Business model selection toolkit

Milestone 8.

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Executive Summary

Geothermal heat pump (GHP) systems are among the most efficient and climate-friendly technologies for heating and cooling. However, deployment is often hindered by high upfront investment costs, fragmented stakeholder responsibilities, and uncertainty around financing and risk allocation. This Business Model Selection Toolkit provides a structured, criteria-based framework to guide stakeholders in selecting appropriate business models for GHP investments.

The toolkit focuses on ten proven and emerging business models and applies a multi-criteria decision approach based on system scale, financial conditions, risk tolerance, stakeholder capacity, and strategic objectives. It supports homeowners, developers, ESCOs, utilities, municipalities, investors, and policymakers in making informed, replicable decisions that improve project bankability and accelerate large-scale adoption of GHP systems.

1. Introduction

Geothermal Heat Pump (GHP) systems represent one of the most energy-efficient and climate-friendly solutions for heating and cooling across residential, commercial, institutional, and industrial sectors. By exploiting the stable temperature of the subsurface, GHPs can deliver heating and cooling with high efficiency, low operating costs, and minimal greenhouse gas emissions.

Despite their technological maturity, GHP systems remain under-utilized in many markets. The main barriers are not technical, but rather related to high upfront investment costs, perceived drilling risks, limited access to financing, and the complexity of coordinating multiple stakeholders. Business models therefore play a decisive role in determining whether a GHP project is implemented successfully.

This Business Model Selection Toolkit has been developed to address these challenges. It provides a structured, criteria-based approach for selecting suitable business models for GHP investments, taking into account project scale, stakeholder characteristics, financial constraints, risk allocation preferences, and strategic objectives. It builds on industry best practices, case studies, and the Business Model Canvas methodology.

This document corresponds with a full report on "User-tailored catalogue of good practice business models to implement geothermal heat pumps systems at different scales", which was submitted in the GeoBOOST project under Deliverable D5.3. This report provides a full and comprehensive analysis of different business models presented via Business Model Canvas.

2. Purpose and scope of the toolkit

The primary purpose of this toolkit is to support informed decision-making for stakeholders considering investments in GHP systems. It does not prescribe a single solution, but instead offers guidance on how to align project characteristics with appropriate business model structures.

The scope of the toolkit covers small-scale systems below 20 kW, typically used in single-family homes and small commercial buildings; medium-scale systems between 20 and 150 kW, commonly applied in multi-family buildings, schools, hospitals, and commercial facilities; and large-scale systems above 150 kW up to multi-MW installations, including district geothermal networks and industrial applications.

The toolkit is intended for use by homeowners, property developers, building owners, energy service companies, utilities, municipalities, financial institutions, and policymakers.

3. Methodological framework

The toolkit is grounded in the Business Model Canvas methodology developed by Osterwalder and Pigneur, which provides a widely accepted framework for describing and comparing business models in a structured manner. The full description of this methodology is provided in the report D5.3 of the GeoBOOST project.

In addition, a multi-criteria decision framework is applied. The key criteria include technical parameters such as system size and load profile; financial parameters such as capital availability and cost of financing; risk-related parameters such as drilling and performance risk; stakeholder capacity; and broader strategic objectives.

The methodology recognizes that in many cases hybrid or blended business models may be required, particularly for medium- and large-scale GHP systems.

4. Business models covered

This toolkit focuses on ten business models that are particularly relevant for the deployment of GHP systems across different scales and market contexts.

The toolkit analyses only the following 10 models:

1. Retailer / Installer-Driven Model - traditional
2. Manufacturer One-Stop-Shop Model - traditional

3. Rental & Leasing (Equipment or Full Service)
4. ESCO Model / Energy Performance Contracting
5. Cooperative or Shared Ownership Model
6. Heat as a Service (HaaS) – Service Provider Model
7. Heat as a Service (HaaS) – Project Developer Model
8. Utility-Led On-Bill Financing
9. Public–Private Partnership (PPP)
10. Green Bonds / Climate Financing Model

1. Traditional ownership model (retailer model, manufacturing model)

- The end-user (homeowner, business, or institution) purchases and owns the GHP system outright.
- Installation costs are covered by the owner, potentially with the help of incentives, grants, or tax credits.
- Long-term savings come from reduced energy bills and maintenance costs.
- Best suited for: Homeowners, businesses with capital investment capacity, and organizations with access to subsidies.
- Challenges: High upfront capital costs, need for technical expertise in system selection and installation.

