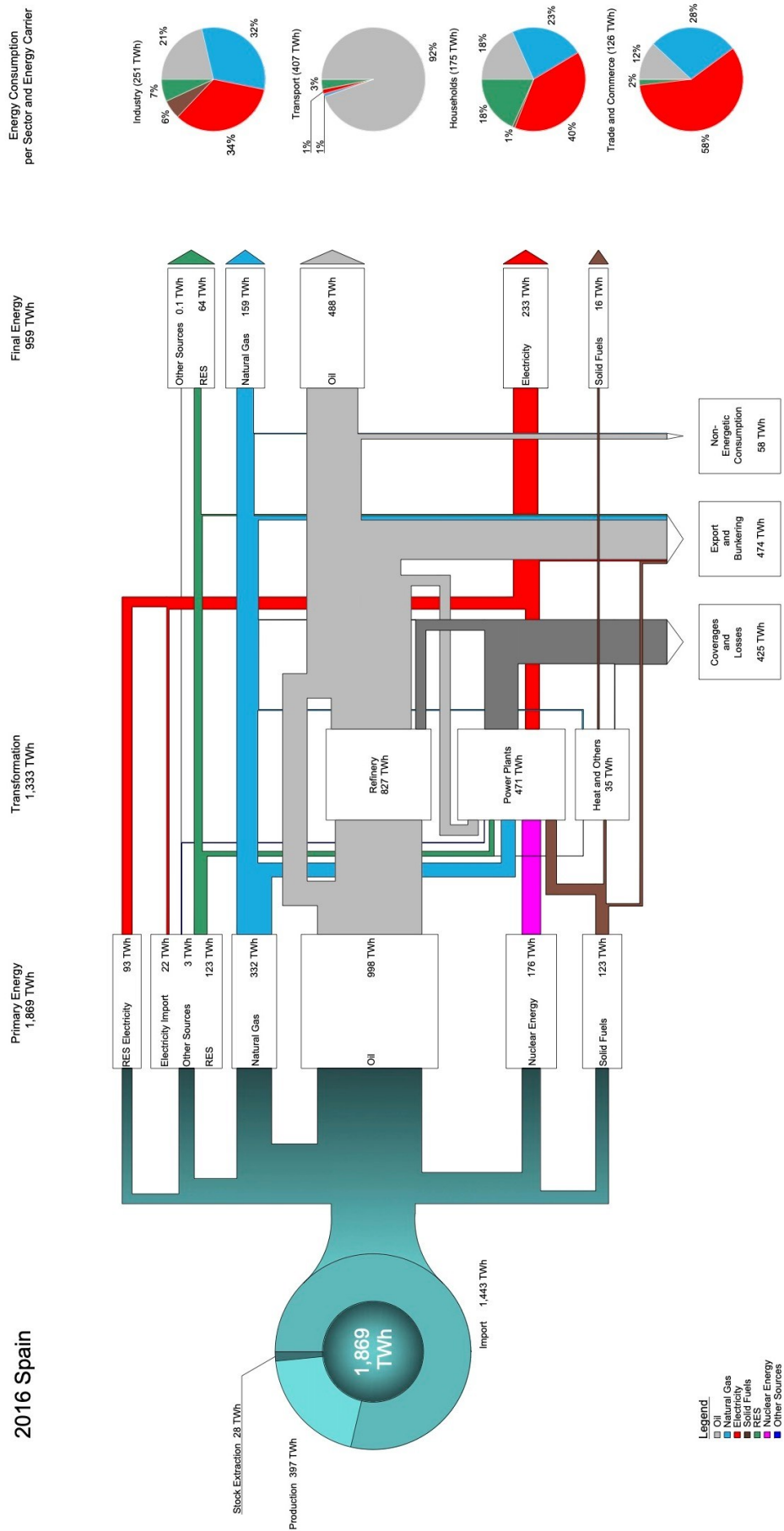


Fig. 33 Spain 2016

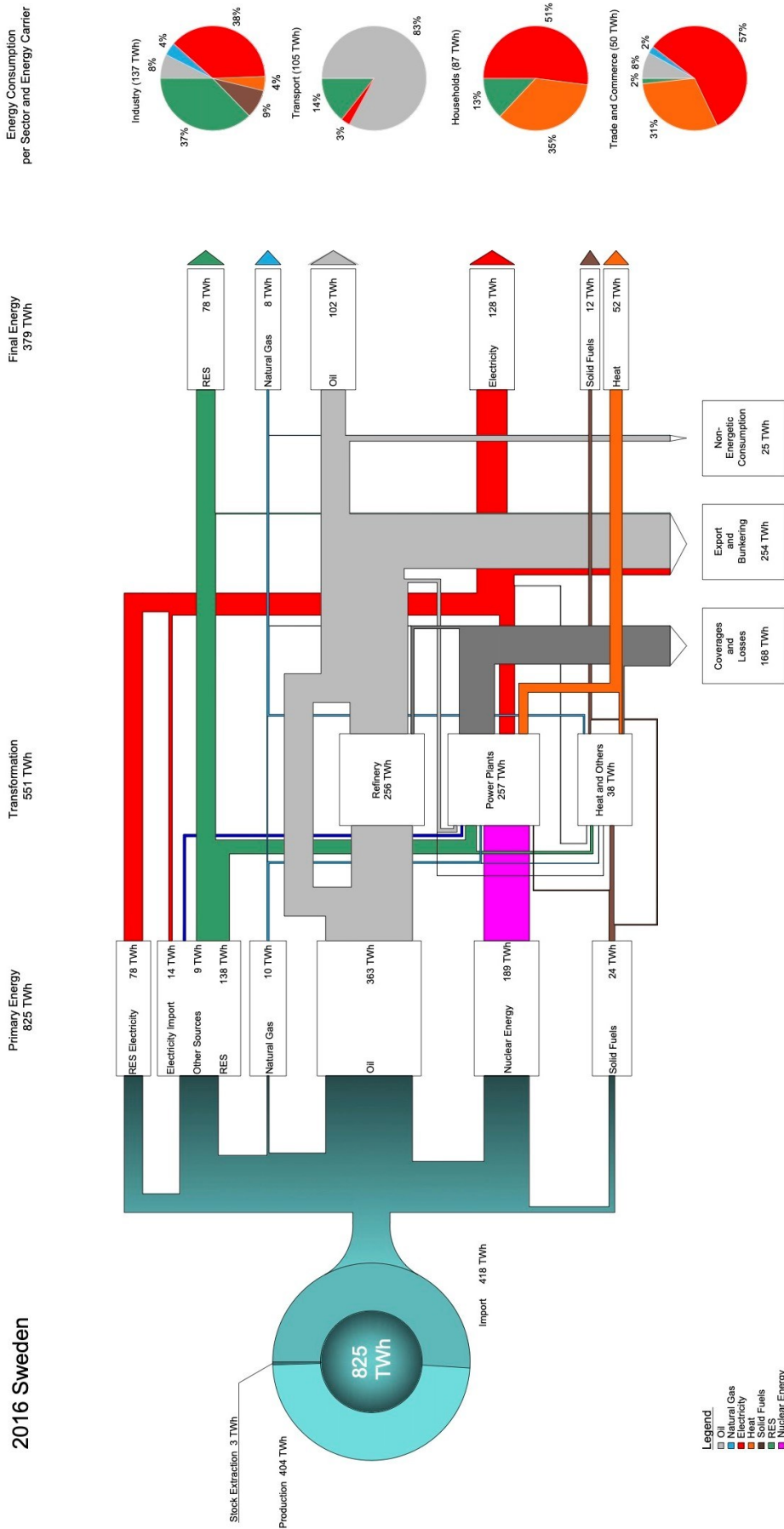


Fig. 34 Sweden 2016

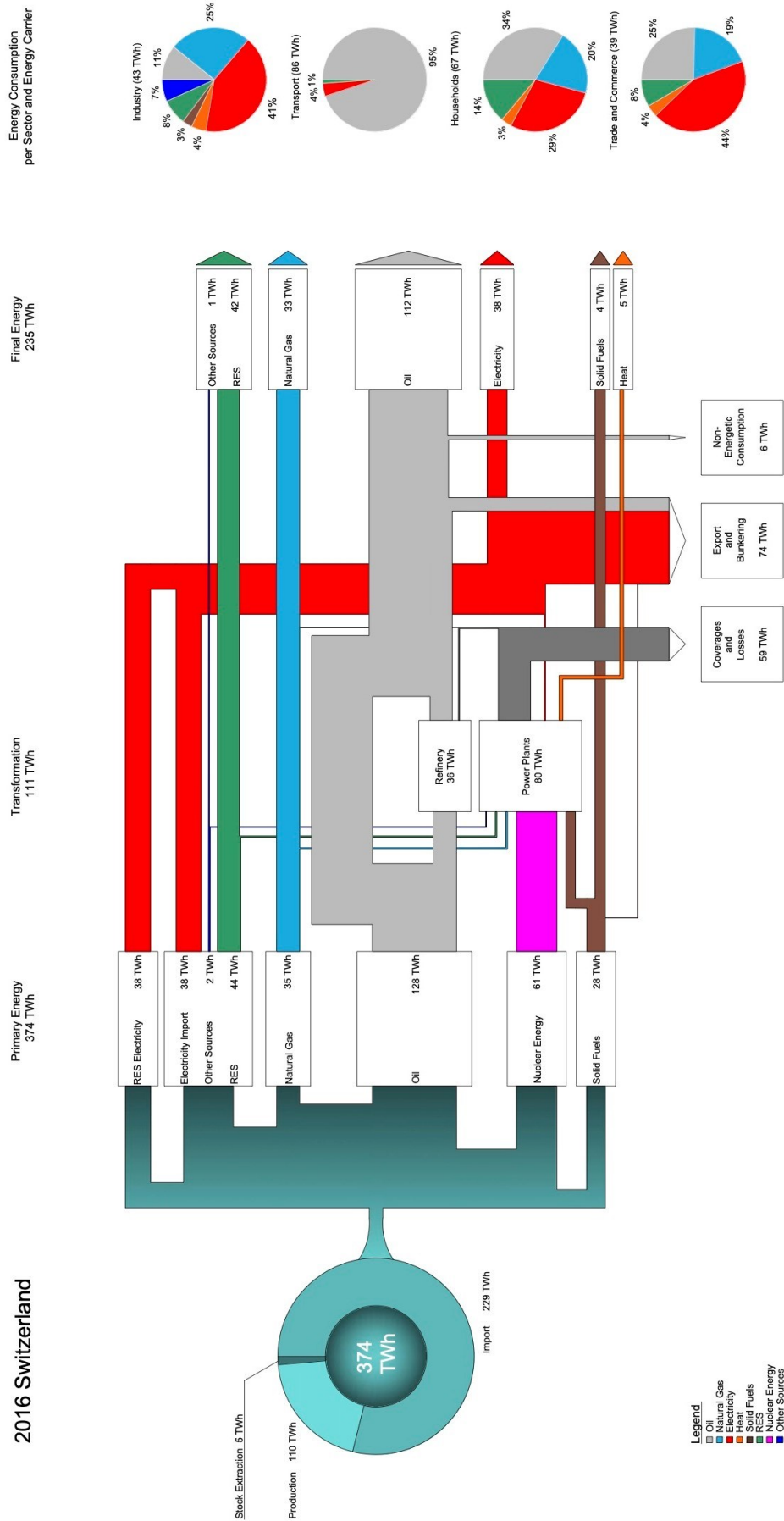


Fig. 35 Switzerland 2016

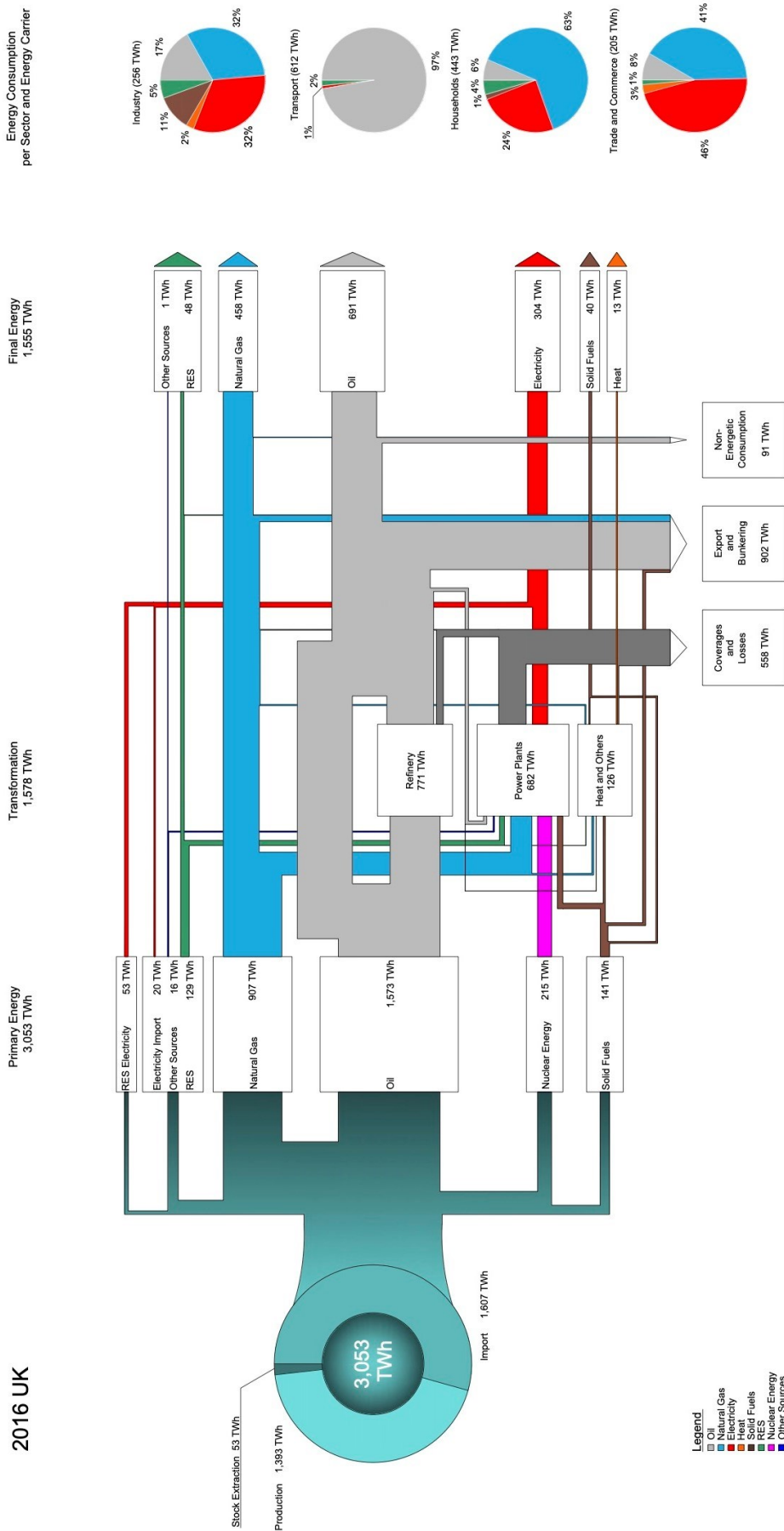


Fig. 36 United Kingdom 2016

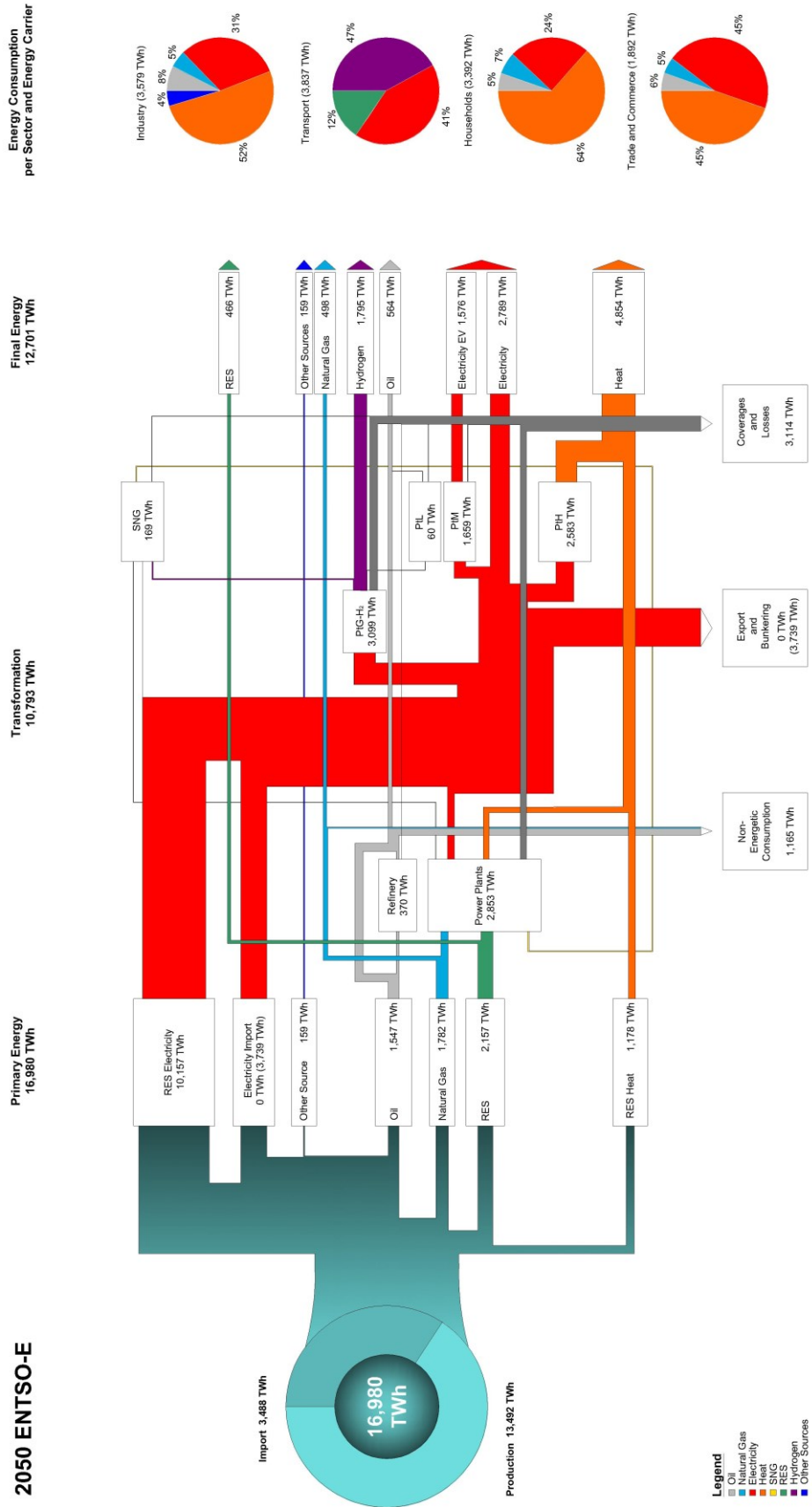


Fig. 37 ENTSO-E 2050

