Αντλίες θερμότητας

Επέκταση της διείσδυσης και Ανάπτυξη τους

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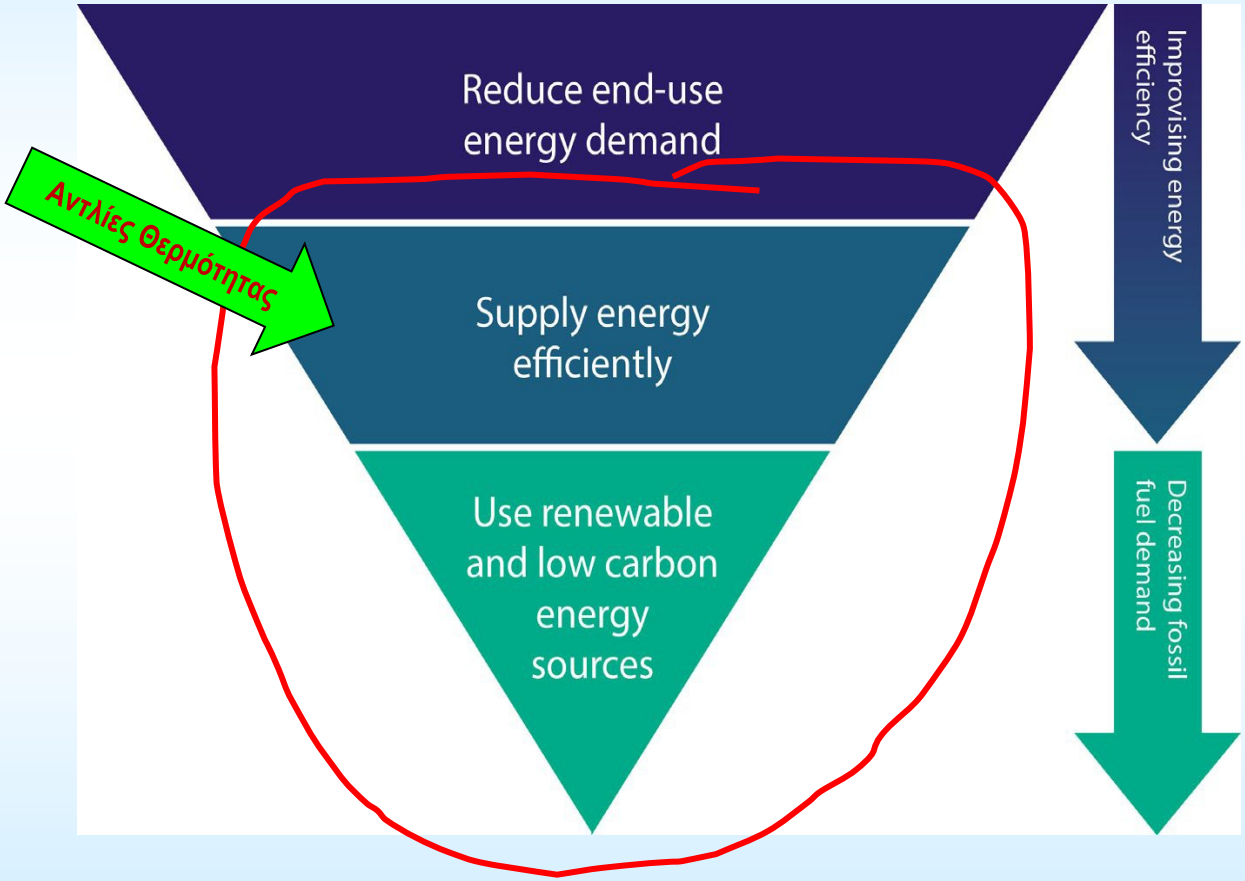
Καθηγητής Σχολής Μηχανολόγων ΕΜΠ

Απανθρακοποιηση Ενεργειακού Τομεα
Ο ρόλος κλειδί της Ενεργειακής Αποδοτικότητας
Ιεράρχηση δράσεων



