

This brief presents an analysis of various scenarios for the deployment of heat pumps in Luxembourg over the period 2023 to 2050. Sales are projected to peak between 7,000 and 12,000 units per year, depending on the speed of adoption. In the long term, sales are expected to stabilize at approximately 5,000 units per year (this estimate excludes heat pumps installed in newly constructed buildings resulting from population growth). The corresponding stock of equipment will require a minimum of 200 to 300 equivalent full-time workers dedicated to installation and maintenance activities.

Luxembourg is taking decisive steps to decarbonize its domestic heating sector. Key developments include:

- Since **2023**, the government has **banned the installation of new fossil-fuel boilers** in buildings
- Approximately **140,000 gas and oil boilers are currently in operation**¹ and should be gradually replaced with heat pumps and biomass boilers. There are currently no mandatory deadlines for the complete replacement of existing boilers. Annex II of the Energy Performance of Buildings Directive (EU/2024/1275) sets 2040 as the target date for the full decarbonization of heating and cooling in buildings. However, as later clarified by the EU², this is not a binding deadline but rather an indicative timeline intended to guide Member States in developing effective policies.
- The government of Luxembourg is offering **generous incentives for renovations**³, covering up to 50% of the investment cost when replacing fossil fuel-based heating systems with renewable alternatives. Specifically, homeowners may receive approximately €9,000 for installing an aerothermal (air-to-water) heat pump and up to €13,000 for a geothermal heat pump. These amounts include bonuses for replacing old fossil-fuel systems and support for oil tank disposal.

Stock forecast

With the current policies in place, Luxembourg is expected to increase the heat pump stock from 5,193 units⁴ in 2023 (latest available data) to around 120,000 units¹ sometime after 2040.

While it is impossible to predict how the annual stock will evolve over such a long period, theoretical models can offer insight into potential future trends in sales and employment (Figure 1). These models represent different feasible trajectories connecting the initial and long-term (LT) stock levels. Four models have been implemented, with the first three assuming different levels of adoption by 2040:

- M1. Fast adoption:** 95% of the LT stock by 2040
- M2. Medium adoption:** 75% of the LT stock by 2040
- M3. Slow adoption:** 55% of the LT stock by 2040
- M4. Linear model:** the stock increases linearly from 2023 to 2045 and gradually aligns with the LT stock up to 2055. Models M1 to M3 are based on a generalized logistic adoption model for innovations.

Note that the behavior at the end on the period is asymptotic for all four models; therefore, exact time lapses are not particularly relevant in the final years of the simulation.

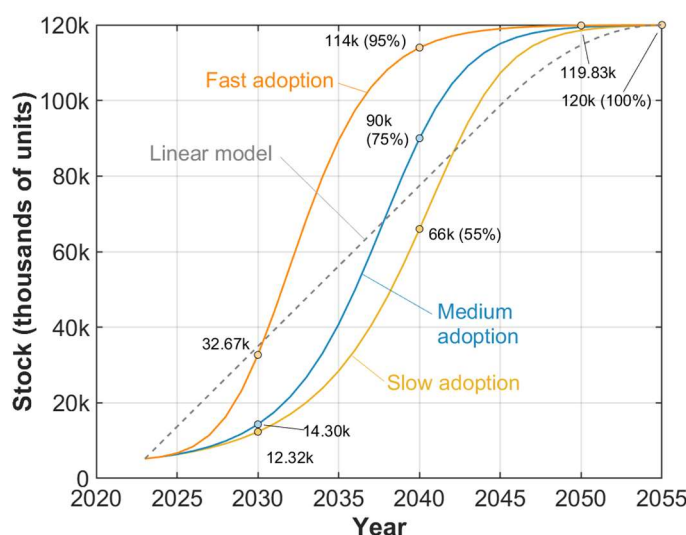


Figure 1. Scenarios for HP stock evolution in Luxembourg

¹ Re-Energize project, document *HPinsights02*

² www.europarl.europa.eu/doceo/document/P-9-2024-001119-ASW_EN.html (accessed April 2025)

³ www.klima-agence.lu/en/installing-heat-pump-your-home-benefits-and-funding-support (accessed April 2025)