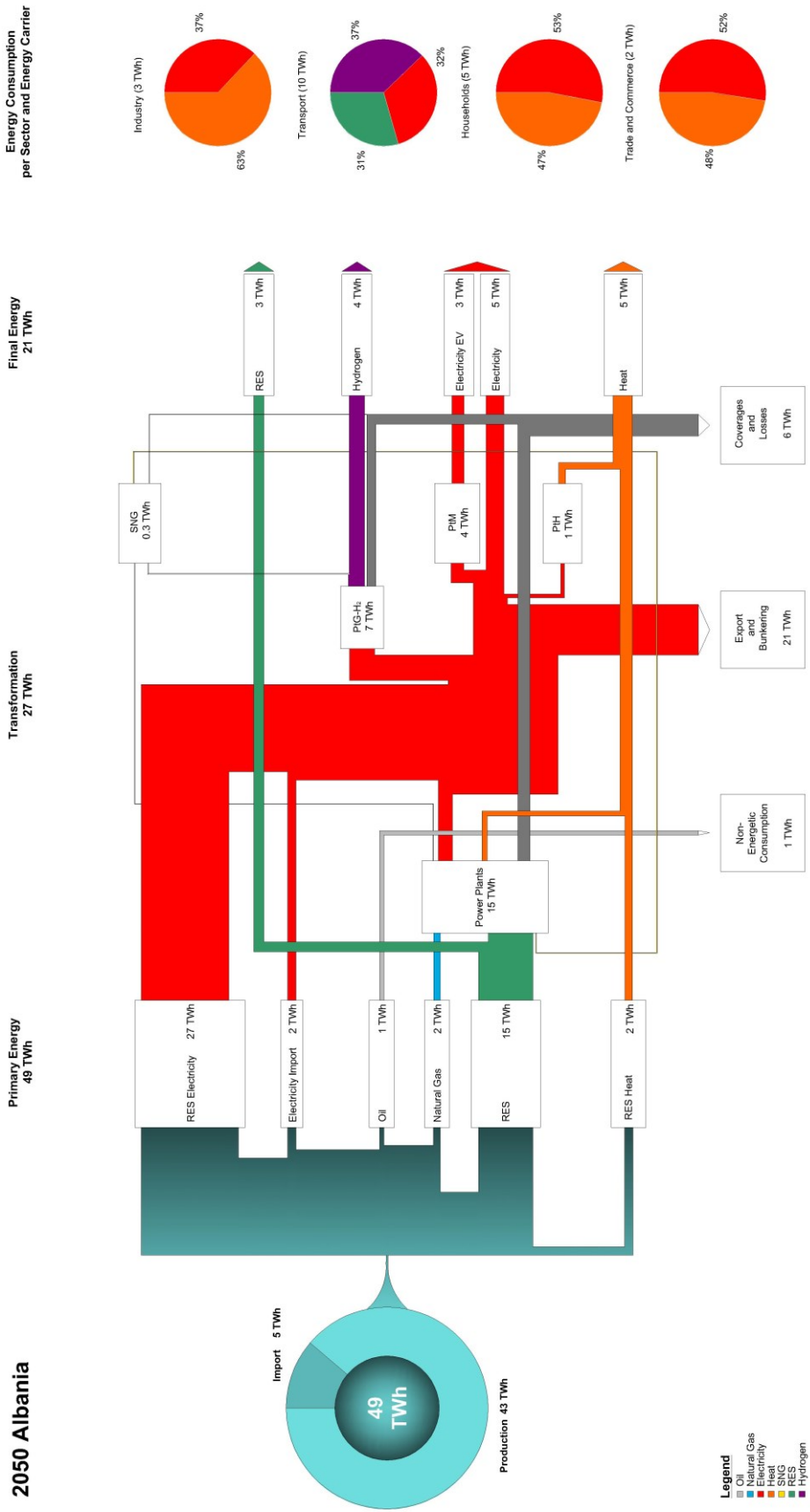


Fig. 38 Albania 2050



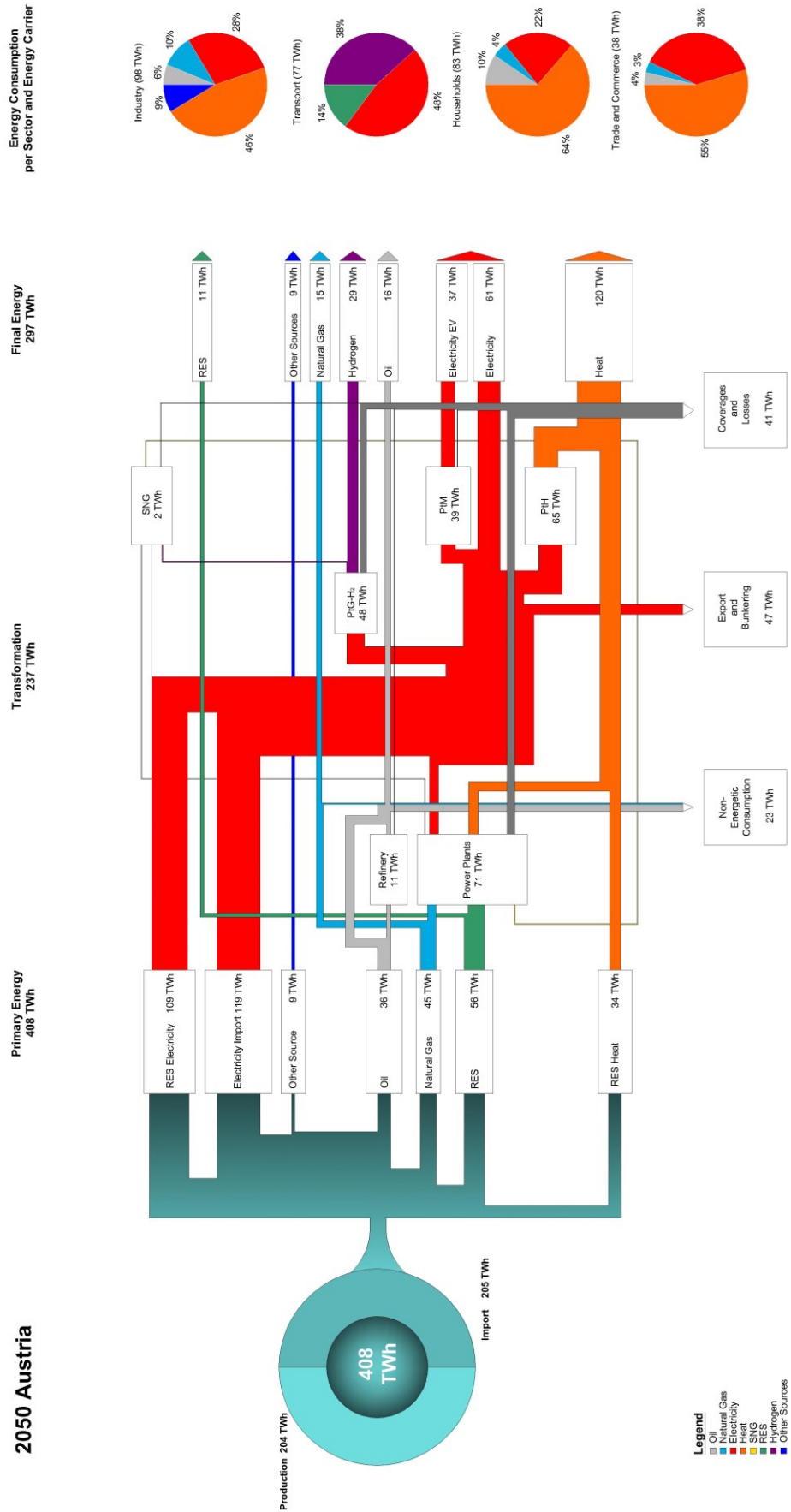


Fig. 39 Austria 2050

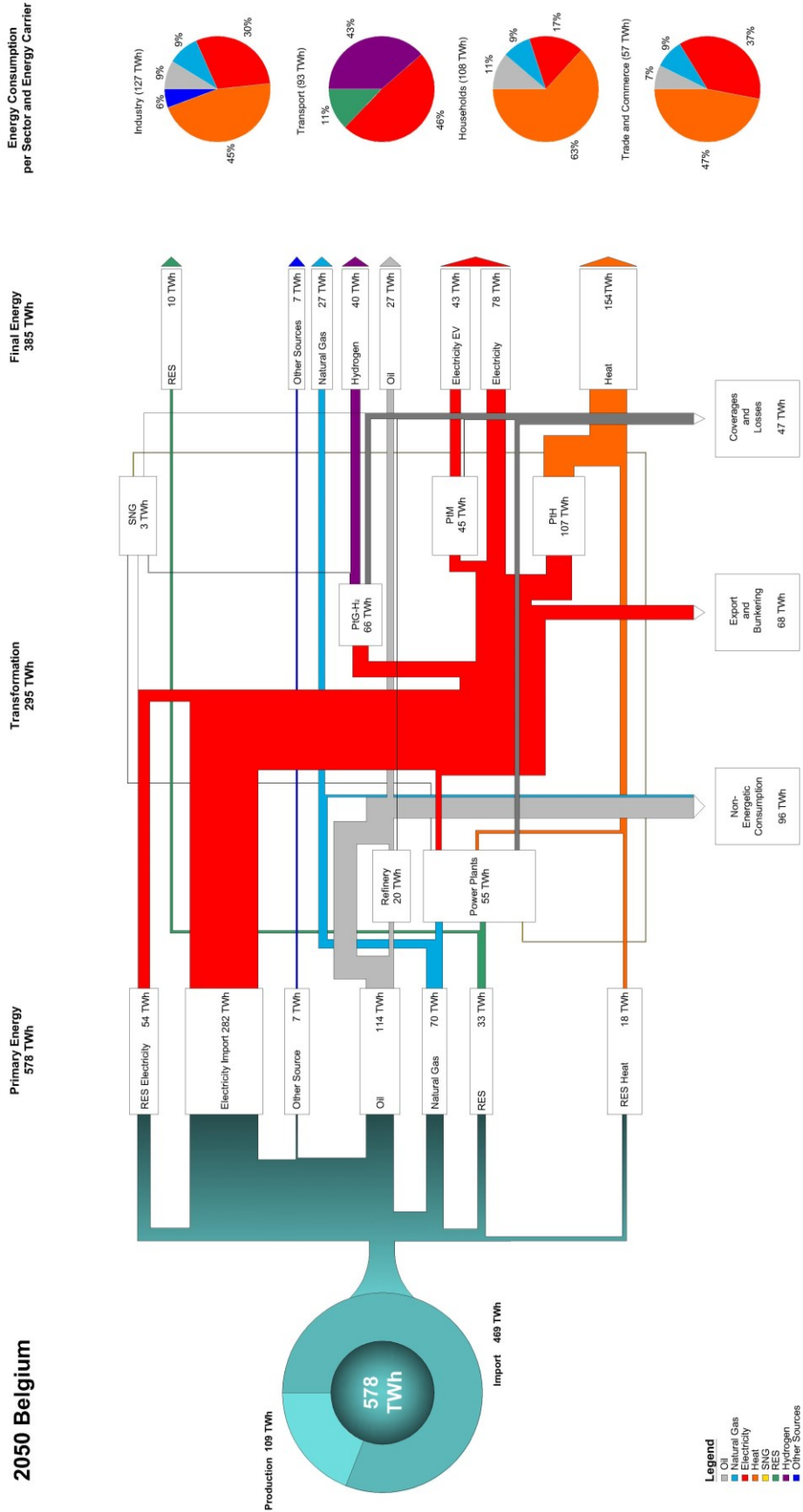


Fig. 40 Belgium 2050

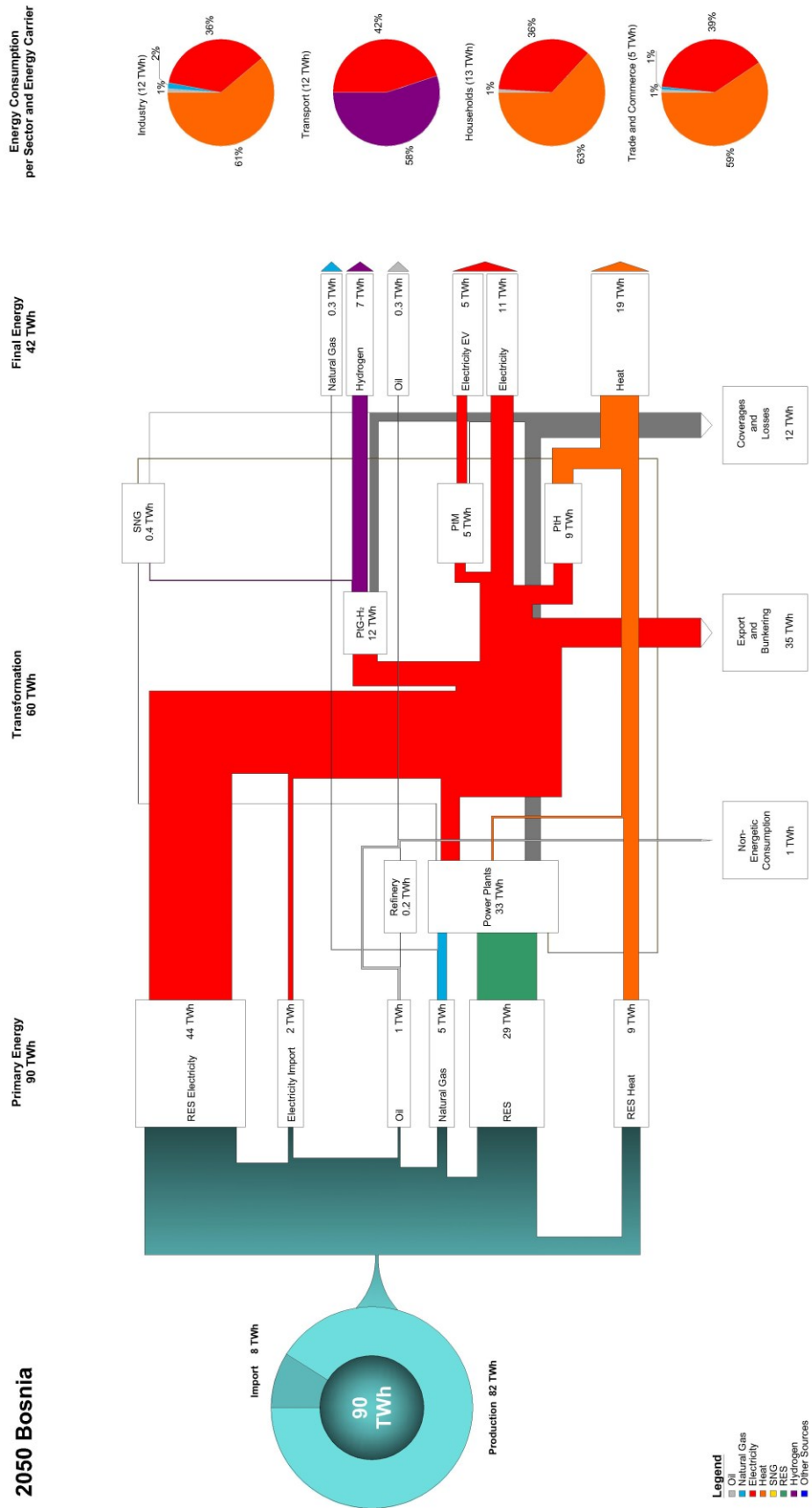


Fig. 41 Bosnia 2050

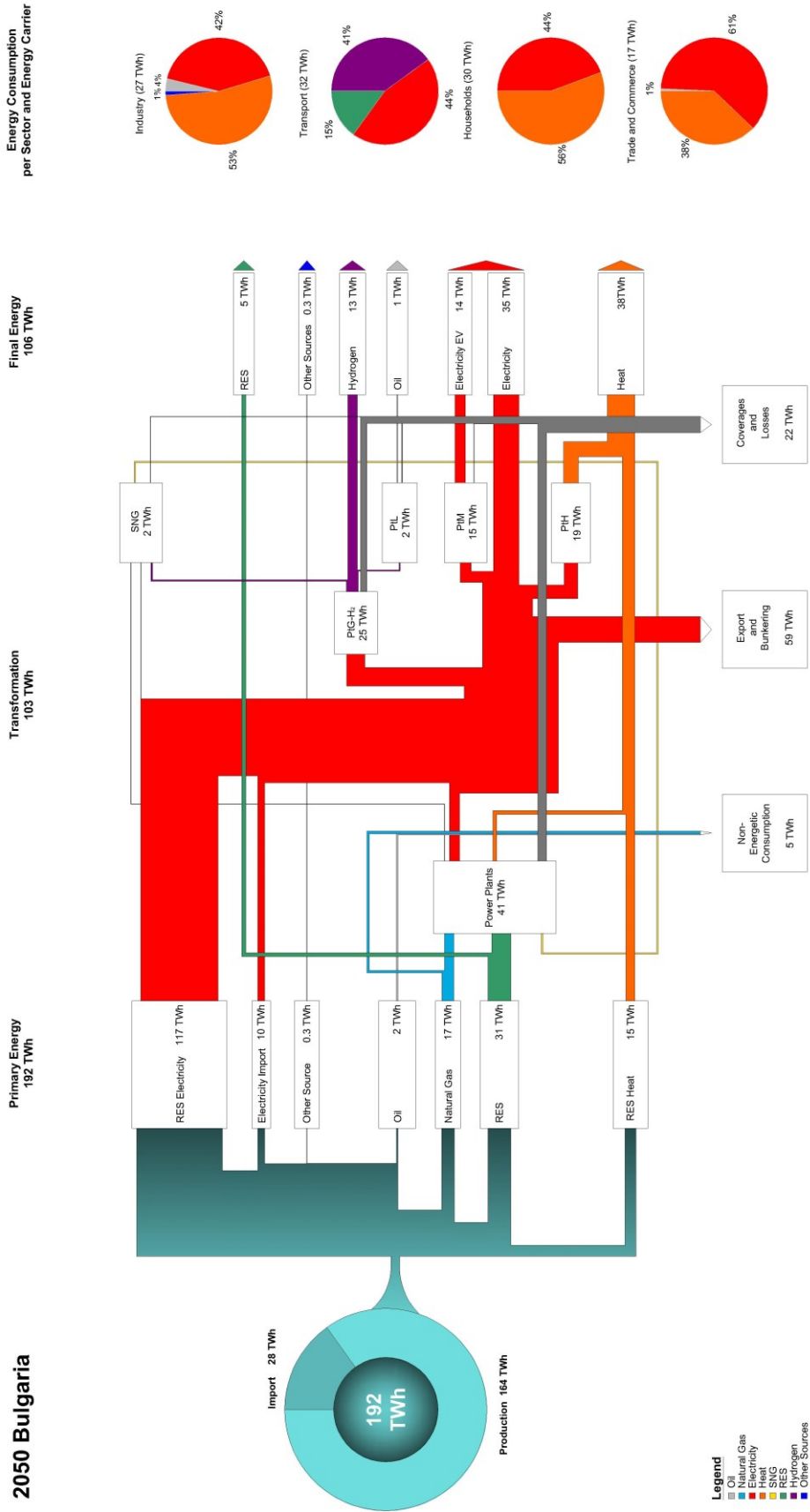


Fig. 42 Bulgaria 2050