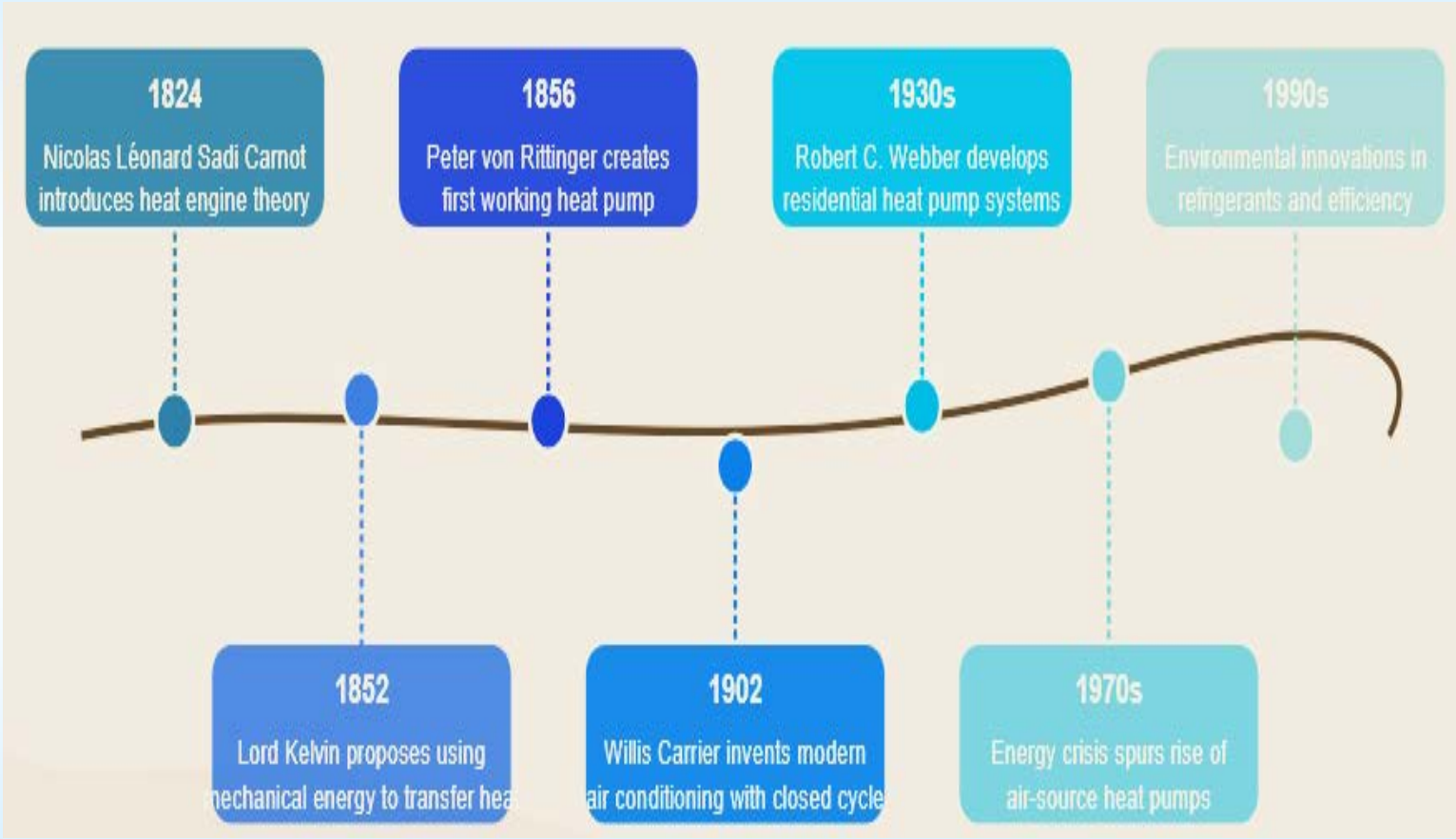
Πηγή: https: https://www.seai.ie/sites/default/files/publications/Heat-Pump-Implementation-Guide.pdf, Heat Pumps - Implementation Guide,

Αντλίες Θερμότητας: Μια απο τις τεχνολογίες-κλειδί για την ενεργειακή μετάβαση

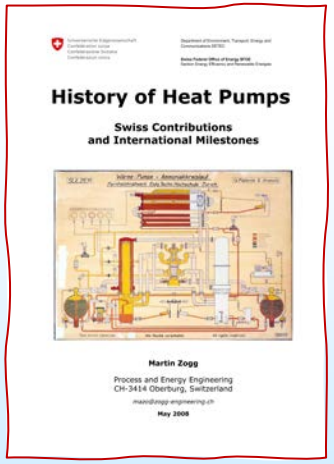
The analysis covers six key clean energy technologies – electric vehicles (EVs), batteries, solar photovoltaics (PV), wind turbines, heat pumps and electrolysers – which together account for around half of global clean energy investment spending and have a combined market size of more than USD 700 billion. The analysis also