2. Rental and leasing model

- The customer leases the GHP system from a third-party provider rather than purchasing it.
- Monthly lease payments cover installation, maintenance, and operational costs.
- Some models offer a buyout option after a certain period.
- Best suited for: Small businesses, homeowners, and institutions seeking to reduce upfront investment.
- Challenges: Long-term contract commitments, potential higher costs over time, hard to combine with subsidies (as they are mainly based on traditional ownership model).

3. Energy-as-a-Service (EaaS)/Heat-as-a-Service (HaaS) led by Service provider or Project developer

- Instead of purchasing a GHP system, customers pay for the heating and cooling as a service.
- A third-party company installs, owns, and operates the system, and users pay based on energy consumption.
- This model removes technology risk and maintenance responsibility from the customer.
- Best suited for: Multi-family buildings, commercial facilities, municipalities.
- Challenges: Contract complexities, reliance on the service provider.

4. Utility-led on-bill financing

- Utility companies finance and own the GHP system while customers repay through their monthly utility bills.
- This lowers the barrier to entry for customers by removing the need for upfront capital.
- Can be structured as a fixed monthly payment or pay-as-you-save model.
- Best suited for: Homeowners and businesses in partnership with utilities.
- Challenges: Requires regulatory approval, potential concerns about long-term cost commitments.

5. Energy Service Company (ESCO) with performance-based contracts

- An Energy Service Company (ESCO) installs and manages the GHP system.
- The ESCO guarantees energy savings, and customers repay costs based on achieved savings (Performance-Based Contracting).
- Reduces customer risk while ensuring ongoing optimization and efficiency.
- Best suited for: Large commercial buildings, institutions, and industrial facilities.
- Challenges: Contract complexity, reliance on accurate savings measurement.

6. Public-Private Partnership (PPP)

- A collaboration between government entities and private investors to finance, install, and operate large-scale GHP systems.
- Often used in district heating projects, public housing, and municipal buildings.
- Governments may provide grants, tax incentives, or low-interest loans to reduce investment risks.
- Best suited for: Large-scale public projects, city-wide or district heating networks.
- Challenges: Long project timelines, regulatory barriers, need for strong public-private collaboration.

7. District Geothermal Heat Networks & Shared Ownership Models

- A centralized GHP system serves multiple buildings or users within a district.
- Customers pay a connection fee and usage-based rates for heating/cooling.
- The system may be owned by utilities, cooperatives or municipalities.
- Best suited for: Urban developments, industrial parks, and community energy projects.
- Challenges: High initial infrastructure costs, long payback periods, and regulatory approvals.

8. Carbon Credit & Green Financing Models

- GHP systems contribute to carbon emission reductions, allowing owners to earn carbon credits or participate in green financing programs.
- Projects may receive funding through sustainability-linked loans, green bonds, or international climate finance initiatives.
- Best suited for: Large-scale industrial and institutional projects with measurable carbon reductions.
- Challenges: Complex market mechanisms, verification requirements for carbon savings.

Each of these models differs significantly in terms of ownership structure, financing mechanisms, allocation of risks and responsibilities, and the role of different stakeholders. A comprehensive presentation via Business Model Canvas (Osterwalder) of these business models is included in the report D5.3. of the GeoBOOST project.

5. Key decision criteria for business model selection

Selecting an appropriate approach for implementing GHP systems depends on a combination of technical, financial, market, and stakeholder considerations. The choice of a specific product, service, or contractual model, which reflects different underlying business models, should take into account the unique characteristics of the project, the needs of the involved stakeholders, and external factors such as regulations and economic conditions. Figure 1 provides an overview of the main factors influencing these decisions. A full and comprehensive description of decision criteria is presented in the report D5.3.