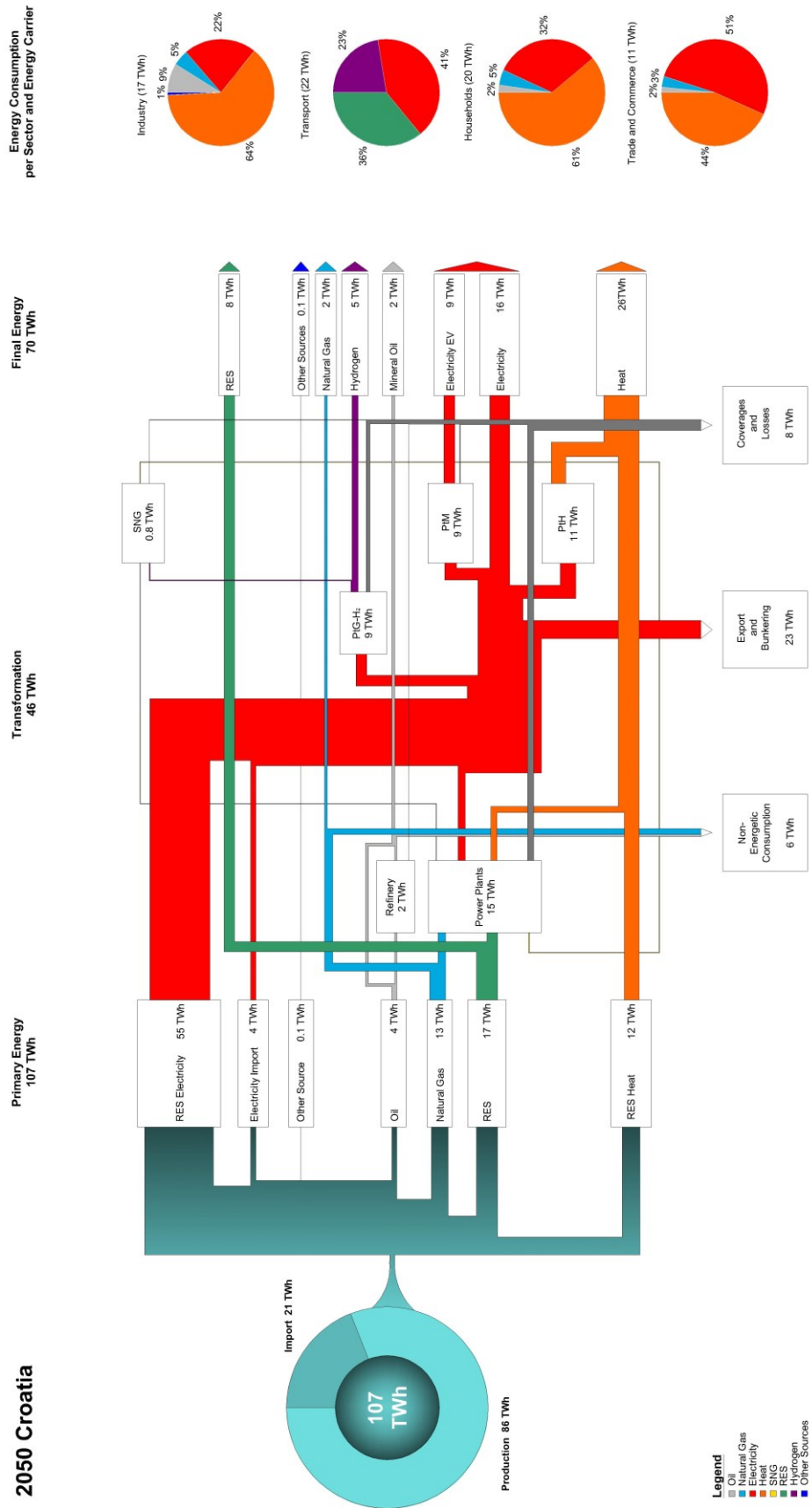


Fig. 43 Croatia 2050

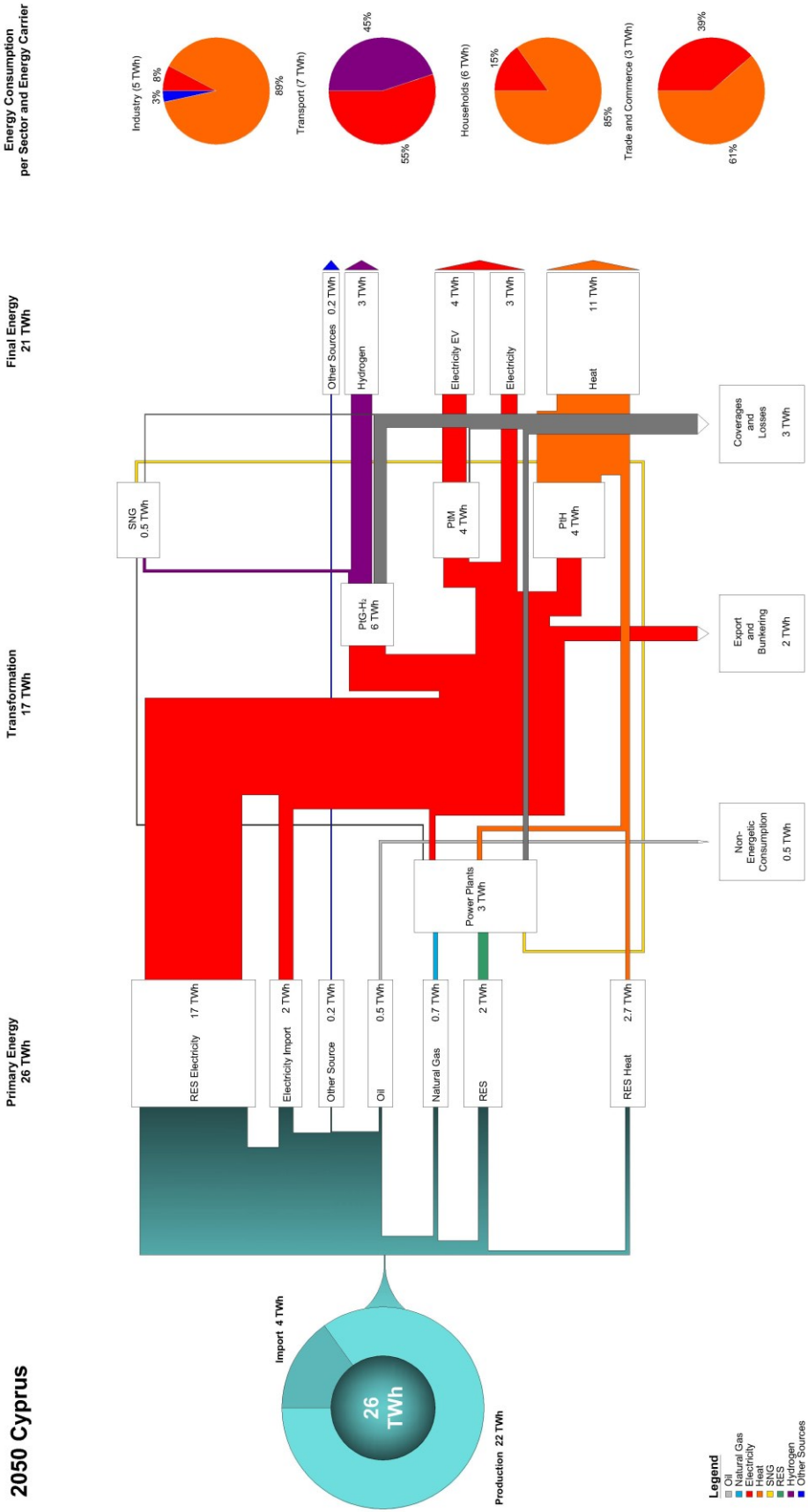


Fig. 44 Cyprus 2050

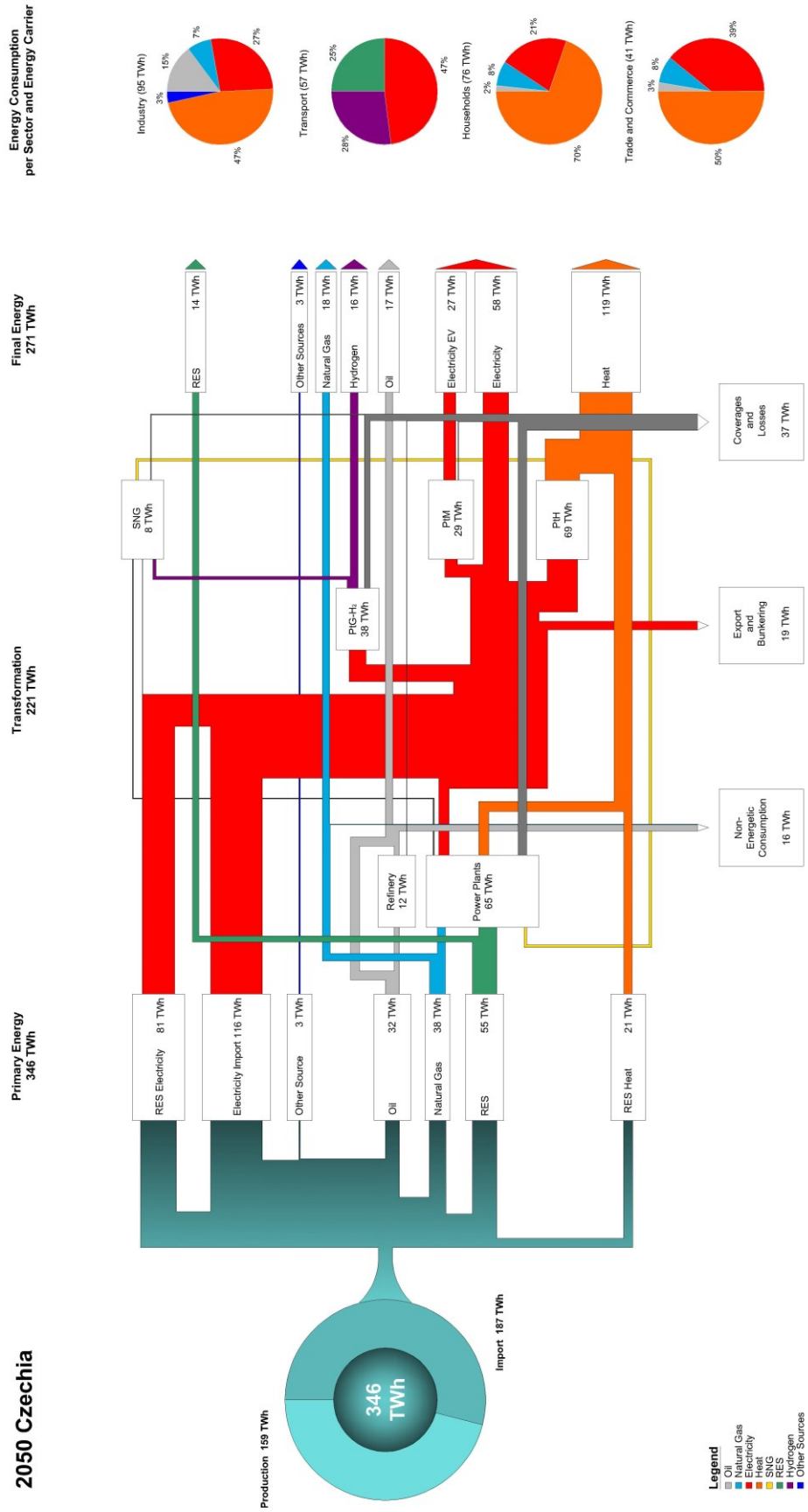


Fig. 45 Czechia 2050

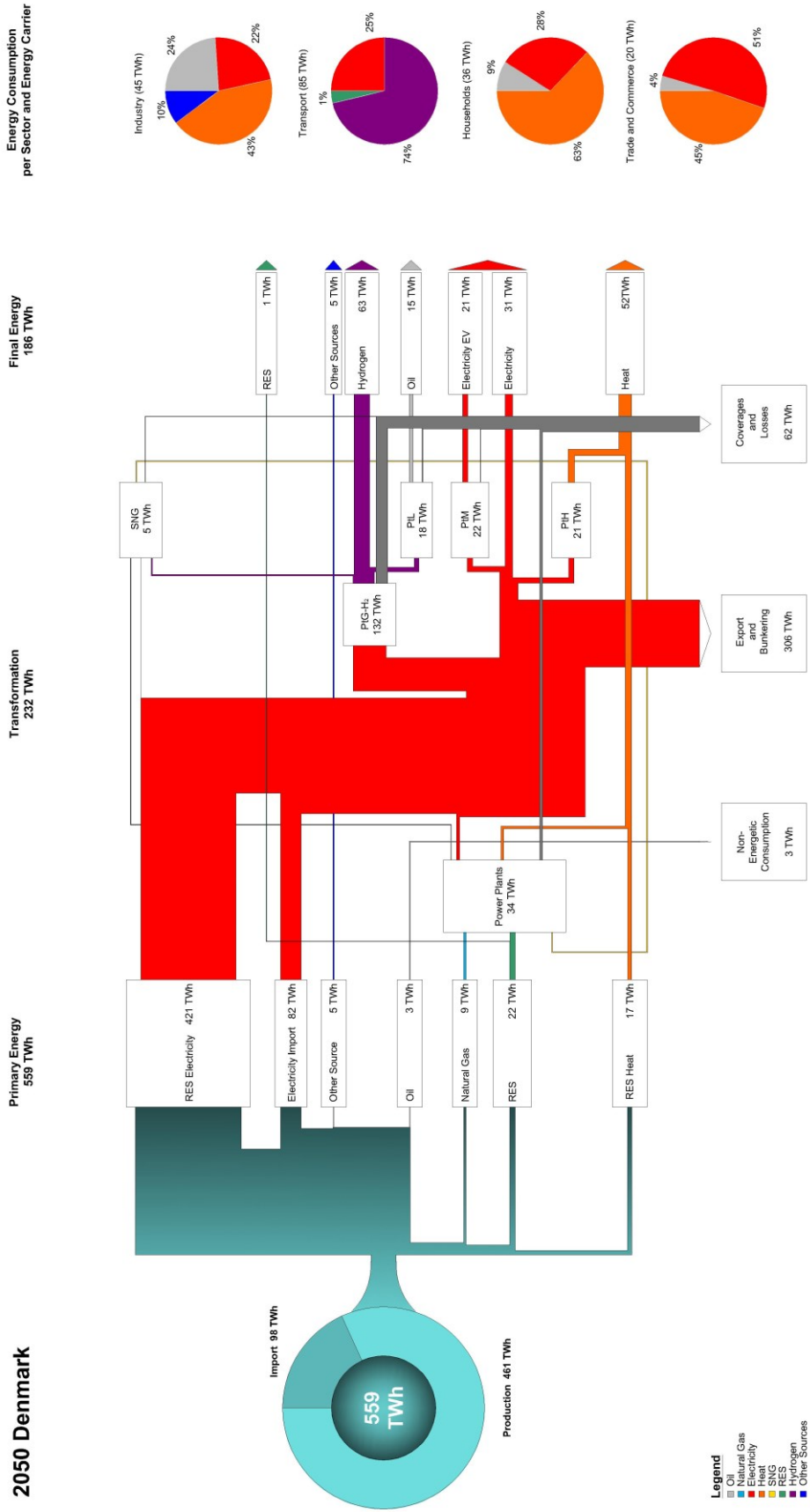


Fig. 46 Denmark 2050



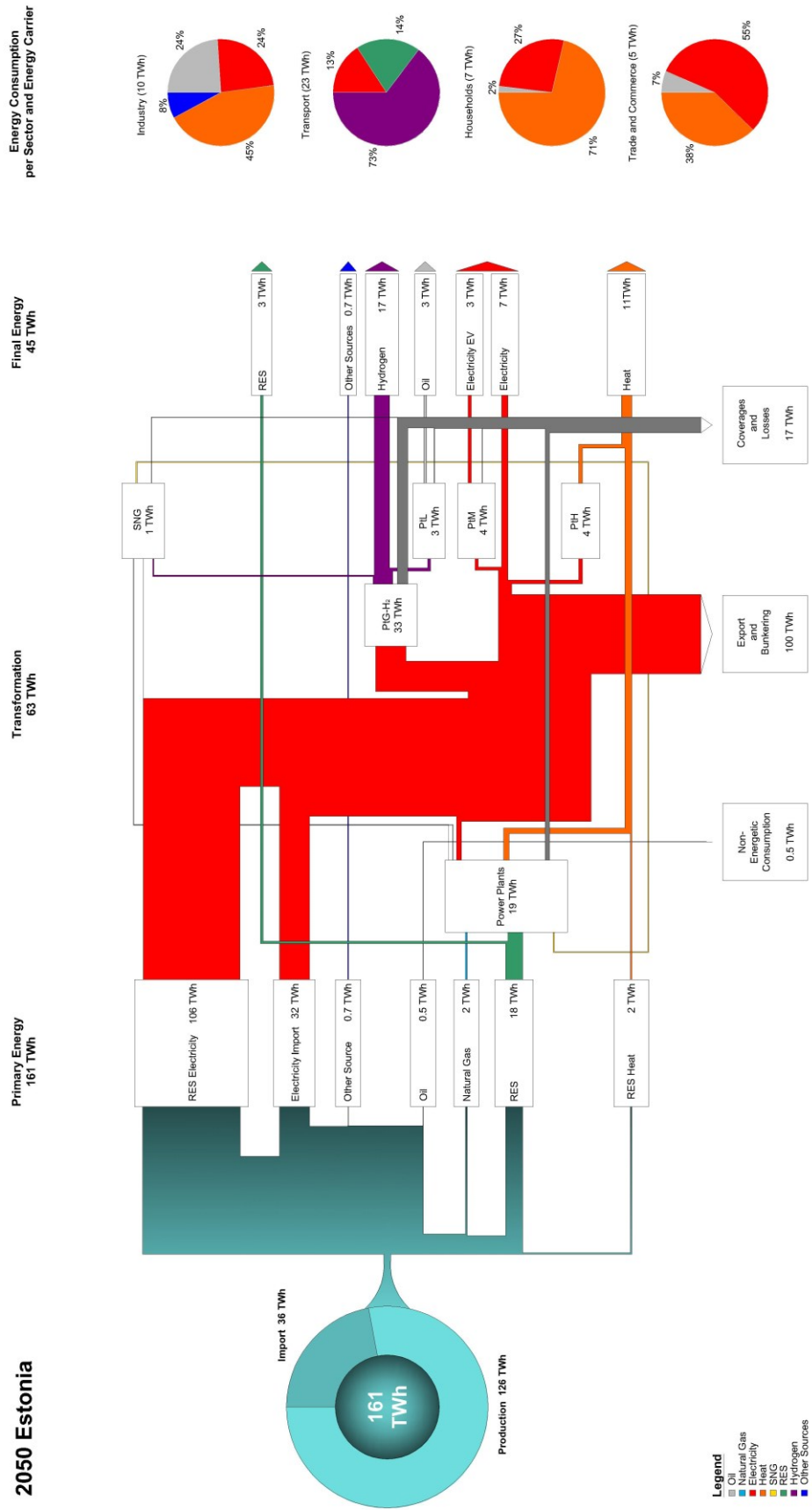