Πηγή:https:IEA Energy Technology Perspectives 2024

Αντλίες Θερμότητας: Παλιοί γνώριμοι, νέοι σύμμαχοι



Μια εναργής ιστορική παρουσίαση


History of Heat Pumps

Swiss Contributions and International Milestones

Martin Zogg

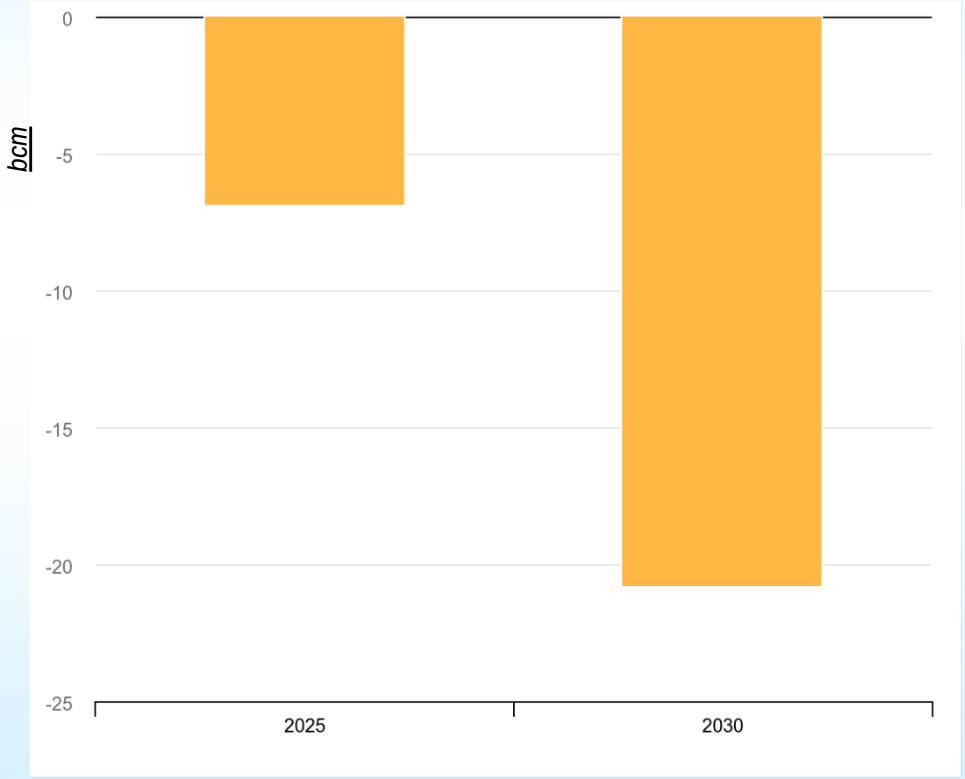
Process and Energy Engineering
CH-3414 Oberburg, Switzerland

May 2008

Δεδομένα διαγράμματος απο: *https://zealux.com/the-history-of-heat-pump-development/*

Διείσδυση Αντλιών Θερμότητας: παράδειγμα οφέλους

IEA:Cumulative natural gas savings related to annual heat pumps installations in the European Union, 2025-2030



In 2024, the EU's total gas consumption was 332 bcm.
Από gas market report for the fourth quarter of 2024

Πηγή: https://www.iea.org/data-and-statistics/charts/cumulative-natural-gas-savings-related-to-annual-heat-pumps-installations-in-the-european-union-2025-2030