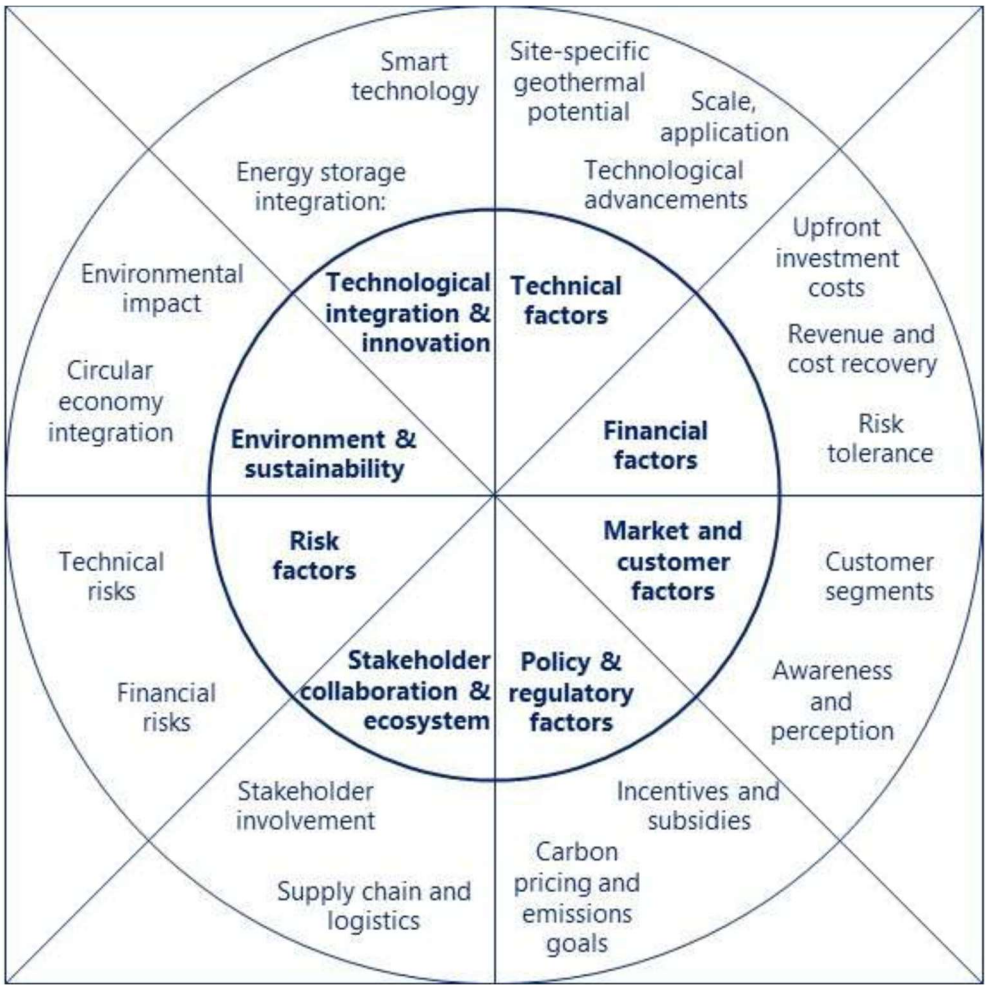

Fig. 1. Main factors influencing business model selection

In order to simplify the selection process it was decided by the GeoBOOST project to focus on the main dimensions influencing the choice of business model: technical criteria, financial criteria, risk-related preferences, stakeholder capacity and strategic objectives.

Technical criteria include the scale of the GHP system, the stability of the thermal load, the availability of land for drilling, and the potential for integration with existing or planned heating and cooling networks.

Financial criteria include the availability of upfront capital, access to debt or equity financing, eligibility for public subsidies or climate finance, and expectations regarding payback periods and long-term operating costs.

Risk-related criteria focus on who bears drilling risk, performance risk, demand risk, and long-term operational risk.

Stakeholder capacity involve technical expertise, management capacity, ownership preferences and operational capacity.

Strategic objectives consist of carbon neutrality (ESG), energy security and autonomy, and cost predictability – they all play a key role in business model selection.

6. Business model recommendations by system scale

For small-scale GHP systems below 20 kW, simplicity, affordability, and low transaction costs are essential. Retailer-driven models, manufacturer one-stop-shop solutions, and rental or leasing models are generally most appropriate.