Fig. 47 Estonia 2050



Fig. 48 Finland 2050

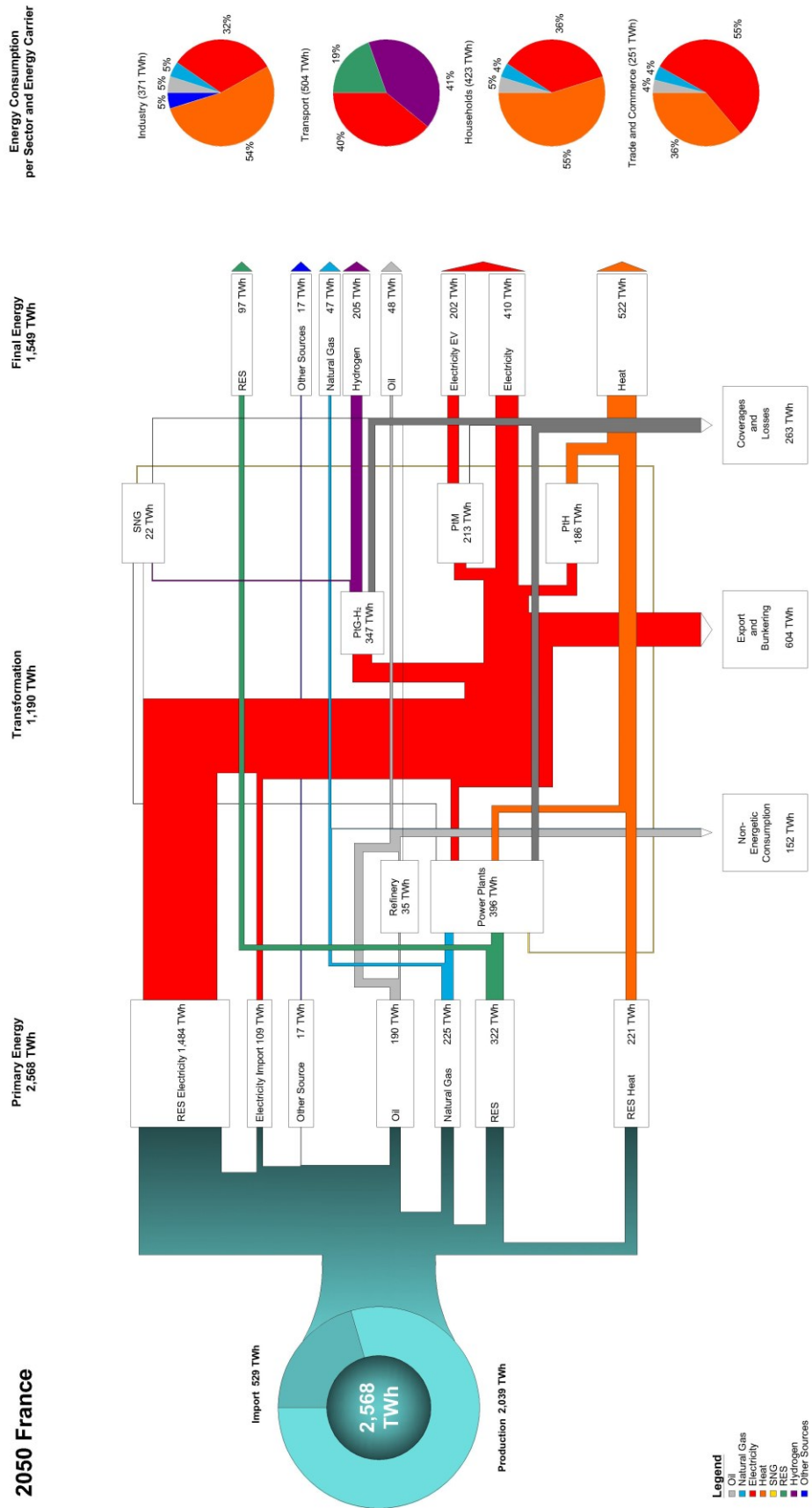


Fig. 49 France 2050

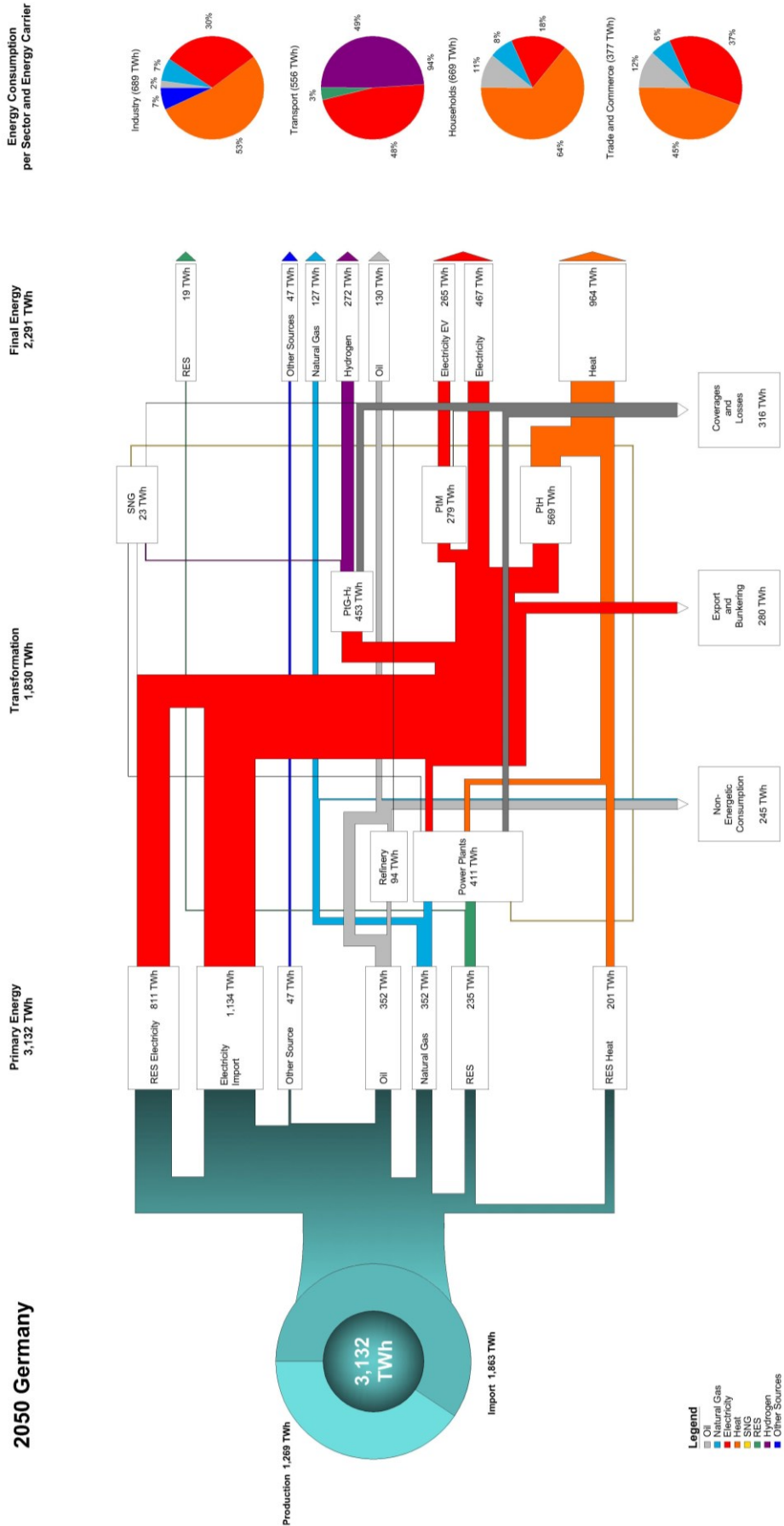


Fig. 50 Germany 2050

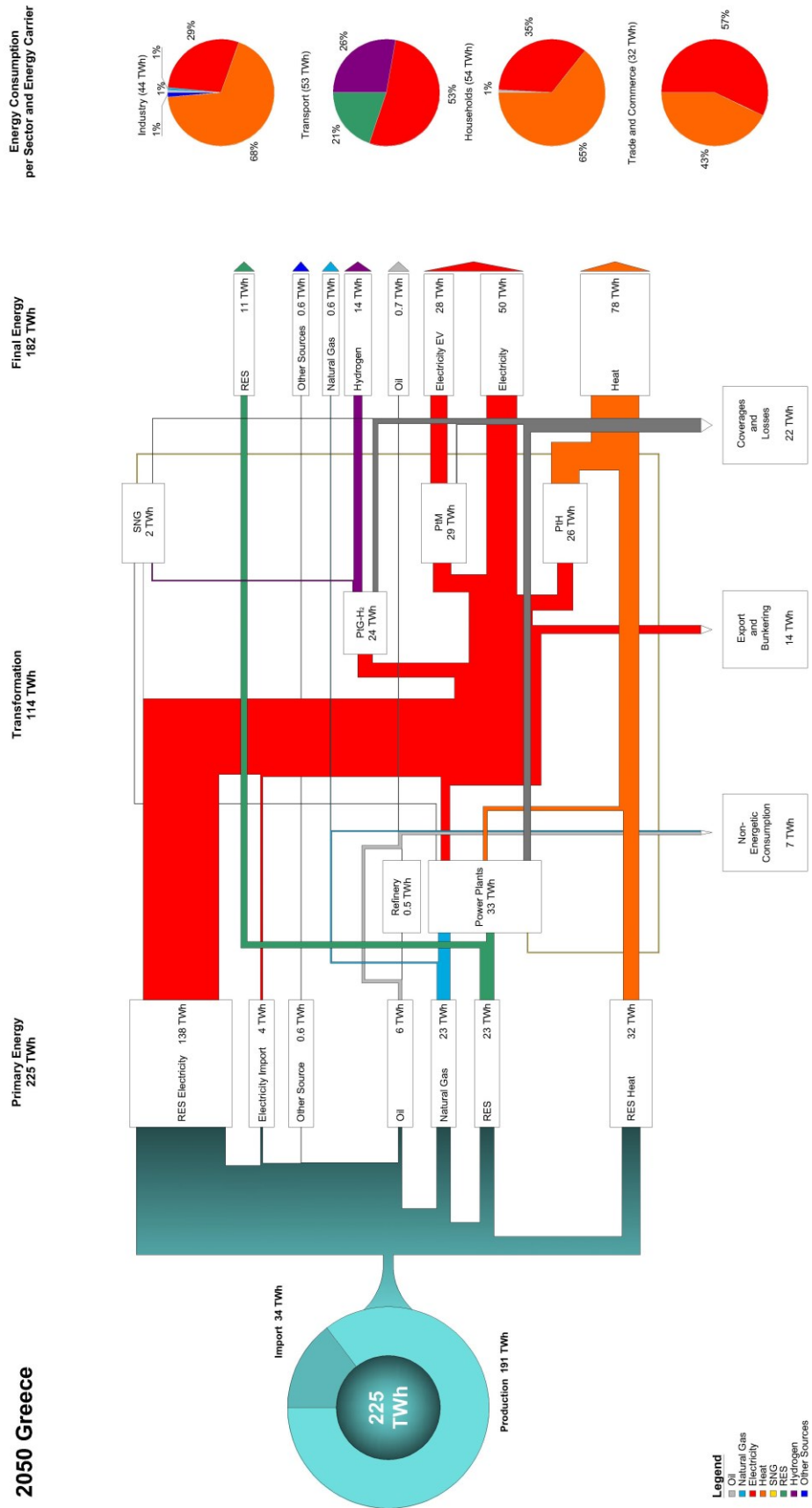


Fig. 51 Greece 2050

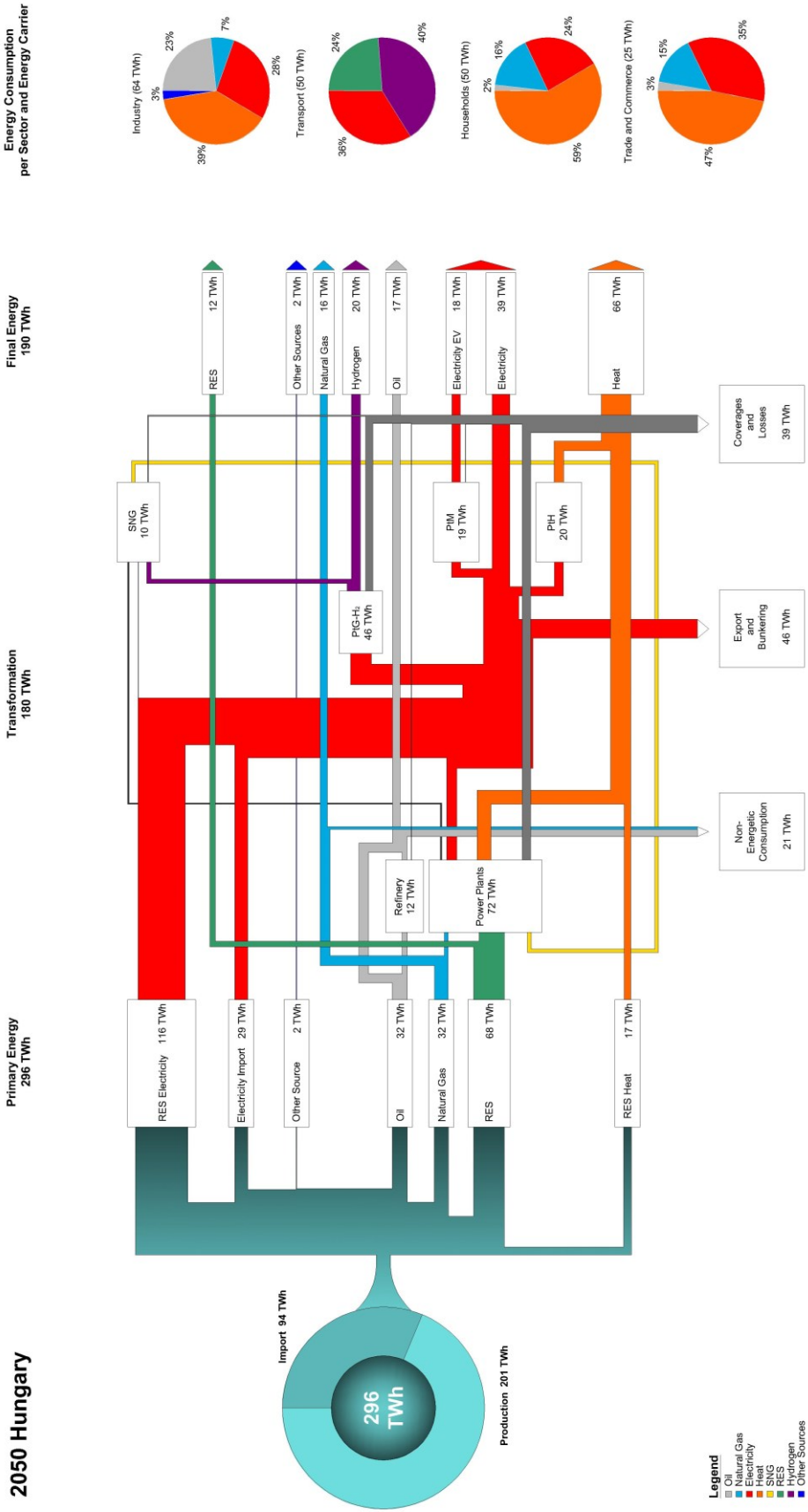


Fig. 52 Hungary 2050

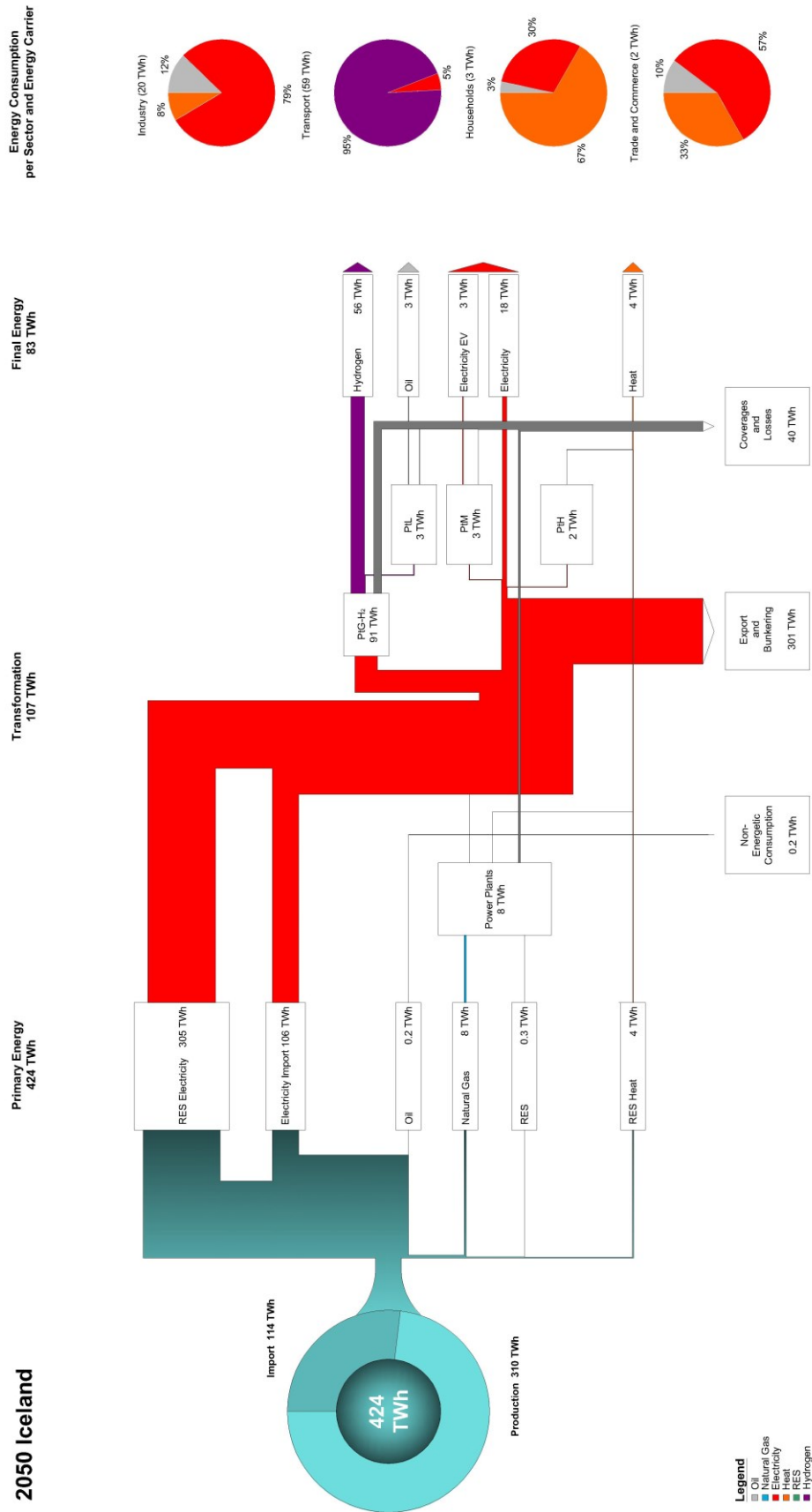