Διείσδυση και Εξάπλωση Αντλιών Θερμότητας Απαιτεί Κίνητρα

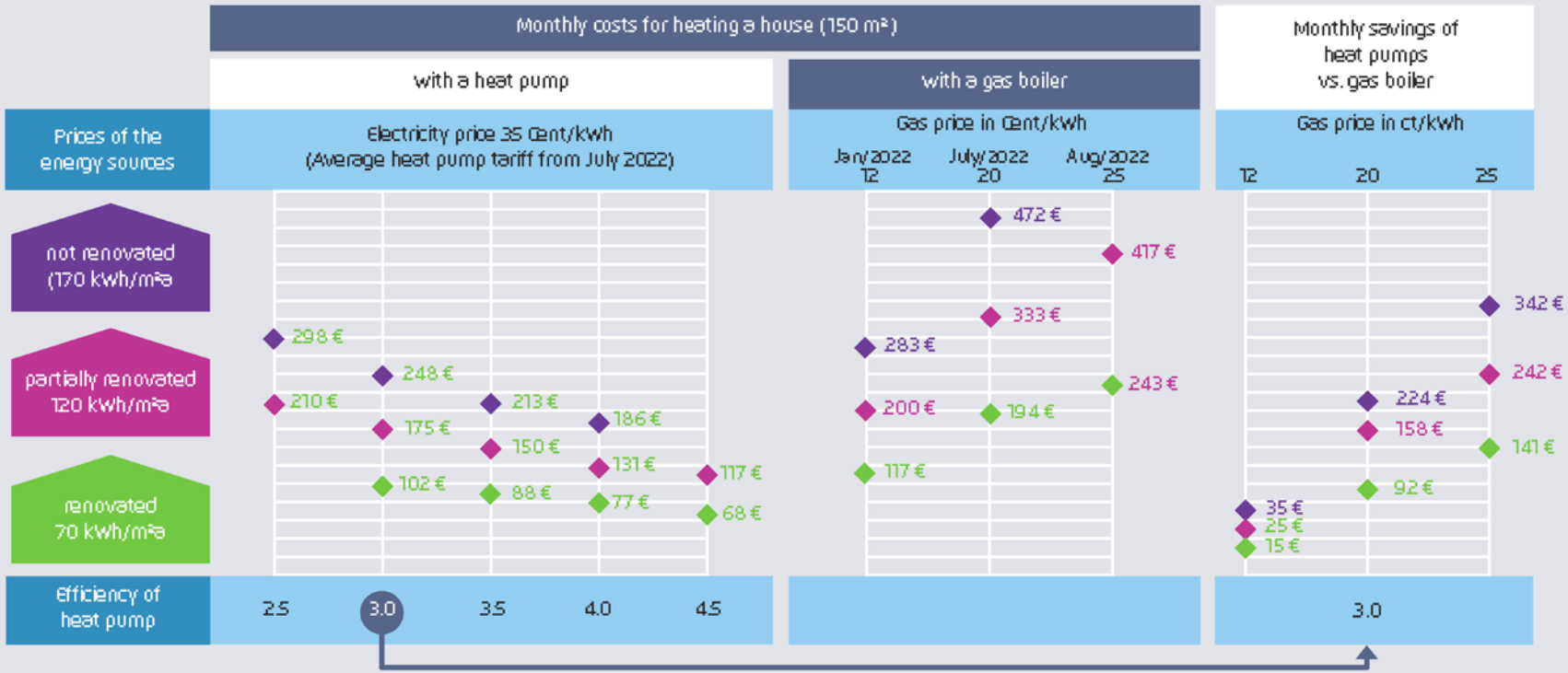
- ***Κίνητρα από την τεχνολογία***
  - *Οικονομικότητα συγκριτικά με εναλλακτικές*

- ***Κίνητρα από την πολιτεία***
  - *Δημιουργούν όφελος ακόμη και όπου η τεχνολογία έχει μεγαλύτερο κόστος*

Κίνητρο για τον χρήστη: οικονομικό όφελος

The operating costs for heat pumps are lower than those for gas boilers. Policy should ensure that the gas-to-electricity price ratio makes heat pumps the more economical choice.