For medium-scale systems between 20 and 150 kW, shared infrastructure and professional operation become increasingly important. ESCO models, cooperative or shared-ownership structures, and Heat as a Service (service provider) models are well suited to these applications. Suitable where multiple end-users share infrastructure, third-party ownership and performance guarantees matter.

For large-scale systems above 150 kW, including district energy and industrial applications, capital intensity and long asset lifetimes necessitate more complex business models such as utility-led on-bill financing, Heat as a Service (Utility / Operator), public–private partnerships, and green bond or climate-finance-based models.

7. Business model recommendations by stakeholder type

Stakeholder	Recommended Models	Reason
Homeowners	Direct Ownership, Leasing	Simple structure, minimal risk, , low administrative burden
Building developers	One-Stop-Shop, ESCO	Turnkey + predictable performance
Multi-family operators	Shared Ownership, ESCO	Aggregated users + stable demand
Municipalities	PPP, Green Bonds, ESCO	Access to public finance & long-term operation
Utilities	Utility-led On-Bill, HaaS	Billing systems + customer base
Industrial operators	HaaS, ESCO	Long-term high loads, stable contracts

Homeowners typically benefit from business models that minimize complexity and upfront investment, such as retailer-driven models, one-stop-shop solutions, and leasing.

Property developers and building owners often prefer turnkey solutions and performance-based contracts, making one-stop-shop, ESCO, and developer-led HaaS models attractive.

Municipalities and public authorities tend to favor models that align with public policy objectives and allow access to low-cost capital, such as PPPs, green bonds, and utility-led models.

8. Business model recommendations by financial conditions

Financial conditions are a decisive factor in the selection of appropriate business models for Geothermal Heat Pump (GHP) systems. The availability of upfront capital, access to external financing, and preferences regarding cost recovery and balance-sheet treatment strongly influence which business models are viable in practice. This section provides guidance on how different financial contexts—ranging from capital-constrained projects to investments with access to public or private finance—align with specific GHP business models. The objective is to support stakeholders in identifying solutions that reduce financial barriers, improve bankability, and ensure long-term economic sustainability. Based on different financial parameters following business models are to be taken into account.

8.1 High access to capital

- Direct Ownership
- One-Stop-Shop
- Developer-led HaaS

8.2 Limited upfront capital

- Leasing
- ESCO
- Utility On-Bill
- HaaS (Service Model)

8.3 Preference for predictable monthly payments

- HaaS
- Leasing
- Utility On-Bill

8.4 Desire for off-balance sheet financing

- ESCO
- Third-Party Ownership
- PPP

9. Business model recommendations by risk & operational constraints

Risk allocation and operational capacity play a critical role in determining the suitability of business models for GHP projects. Drilling uncertainty, performance guarantees, long-term operation and maintenance requirements, and stakeholder experience can significantly influence project outcomes. This section outlines how different business models address these

constraints by redistributing technical, financial, and operational risks and by offering varying levels of responsibility transfer to specialized actors.

9.1 Low tolerance for technical and drilling risk

- ESCO
- HaaS
- Utility-Led On-Bill
- PPP

9.2 High operational capacity

- Retailer ownership
- Manufacturer One-Stop-Shop
- Developer-Led HaaS

9.3 Limited operational capacity

- ESCO
- Utility models
- PPP

10. Business model recommendations by strategic objective

Strategic objectives strongly influence the choice of business model for geothermal heat pump systems. Whether the primary goal is cost reduction, rapid deployment, climate neutrality, or the modernization of district energy infrastructure, different business models offer distinct advantages. This section links common strategic objectives to best-fit business models, helping stakeholders align technical and financial solutions with long-term policy, investment, and operational goals.

Strategic Objective	Best-Fit Business Models
Maximize cost savings	Direct Ownership, ESCO
Minimize upfront investment	HaaS, Utility On-Bill, Leasing
Fast deployment	One-Stop-Shop, Leasing
Climate neutrality / ESG alignment	Green Bonds, Cooperative Ownership
District energy modernization	Utility-Led, PPP
Demand flexibility integration	Digital ESCO, Aggregator-enabled HaaS

11. Integrated business model selection matrix

The Integrated Business Model Selection Matrix is designed as a qualitative decision-support tool. Its purpose is not to deliver a single, automatic answer, but to structure and support informed decision-making when selecting appropriate business models for Geothermal Heat Pump investments. The matrix synthesizes expert judgement, market experience, and best practices into a transparent and comparable format.