Fig. 53 Iceland 2050

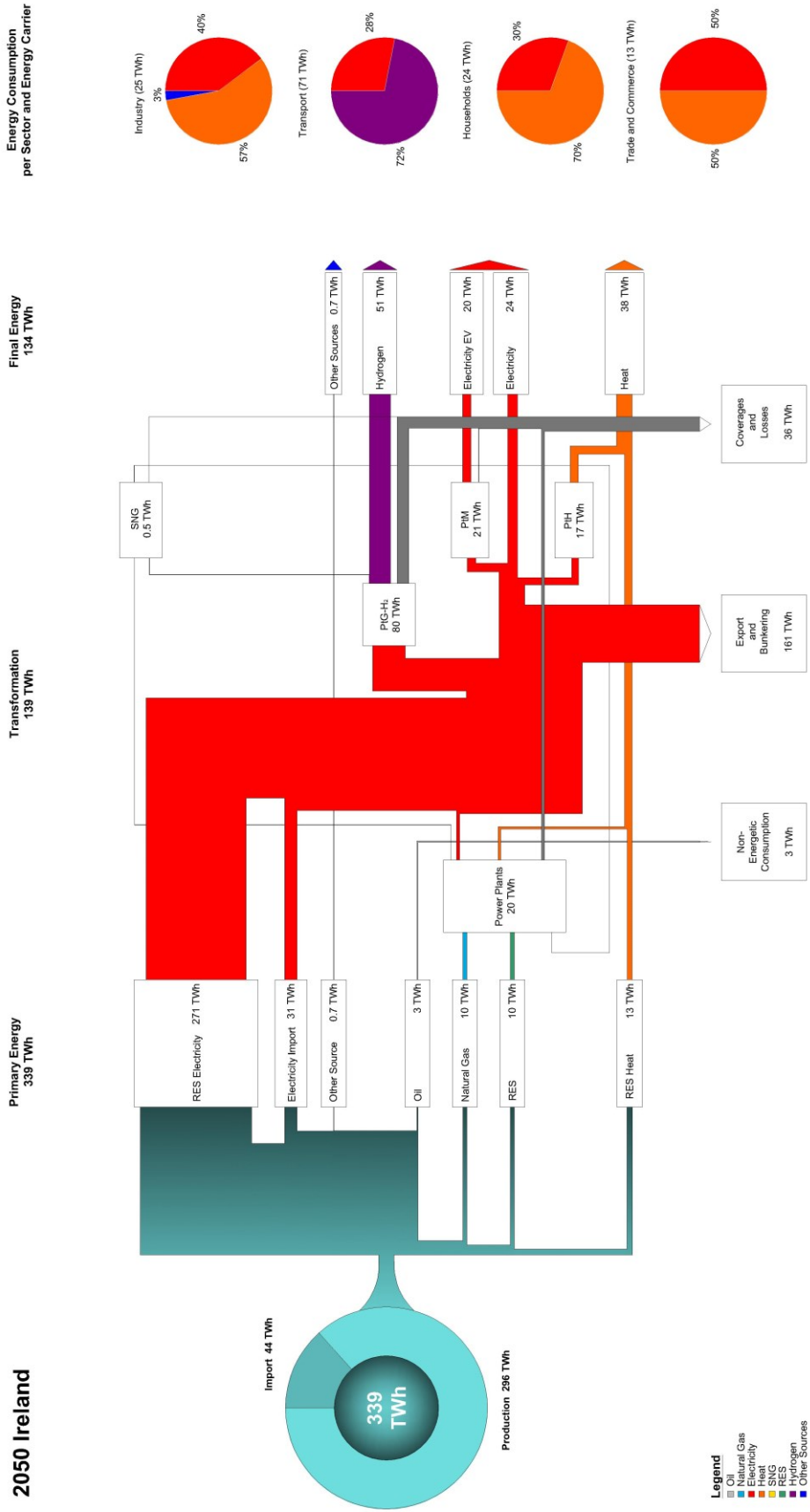


Fig. 54 Ireland 2050



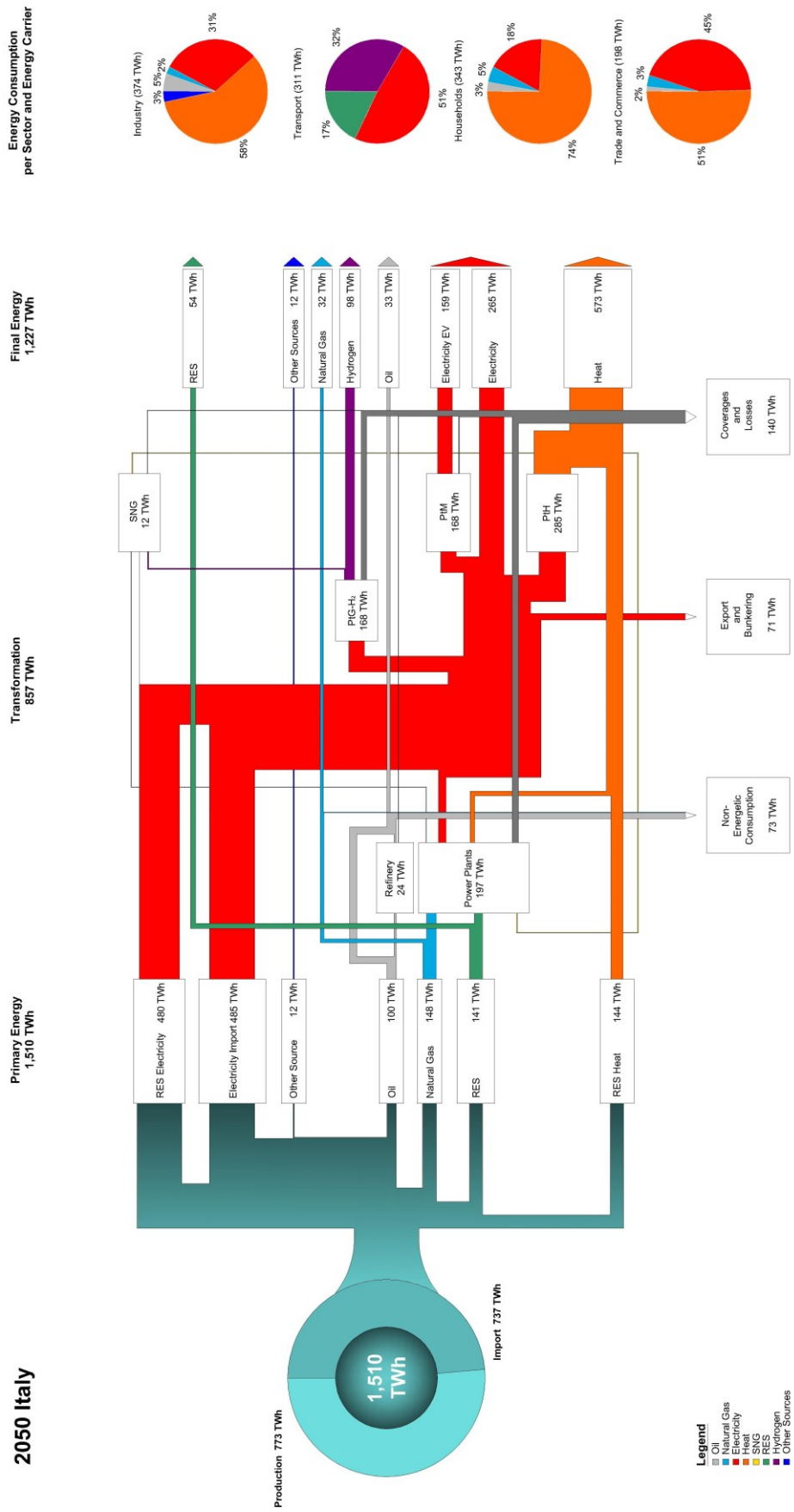


Fig. 55 Italy 2050

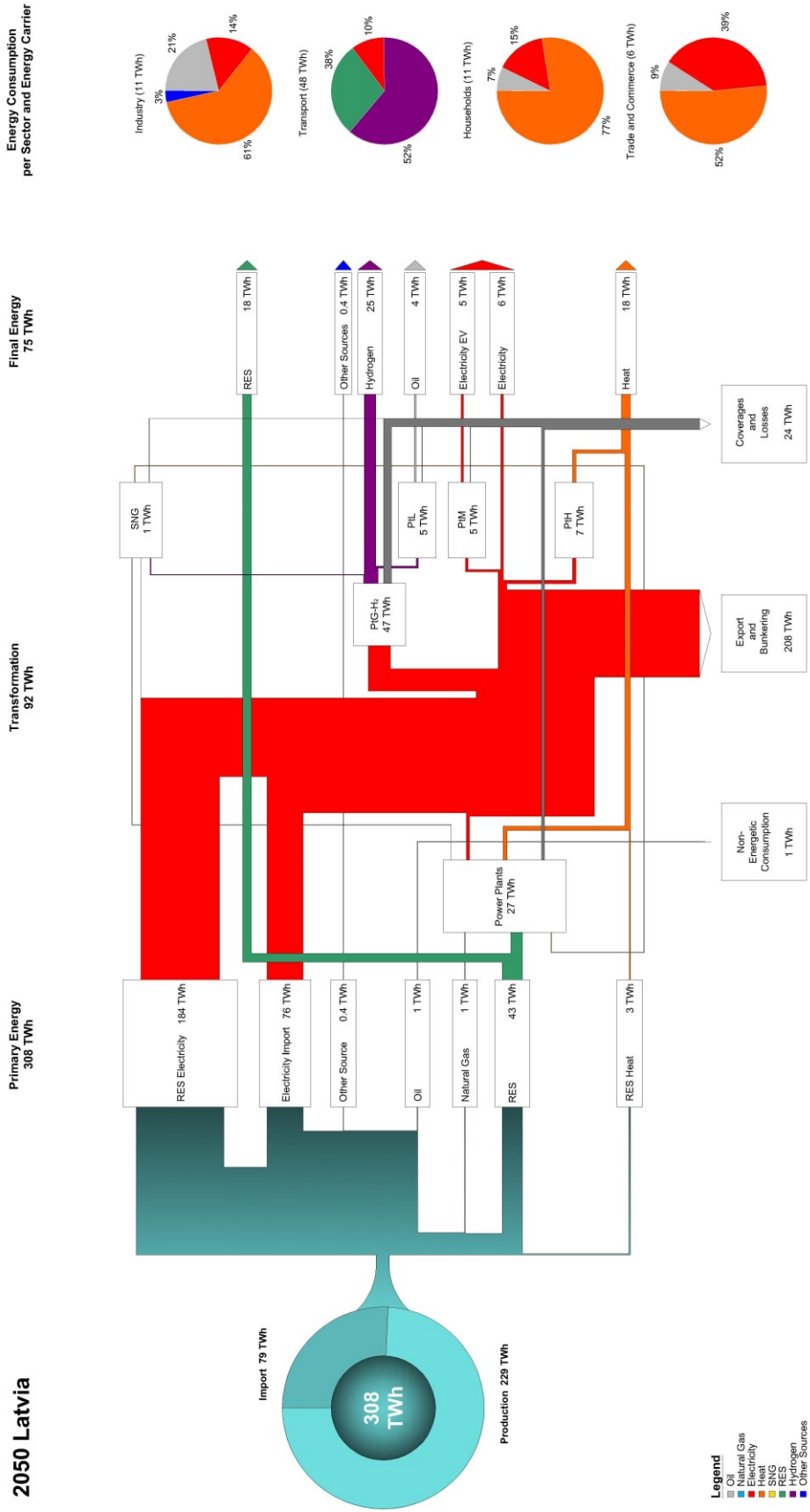


Fig. 56 Latvia 2050

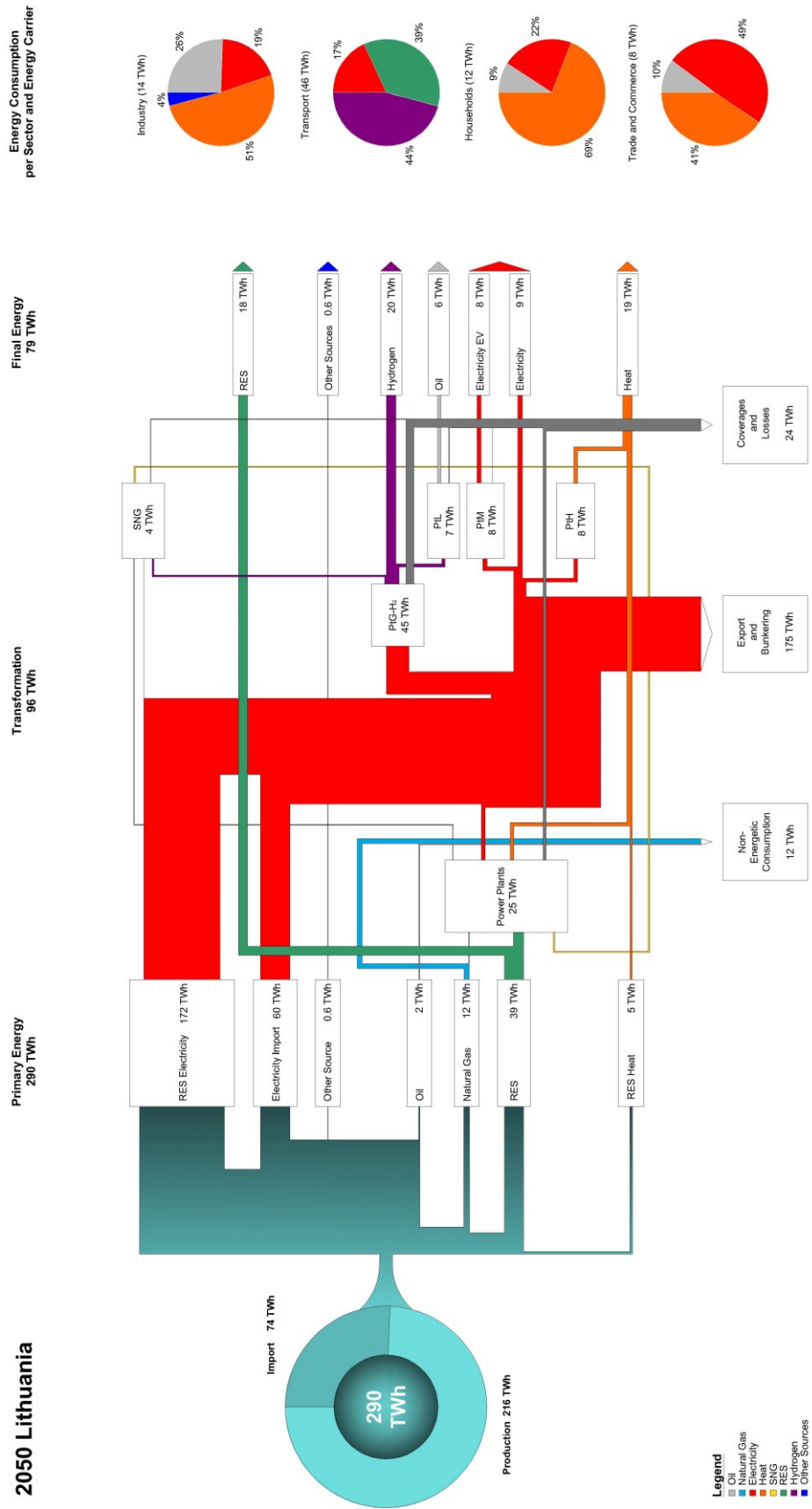


Fig. 57 Lithuania 2050

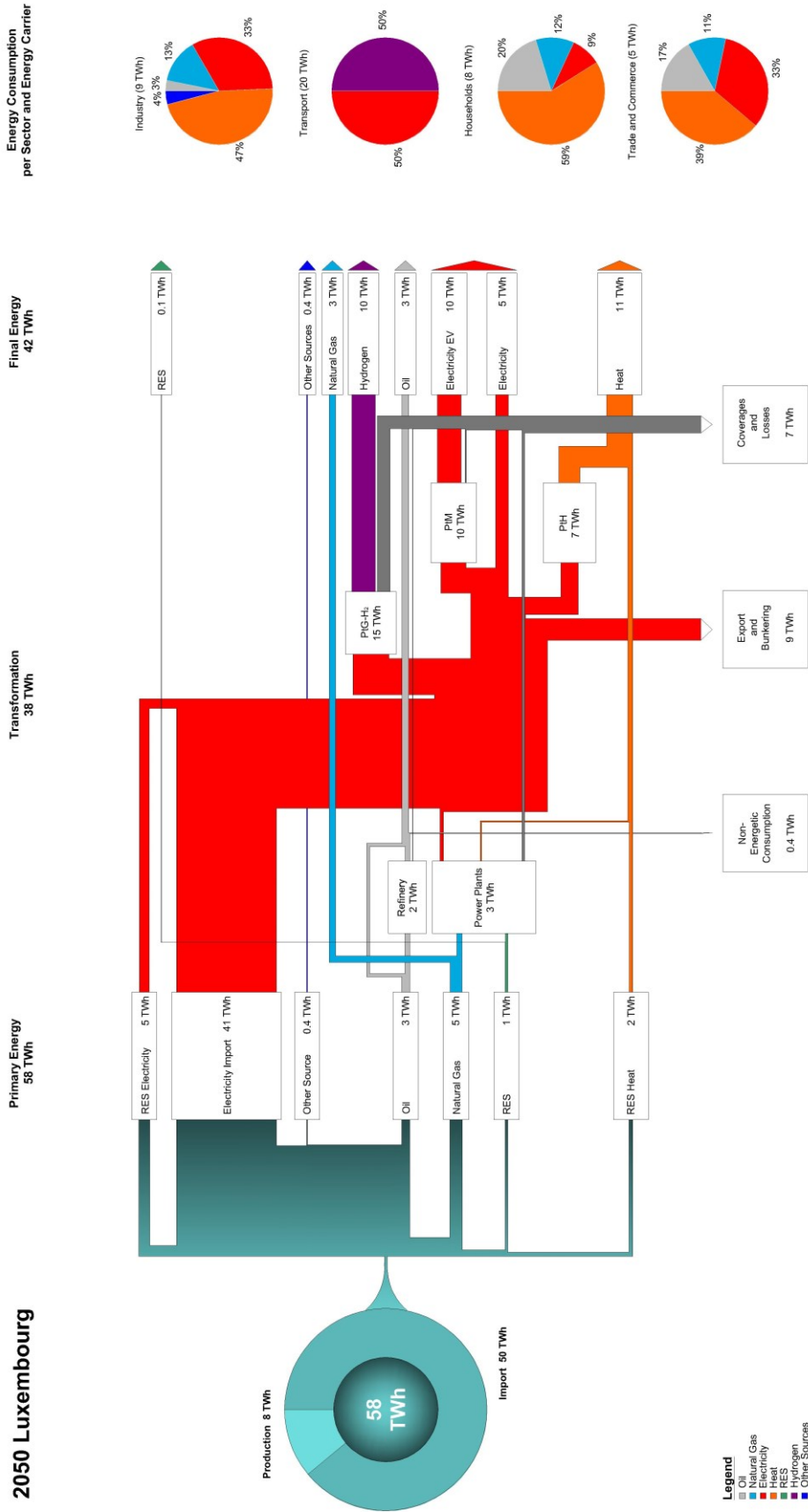