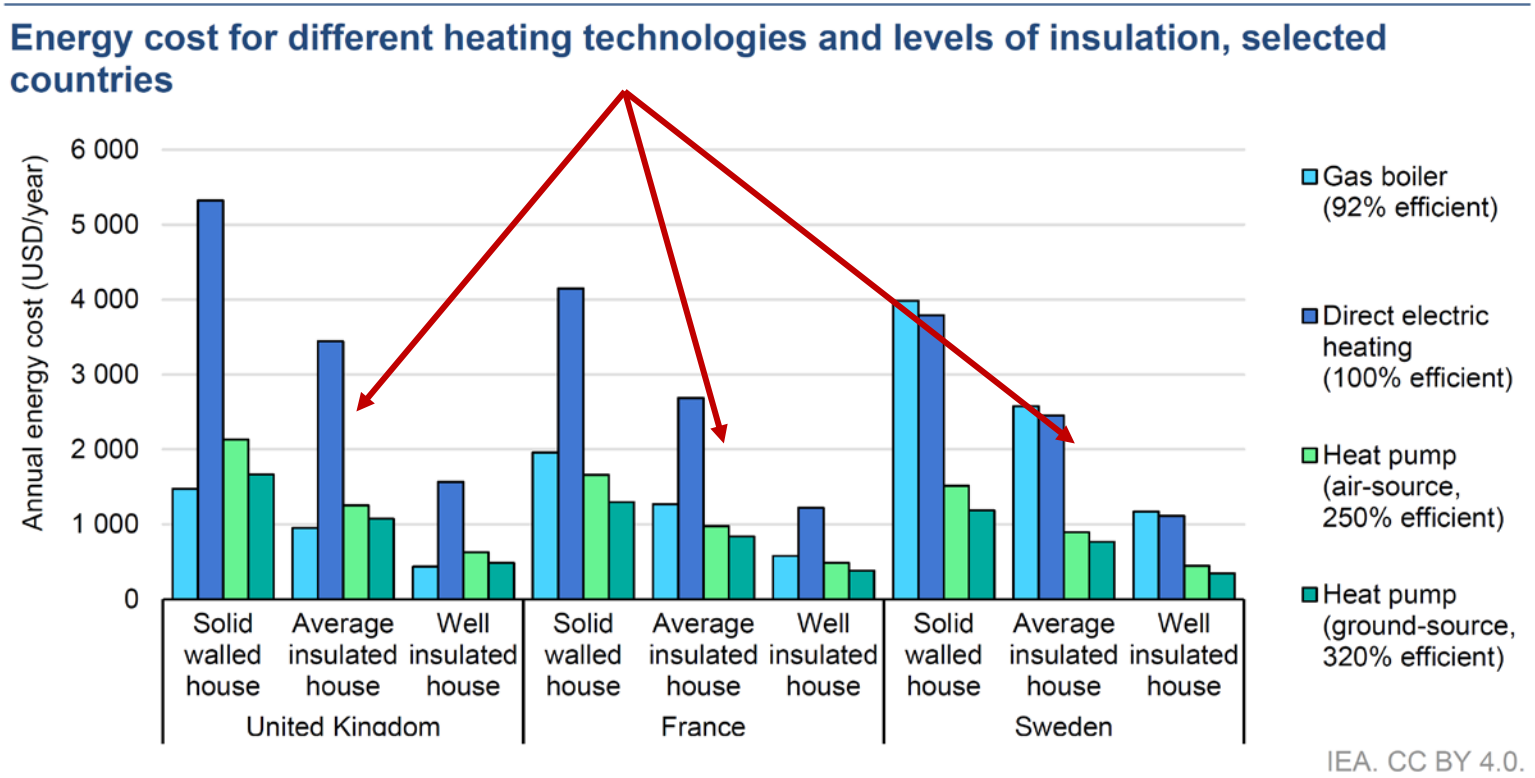
Agora Energiewende



Fraunhofer ISE (2022)

https://www.agora-energiewende.org/fileadmin/Projekte/2022/2022-04_DE_Scaling_up_heat_pumps/2022_Scaling_up_heat_pumps_in_Germany.pdf

Ενδεικτικά Συγκριτικά Στοιχεία Κόστους Θέρμανσης

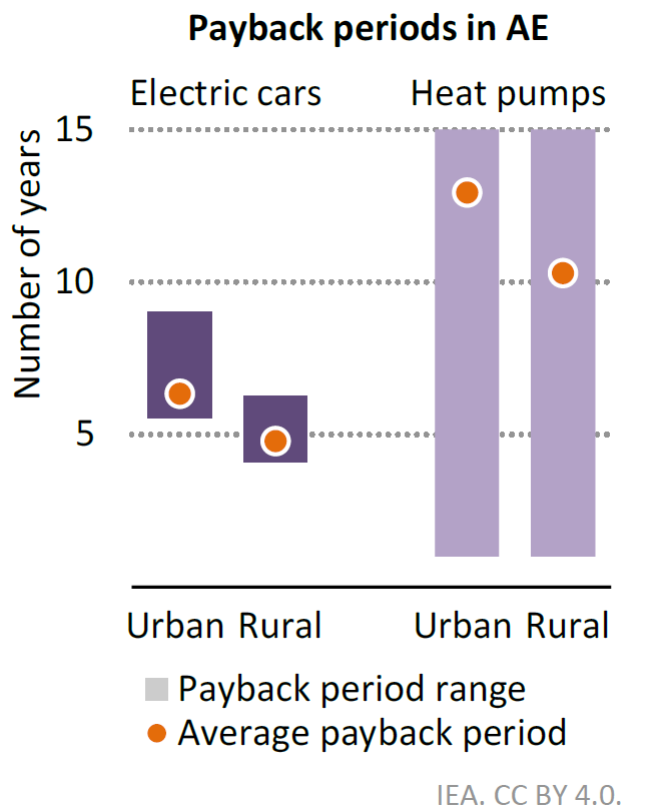


Notes: Annual heating demand estimations are based on a typical two-storey residential house. The analysis assumes tariffs for gas and electricity for each country. United Kingdom: USD 0.31/kWh (electricity), USD 0.08/kWh (gas); France: USD 0.25/kWh (electricity), USD 0.11/kWh (gas); Sweden: USD 0.23/kWh (electricity), USD 0.22/kWh (gas).