The numerical scores assigned in the matrix (1 = limited suitability, 2 = suitable, 3 = highly suitable) should be interpreted as indicative guidance rather than quantitative rankings. They reflect the relative alignment between specific project characteristics (such as system scale, capital availability, risk tolerance, or governance context) and the structural strengths of each business model.

The criteria provided in the matrix were selected as the most relevant among all the criteria showed in the chapter 5.

Identification of Candidate Business Models

Multiple "3" scores within a row indicate candidate business models that are particularly well suited to the corresponding project condition or investment context. In practice, stakeholders are encouraged to:

- Focus on business models that score highly across several relevant criteria, rather than on a single row only;
- Shortlist two or three candidate models for further detailed analysis;
- Use the matrix as a first screening step before conducting technical, financial, and regulatory feasibility assessments.

The presence of several highly suitable models reflects the diversity of possible implementation pathways for GHP systems and acknowledges that different organisational and financial structures can lead to successful outcomes.

Role of Hybrid Business Models

It is important to note that hybrid business models are often the most effective solution, particularly for medium- and large-scale GHP projects. Hybrid models combine strengths from different columns of the matrix, for example:

- A Public–Private Partnership (PPP) supported by Green Bonds or climate finance;

- A Utility-led On-Bill Financing model combined with a Heat as a Service (HaaS) delivery approach;
- An ESCO model embedded within a cooperative or community ownership structure.

Such combinations allow stakeholders to optimize risk allocation, financing conditions, and operational performance while aligning with strategic objectives such as climate neutrality, affordability, and long-term infrastructure planning.

Position of the Matrix in the Decision Process

The matrix should therefore be understood as:

- A starting point for structured discussion among stakeholders;
- A tool for transparent comparison of business model options;
- A means to improve bankability and project design by narrowing down feasible models early in the planning process.

Final business model selection should always be complemented by:

- Detailed technical studies;
- Financial modelling;
- Legal and regulatory analysis;
- Stakeholder consultation.

Expanded Integrated Business Model Selection Matrix for GHP Systems
(3 = Highly suitable | 2 = Suitable | 1 = Limited suitability)

	BM1 Retailer	BM2 One-Stop-Shop	BM3 Leasing	BM4 ESCO	BM5 Cooperative	BM6 HaaS-SP	BM7 HaaS-Dev	BM8 Utility On-Bill	BM9 PPP	BM10 Green Bonds
Small-scale (<20 kW)	3	3	2	1	1	1	1	1	1	1
Medium-scale (20–150 kW)	1	2	2	3	3	3	3	2	2	2
Large-scale (>150 kW)	1	1	1	2	2	3	3	3	3	3
Low upfront capital	1	2	3	3	2	3	2	3	2	1
High upfront capital	3	3	1	1	2	1	2	1	2	3
Low risk tolerance	1	2	3	3	2	3	2	3	3	2
High operational capacity	3	2	1	1	2	1	2	1	1	1
Low operational capacity	1	2	3	3	2	3	2	3	3	2
Multi-user / shared assets	1	1	1	3	3	2	2	2	2	1
Utility involvement required	1	1	1	2	1	3	2	3	3	2
High ESG / climate priority	1	2	2	3	3	3	2	3	3	3
Public sector leadership	1	1	1	2	2	2	2	3	3	3

12. Implementation Roadmap

The implementation process begins with defining project objectives and scope, followed by the application of the selection criteria and shortlisting of suitable business models.

Next, a detailed Business Model Canvas should be developed, supported by technical and financial feasibility studies.

Finally, financing structures and contracts are established, the system is implemented, and performance is monitored over time.

13. Conclusions and Key Takeaways

Business model selection is a critical success factor for the widespread deployment of geothermal heat pump systems.

There is no single optimal business model; instead, solutions must be tailored to specific project conditions and stakeholder needs.

Service-based and performance-based models are particularly effective in reducing barriers and enabling scale-up.

This toolkit provides a transparent and replicable framework to support decision-making and accelerate the energy transition.