Fig. 58 Luxembourg 2050

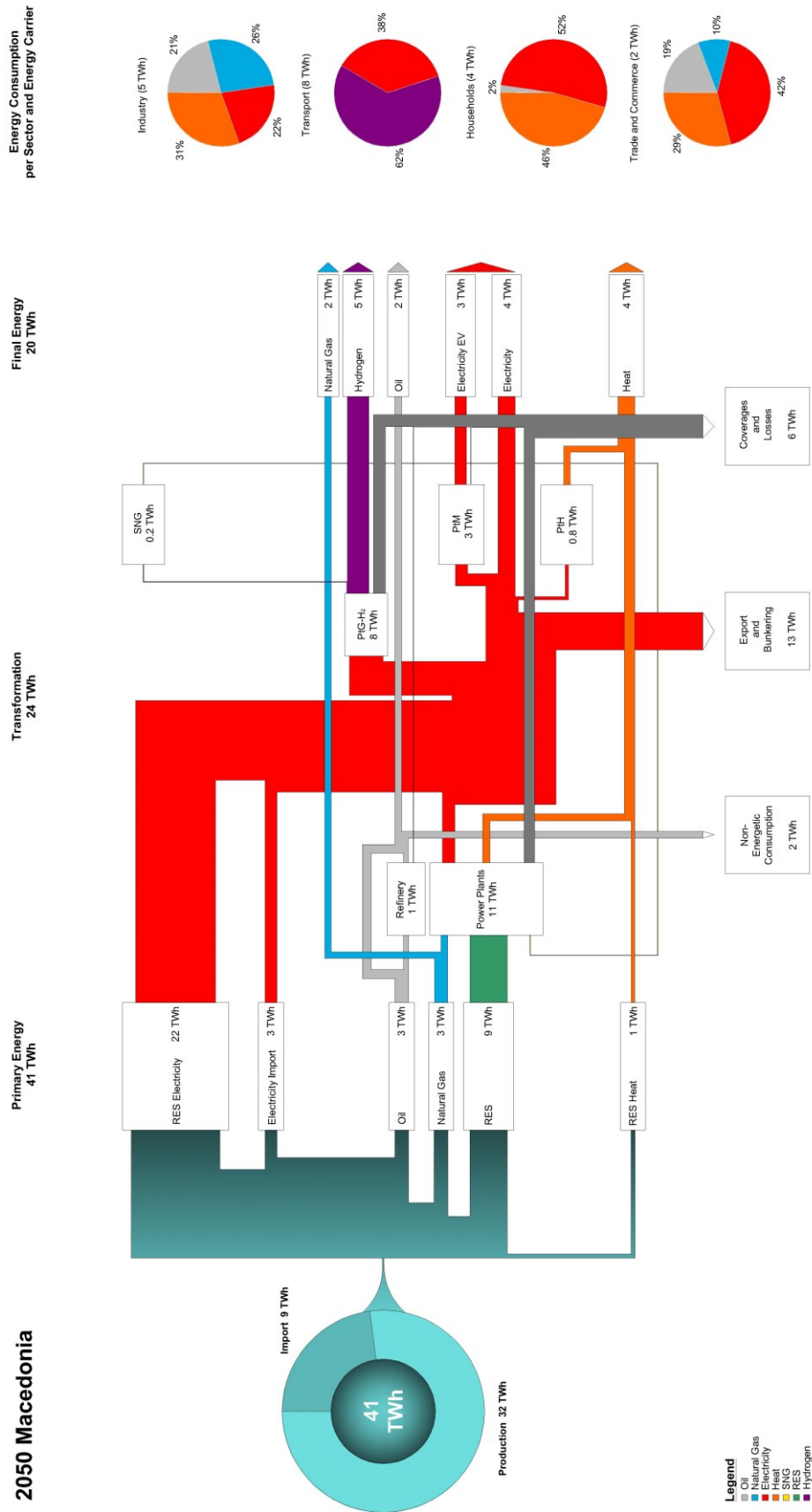


Fig. 59 North Macedonia 2050

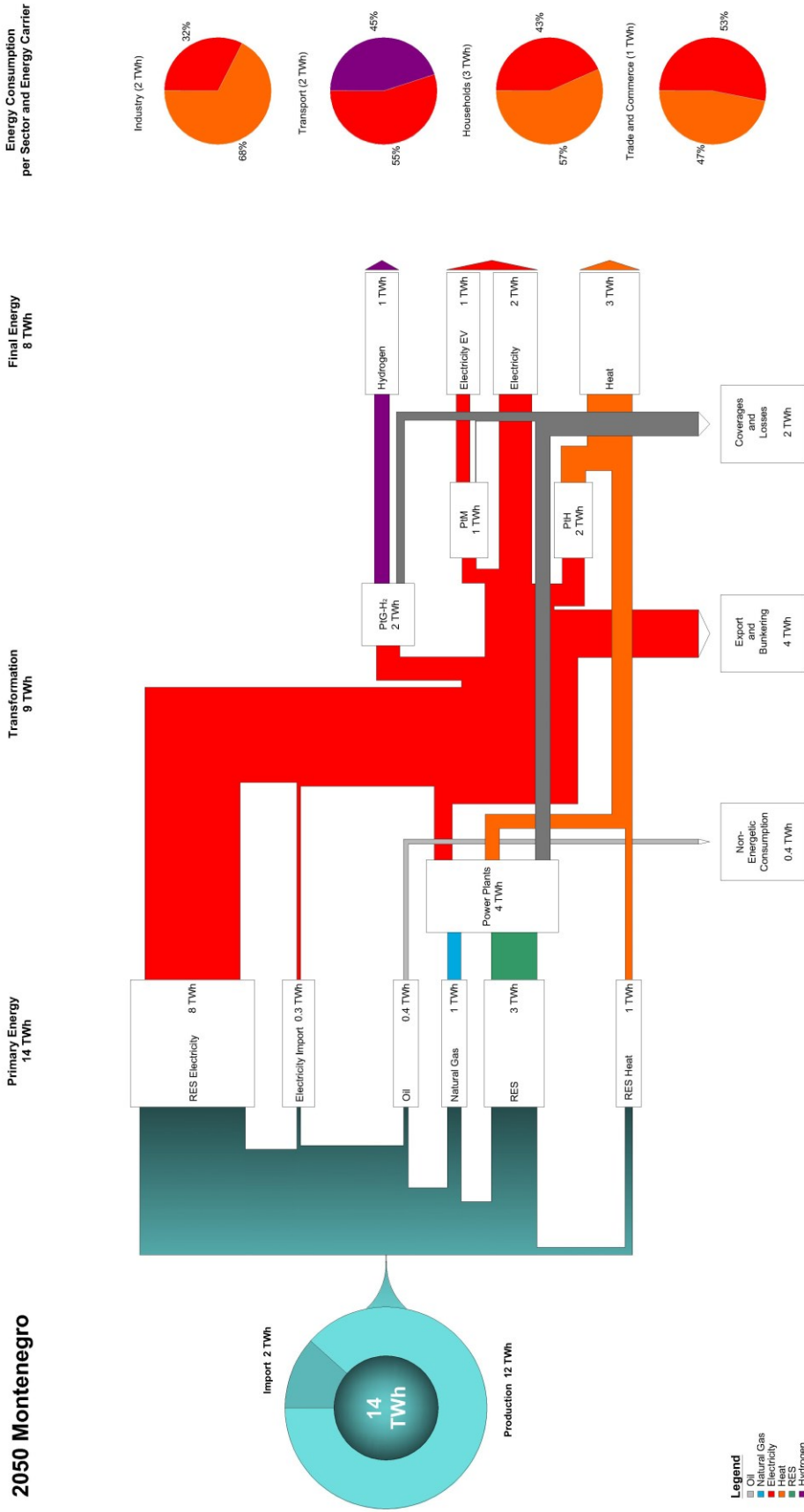


Fig. 60 Montenegro 2050

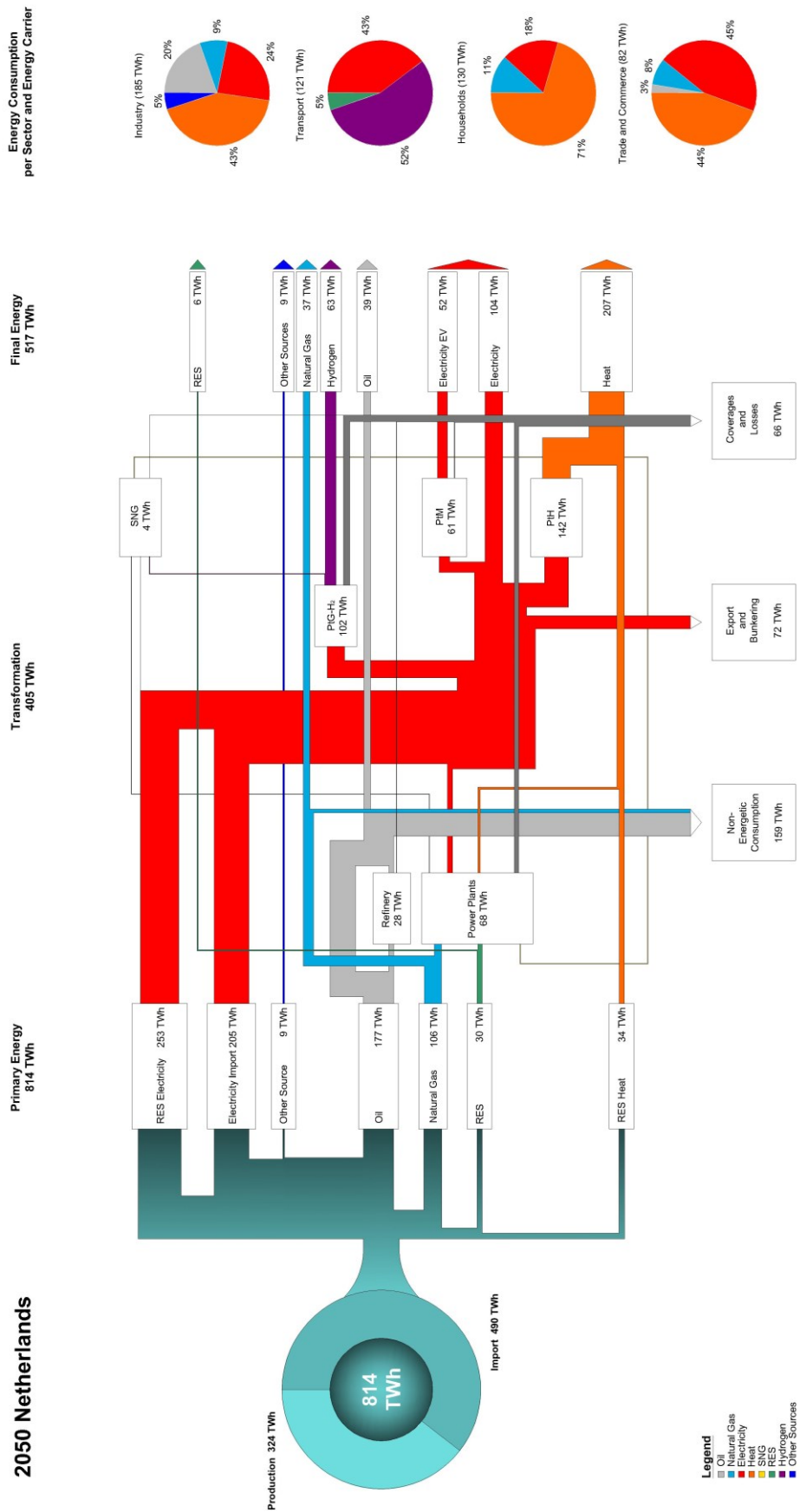


Fig. 61 Netherlands 2050

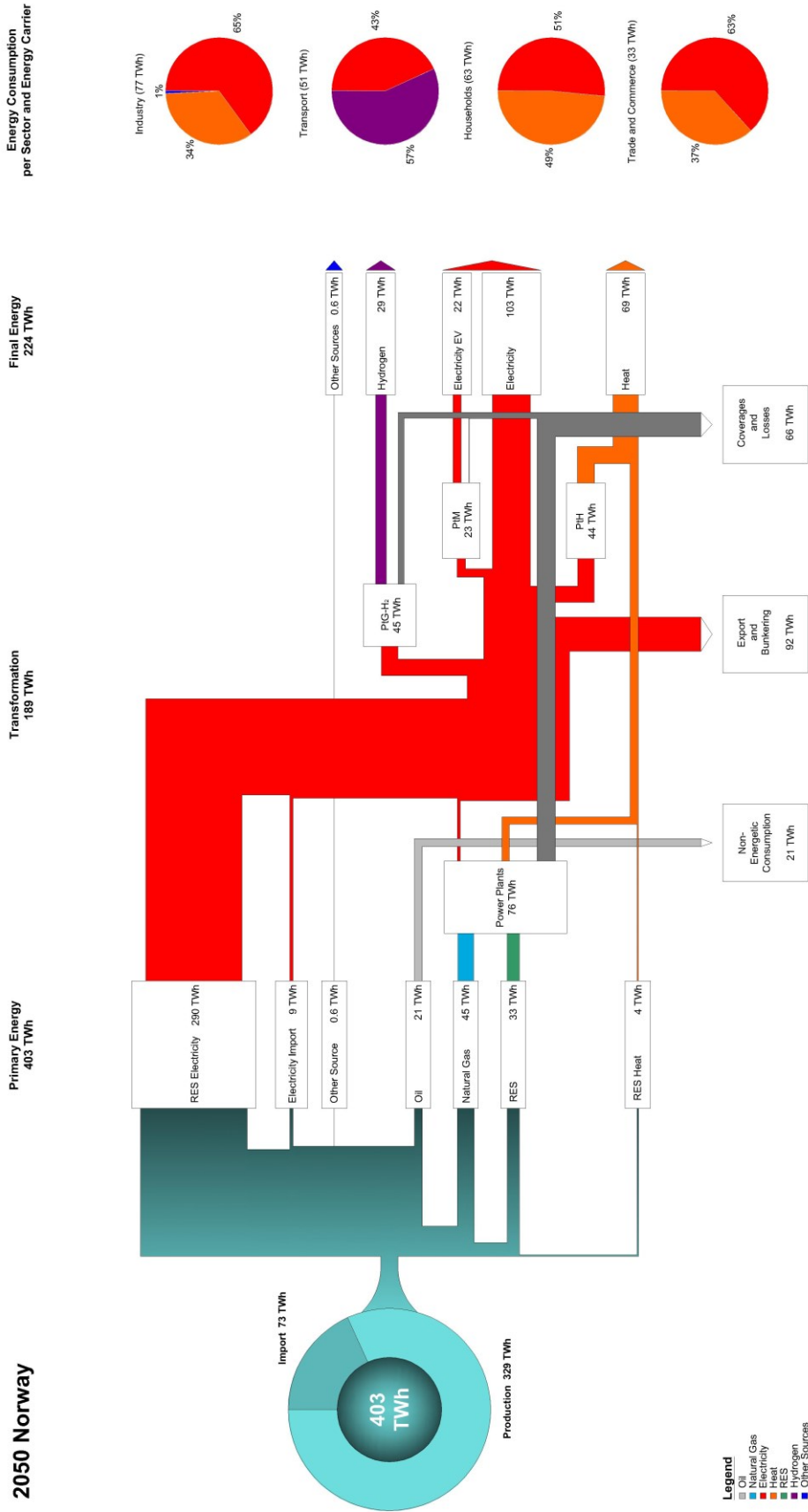


Fig. 62 Norway 2050