⁴ www.eurobserv-er.org/heat-pumps-barometer-2024/ (accessed April 2025)

Annual sales forecast

Total sales are the sum of two components:

- **New units** replacing fossil-fuel boilers (Figure 2). The number of new units added each year is calculated as the difference in stock (Figure 1) between two consecutive years. Our calculations do not include sales of new heat pumps for new buildings constructed to accommodate future population growth; that is why sales of new units eventually decline to zero.
- **Replacement units** for heat pumps that have broken down. These units contribute to total sales but do not increase the overall stock. Replacements are estimated by modeling heat pump lifetimes as a normal distribution with a mean of 20 years and a standard deviation of 5 years, truncated at ± 3 sigma.

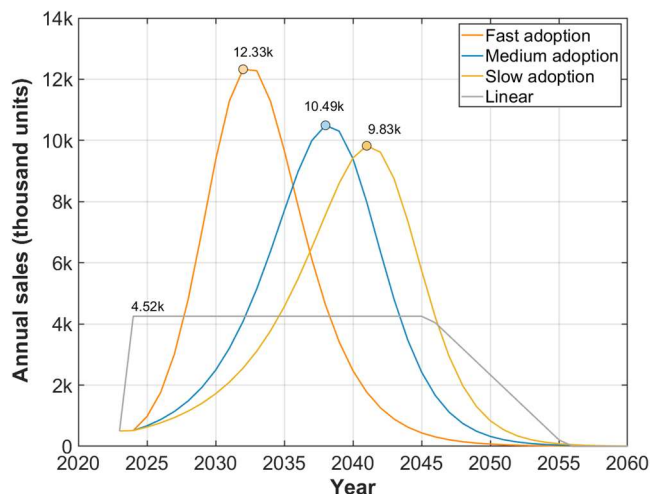


Figure 2. Sales of new units that replace fossil fuel boilers

Figure 3 shows total, new units and replacement sales for models M3 and M4.

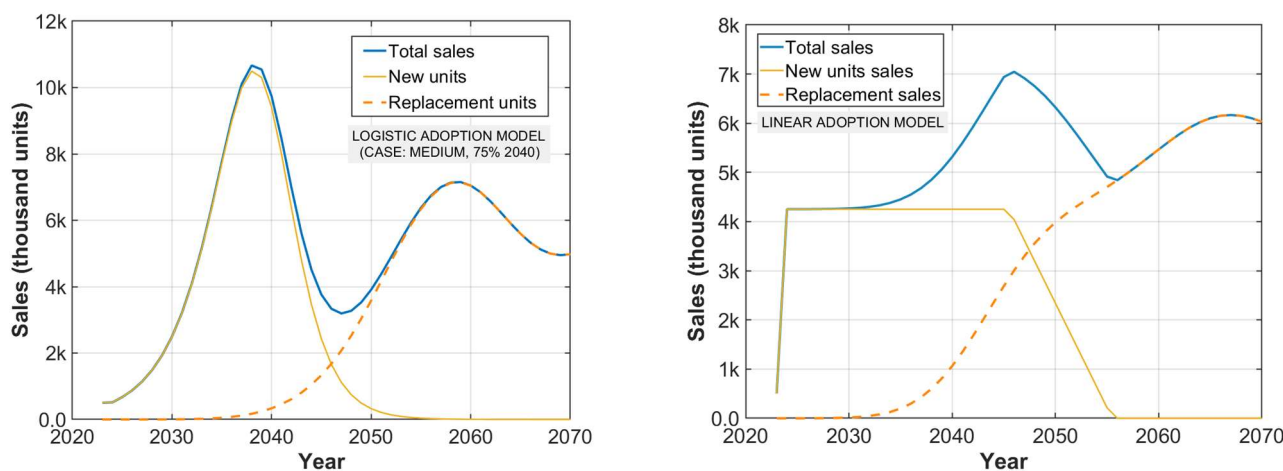


Figure 2: Annual sales for two cases, logistic adoption model (left) and linear model (right)

We can highlight the following facts:

- Sales of new units must grow significantly in the short term. In 2023, only 502 heat pumps were sold. According to Model M4 (linear), achieving full replacement by 2050 would require annual sales to increase to 4,252 units per year (Figure 2) and remain at that level for more than two decades. In contrast, Models M1 to M3 project a more gradual increase, but with higher peak sales needed to meet the 2040 target (Figure 2): Model M1 reaches a peak of 12,327 units per year in 2032; Model M2 peaks at 10,493 units in 2038; and Model M3 at 9,825 units in 2041. After these peaks, sales decline progressively as late adopters transition to heat pump heating.
- Replacements begin to rise significantly around 20 years after the onset of the new sales wave, eventually dominating

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long-term sales, which stabilize at approximately 5,000 units per year (this figure excludes new construction projects). The oscillation seen in the replacement curve of Figure 3 are caused by the propagation of the sales peak that occurred 20 years before.

- Peak total sales depend on the combination of sales of new units and replacements. The results for each model are: **M1** 10,184 units/year in 2041; **M2** 10,663 units/year in 2038; **M3** 12,347 units/year in 2032; **M4** 7,047 units/year in 2032

Employment forecast

The number of full-time jobs needed to install the number of units sold annually and maintain the stock of operating machines has been estimated assuming that an average worker can install 61 heat pumps per year and can service 1100 heat pumps per year. Figure 3 shows the results for M3 and M4 models. The development of the Luxembourgish heat pump market requires between **200 (long term) and 265 (peak, model M1)** equivalent full-time jobs to install and maintain the machines. **The number of persons in need of training will be higher**, as an installer normally does not employ 100% of his time on heat pumps but works on other technologies as well.

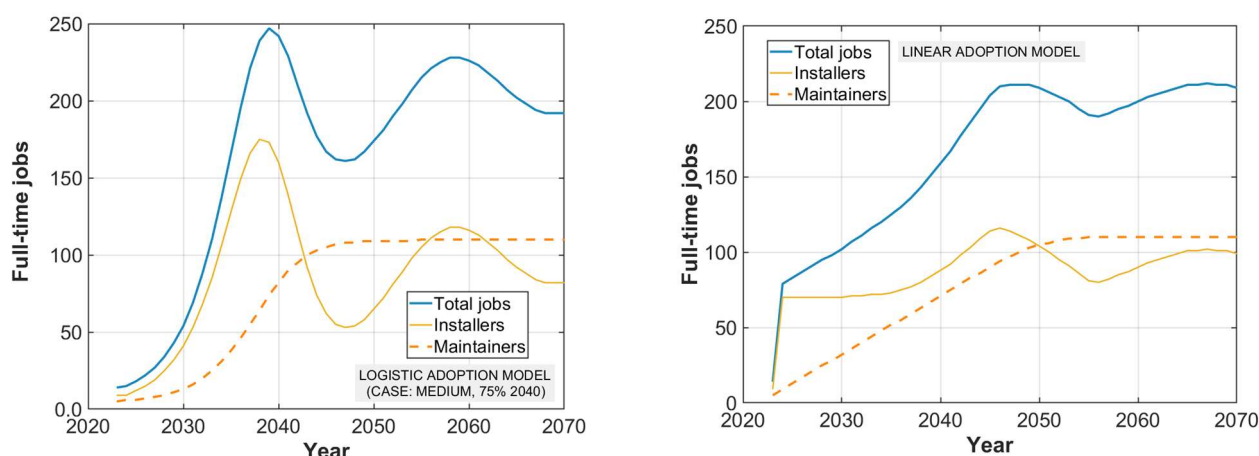


Figure 3: Annual full-time jobs for two cases, logistic adoption model (left) and linear model (right)

Table 1. Main results of the modelling

Model	Peak annual sales (Units (year))	Long-term annual sales (Units)	Peak EFT jobs	Long-term EFT jobs
Slow adoption	10184 (2041)	~ 5000	244	~ 200
Medium adoption	10663 (2038)	~ 5000	247	~ 200
Fast adoption	12347 (2032)	~ 5000	265	~ 200
Linear model	7047 (2046)	~ 5000	212	~ 200

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