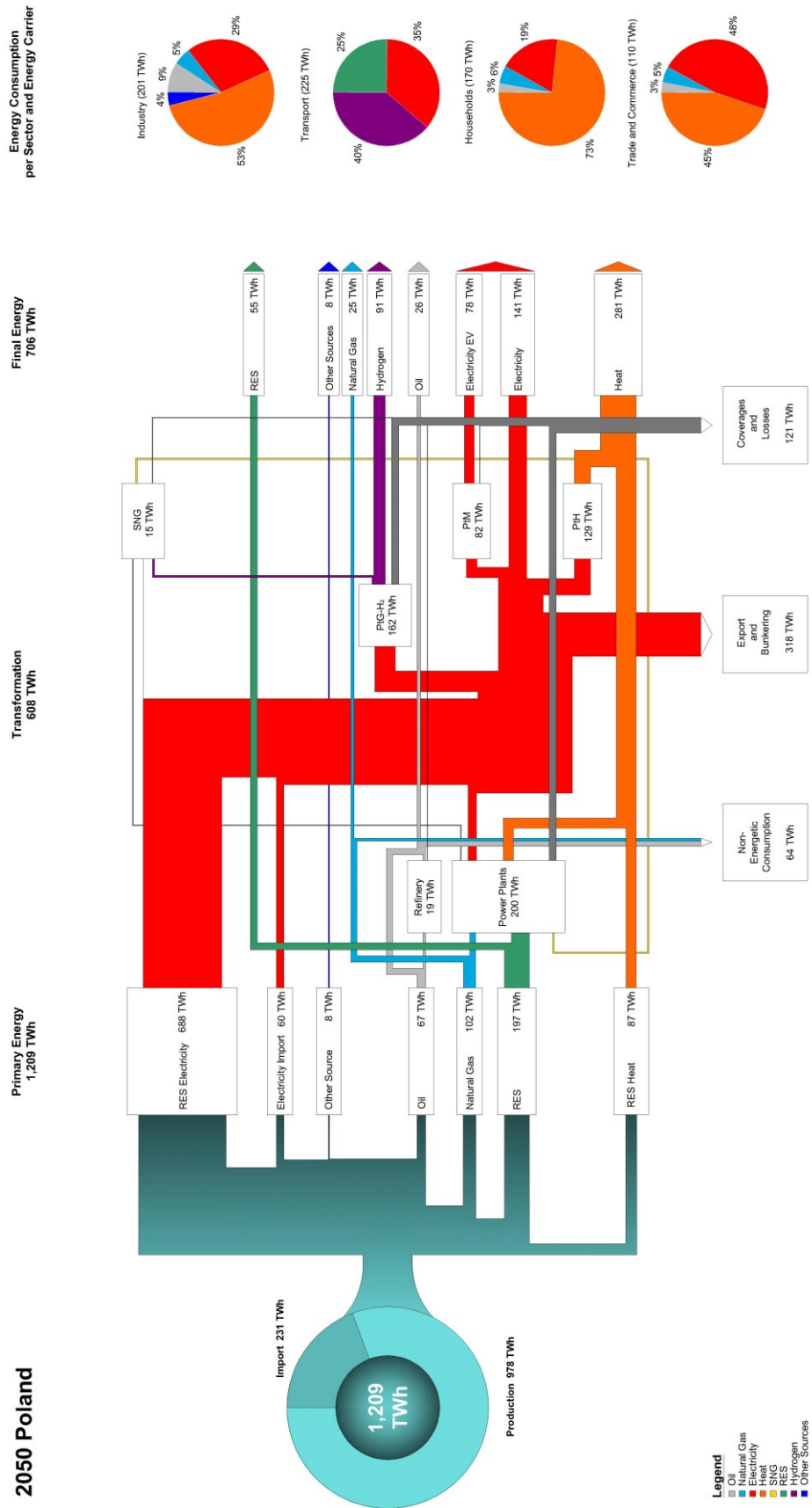


Fig. 63 Poland 2050

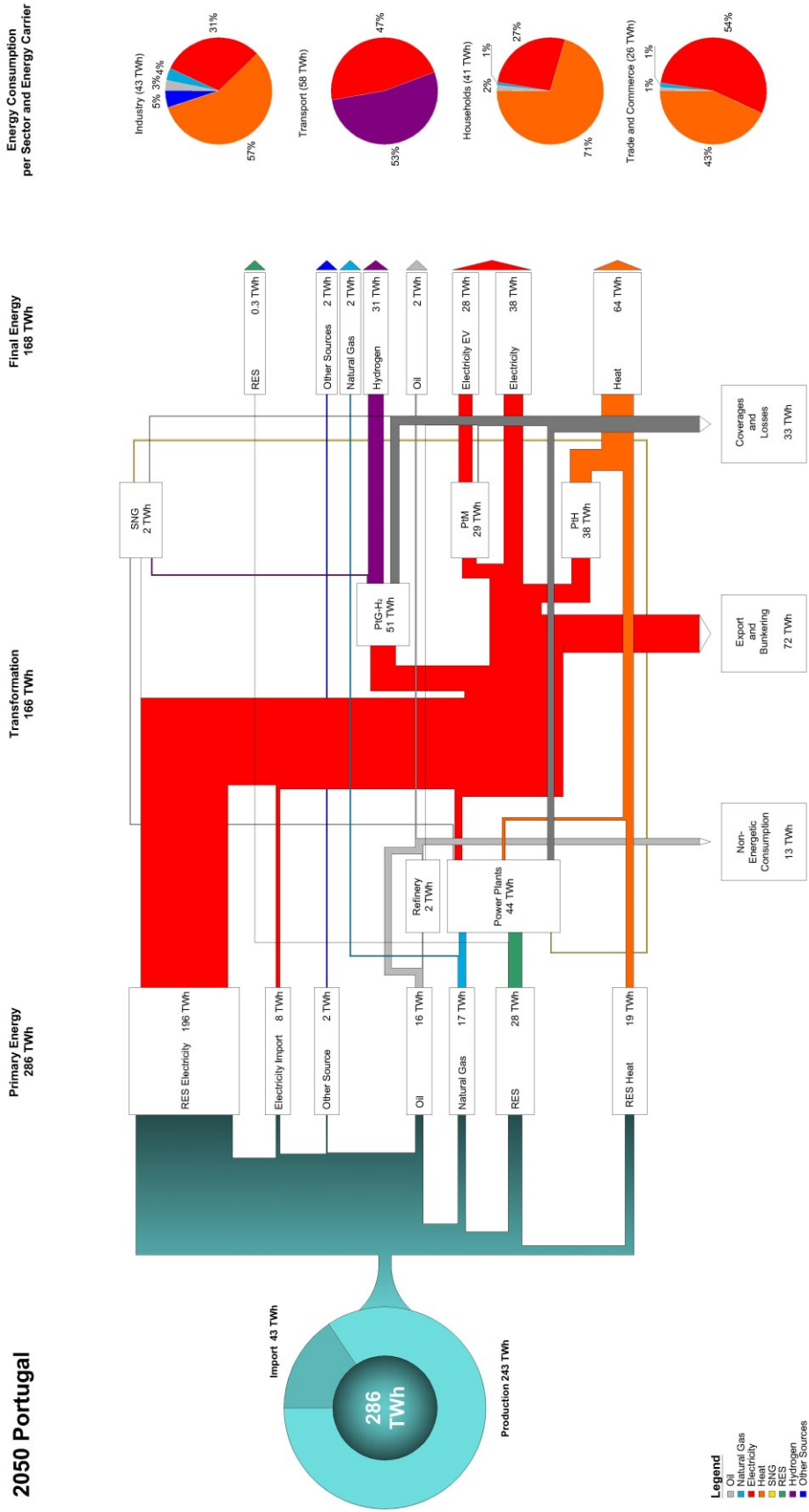


Fig. 64 Portugal 2050

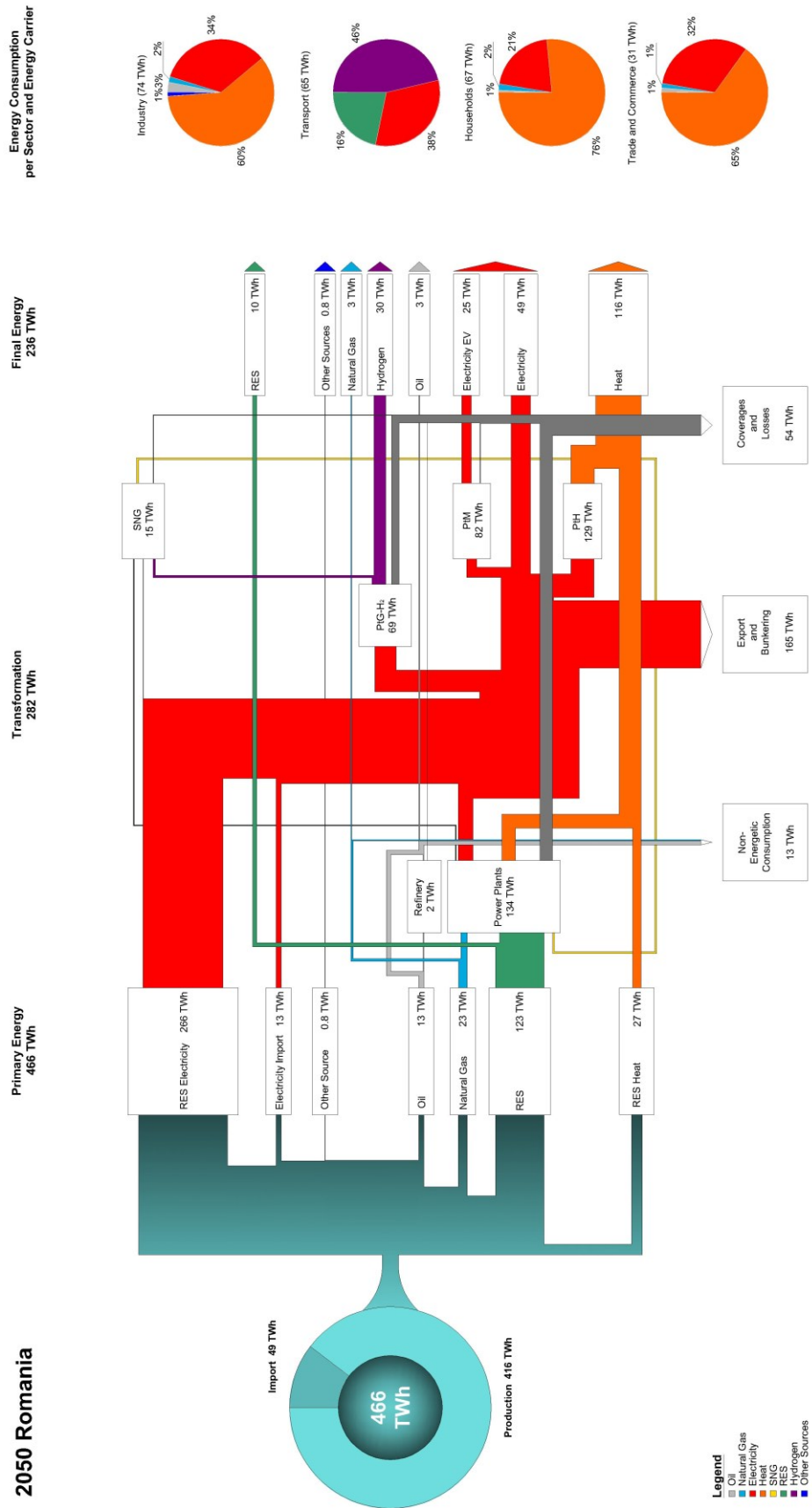


Fig. 65 Romania 2050

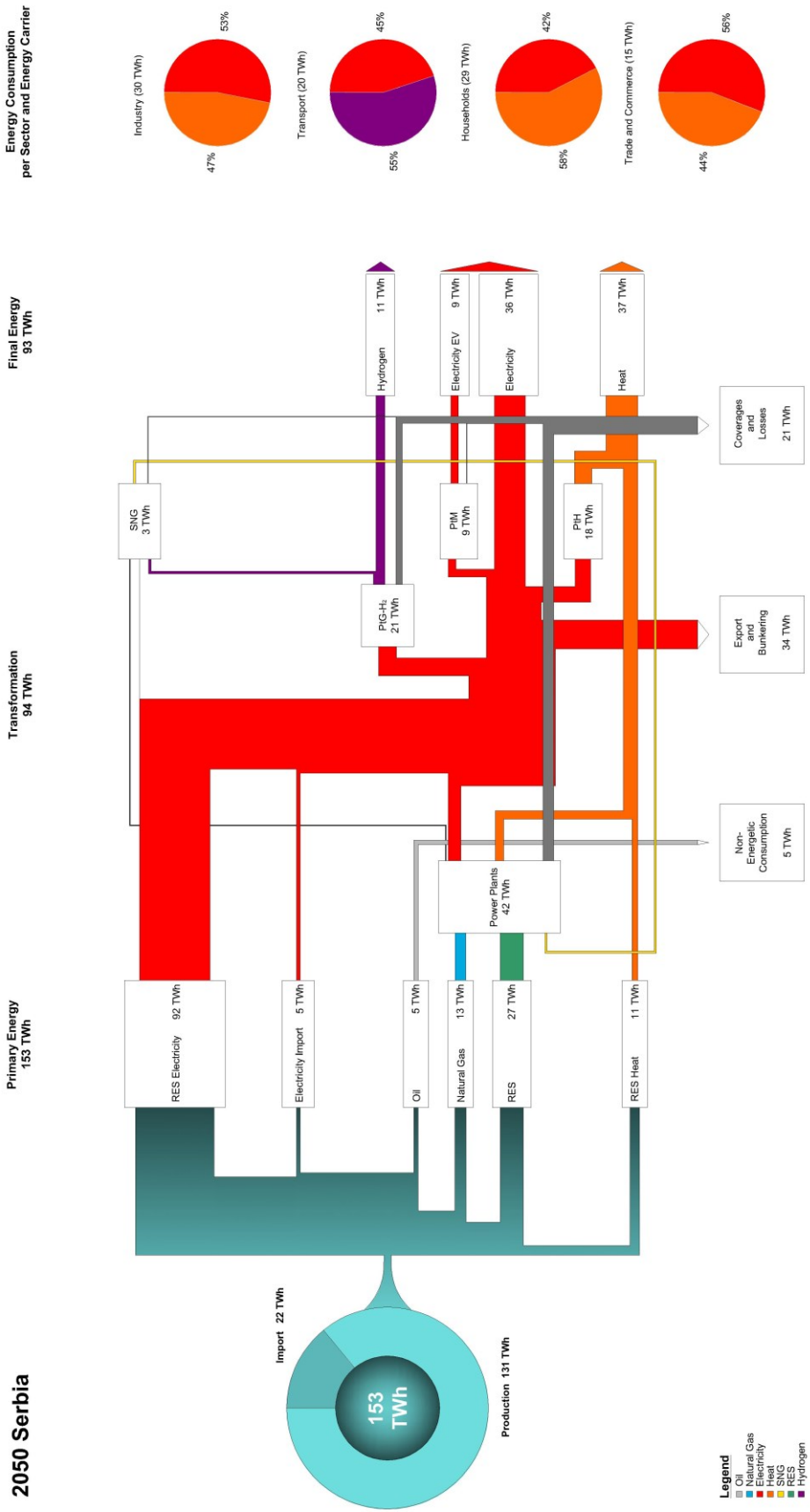


Fig. 66 Serbia 2050

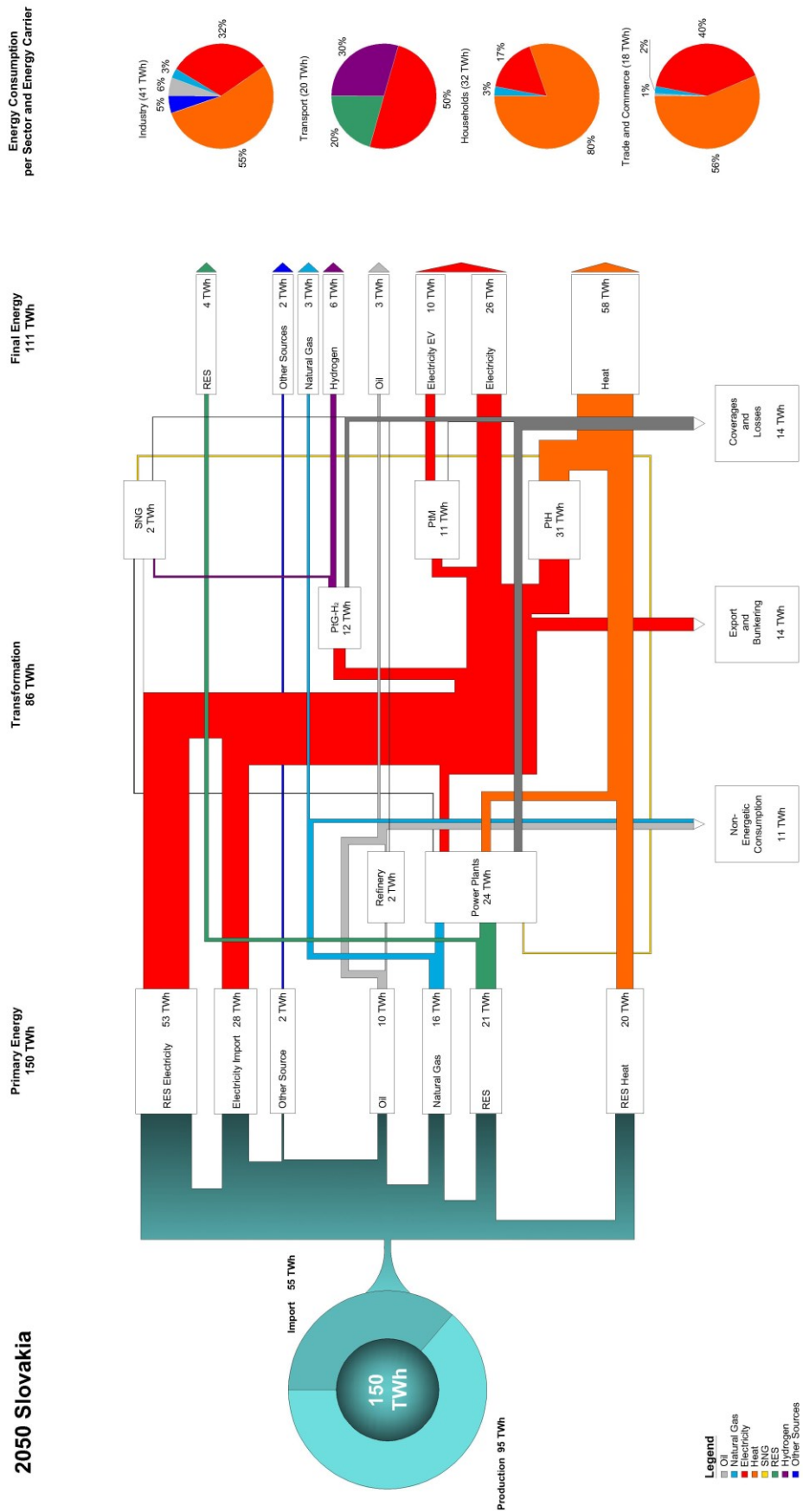


Fig. 67 Slovakia 2050

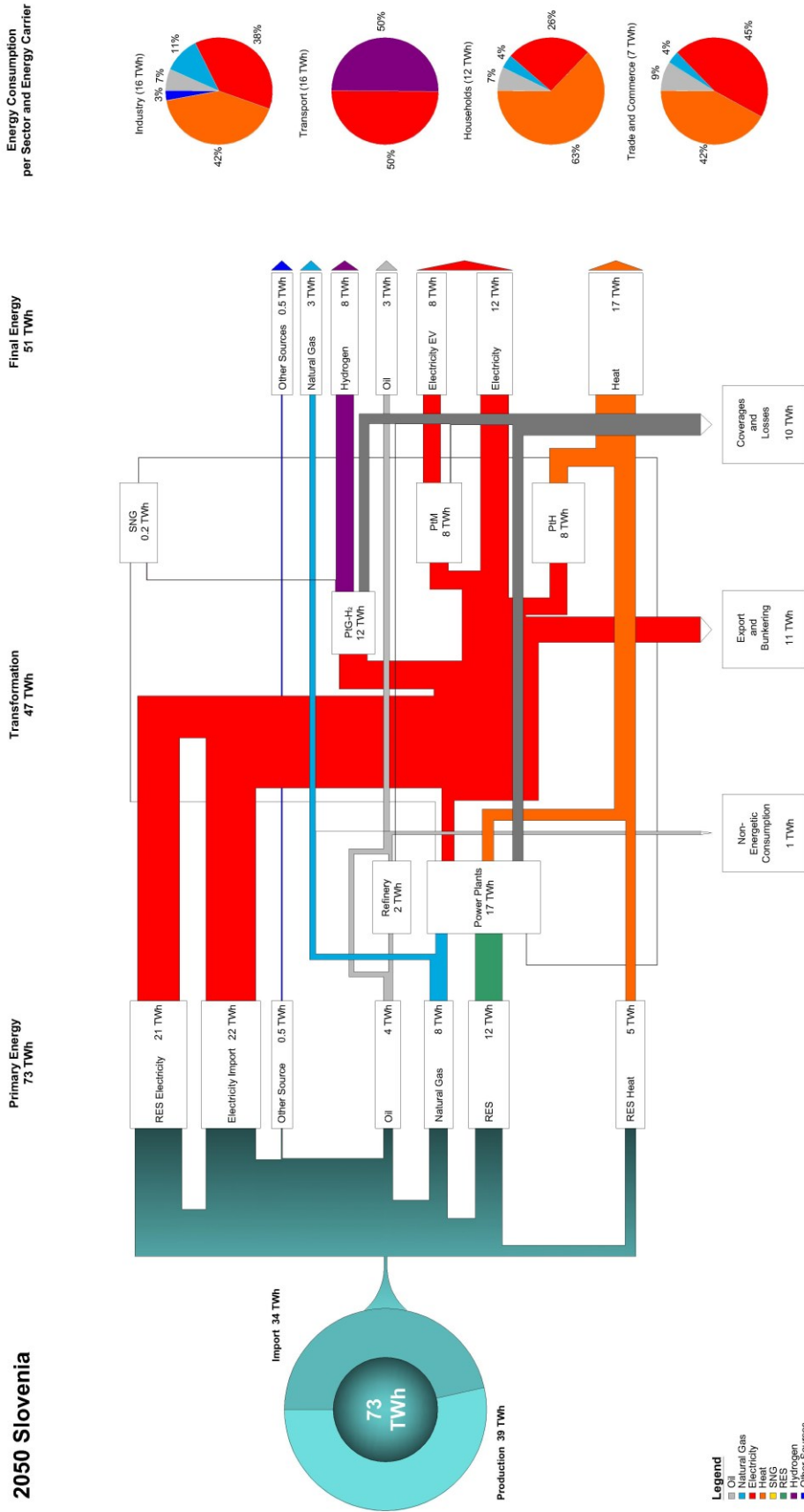


Fig. 68 Slovenia 2050

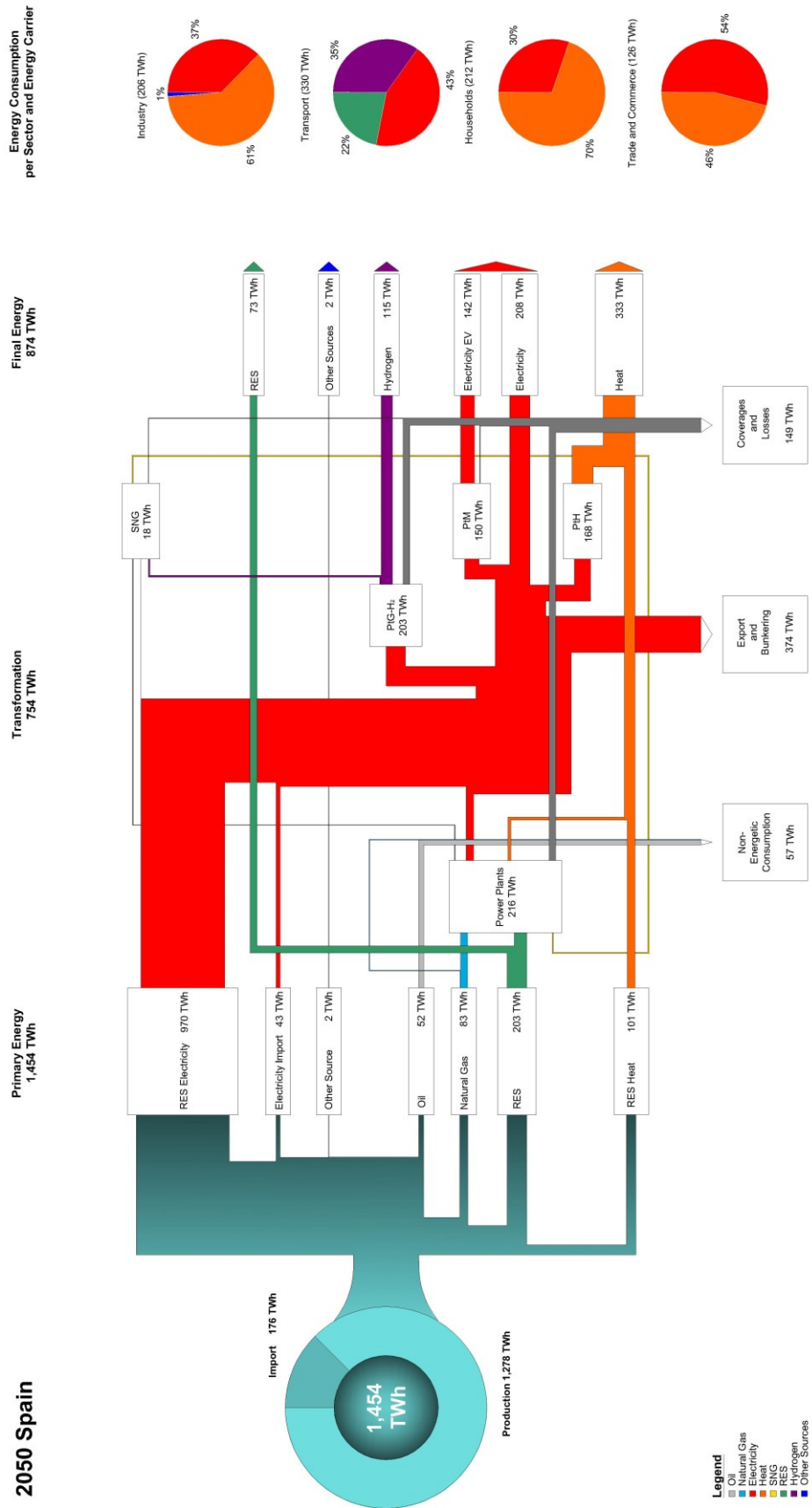


Fig. 69 Spain 2050

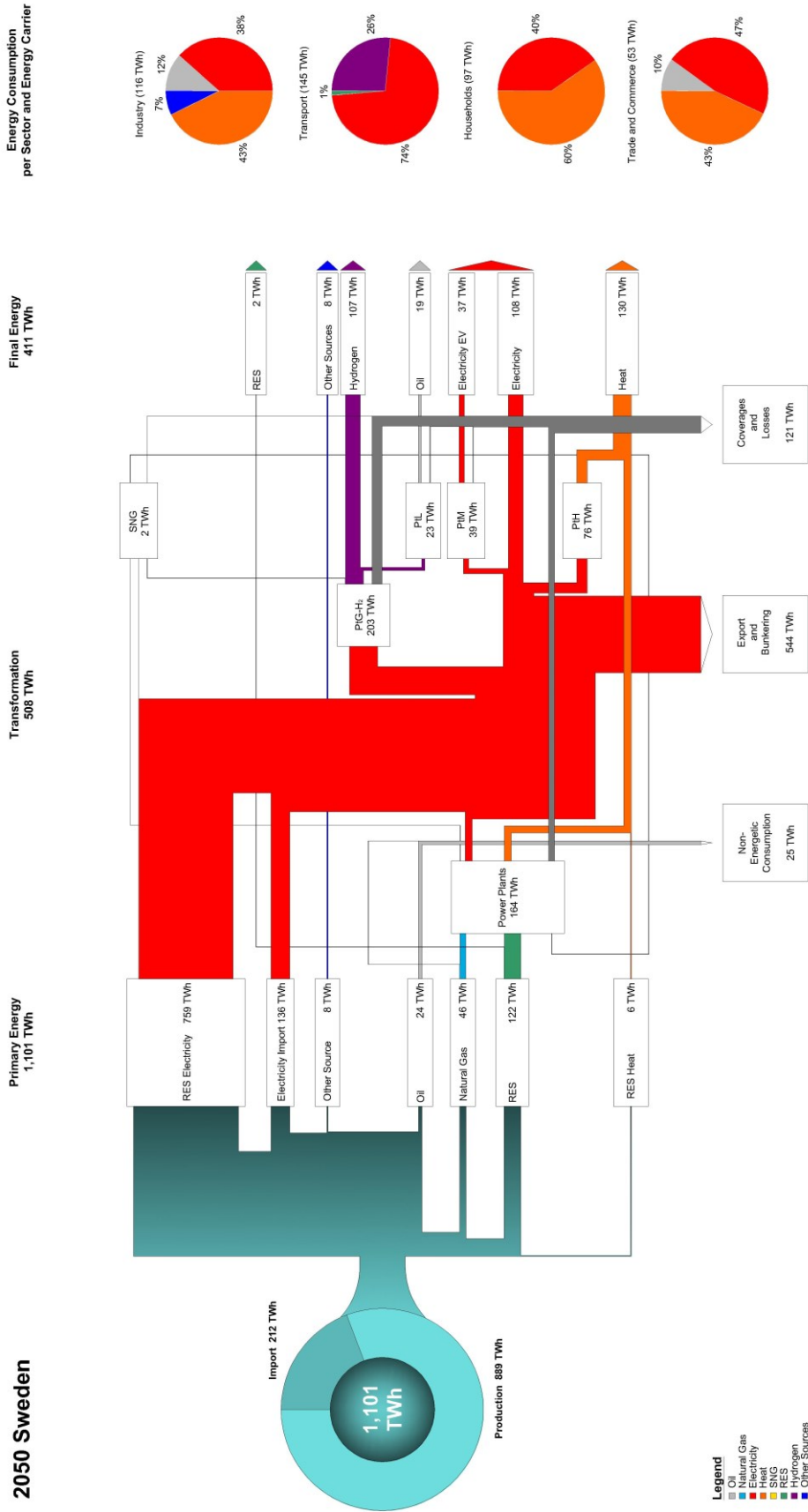


Fig. 70 Sweden 2050



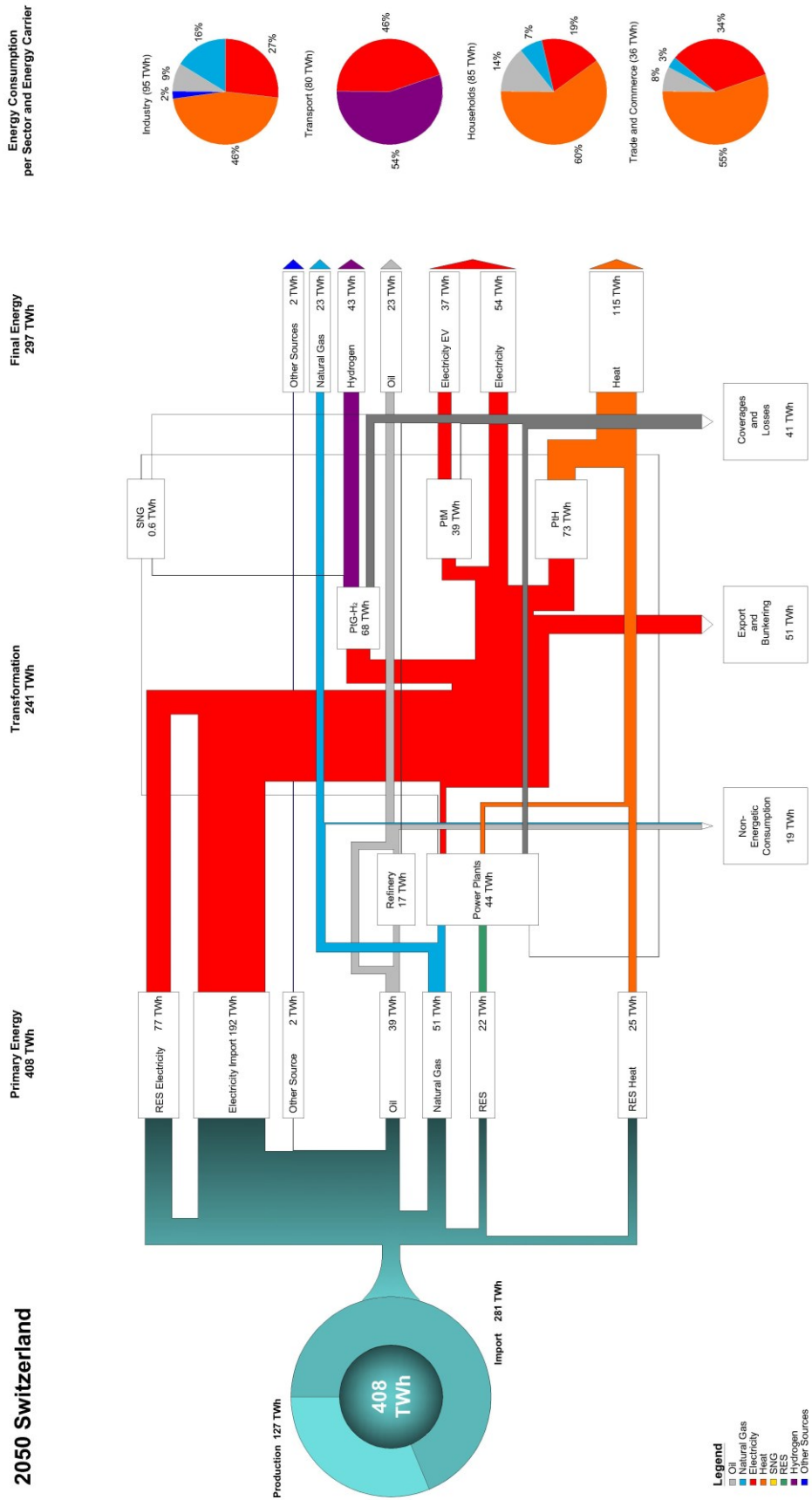


Fig. 71 Switzerland 2050

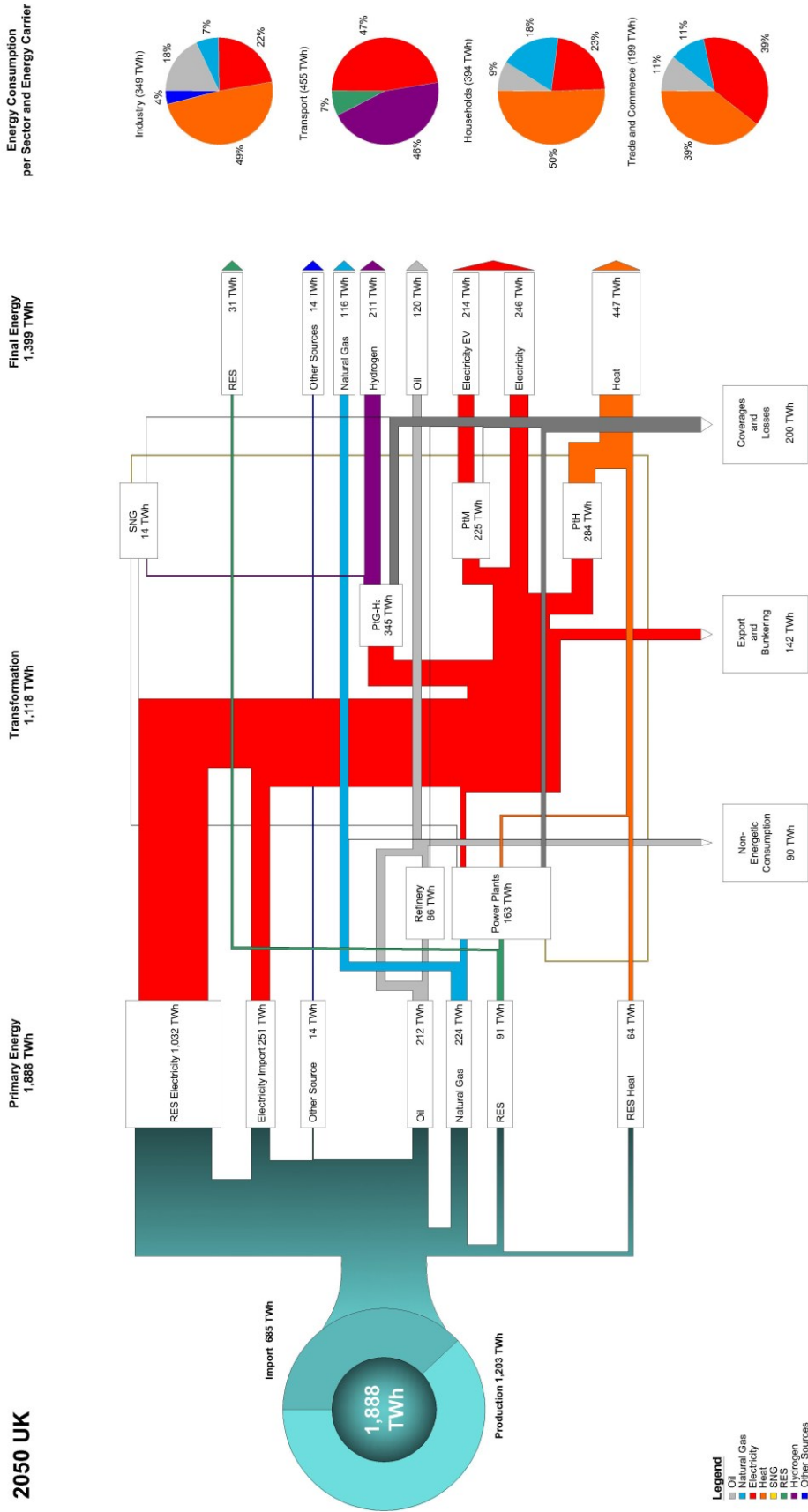


Fig. 72 United Kingdom 2050