Πηγή: IEA Energy Efficiency 2024

Εναλλακτική έκφραση οικονομικού οφέλους: χρόνος αποπληρωμής

Key clean technology payback periods by urban and rural areas, 2023 (AE: Advanced Ecomnomies

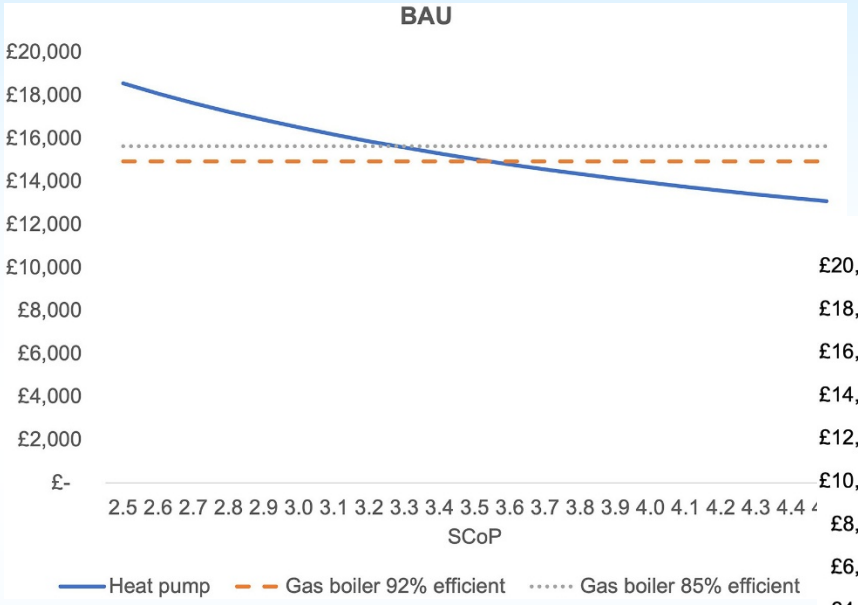


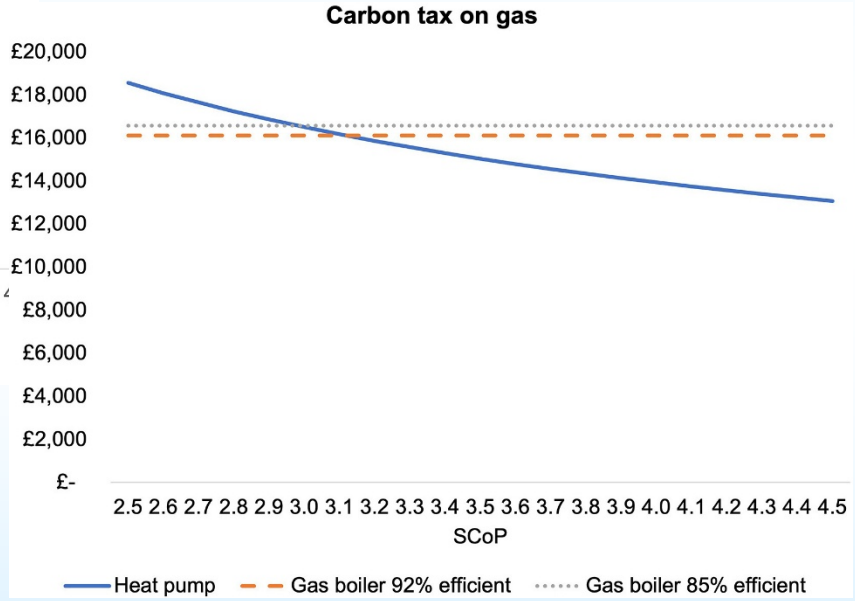
«Overcoming the higher upfront costs for many clean energy technologies is a challenge, but rural households might benefit more than urban households from lower operating costs «

Πηγή: IEA World Energy Outlook 2024

Σχεδιασμός Πολιτικής

Τεχνο-οικονομικές εκτιμήσεις





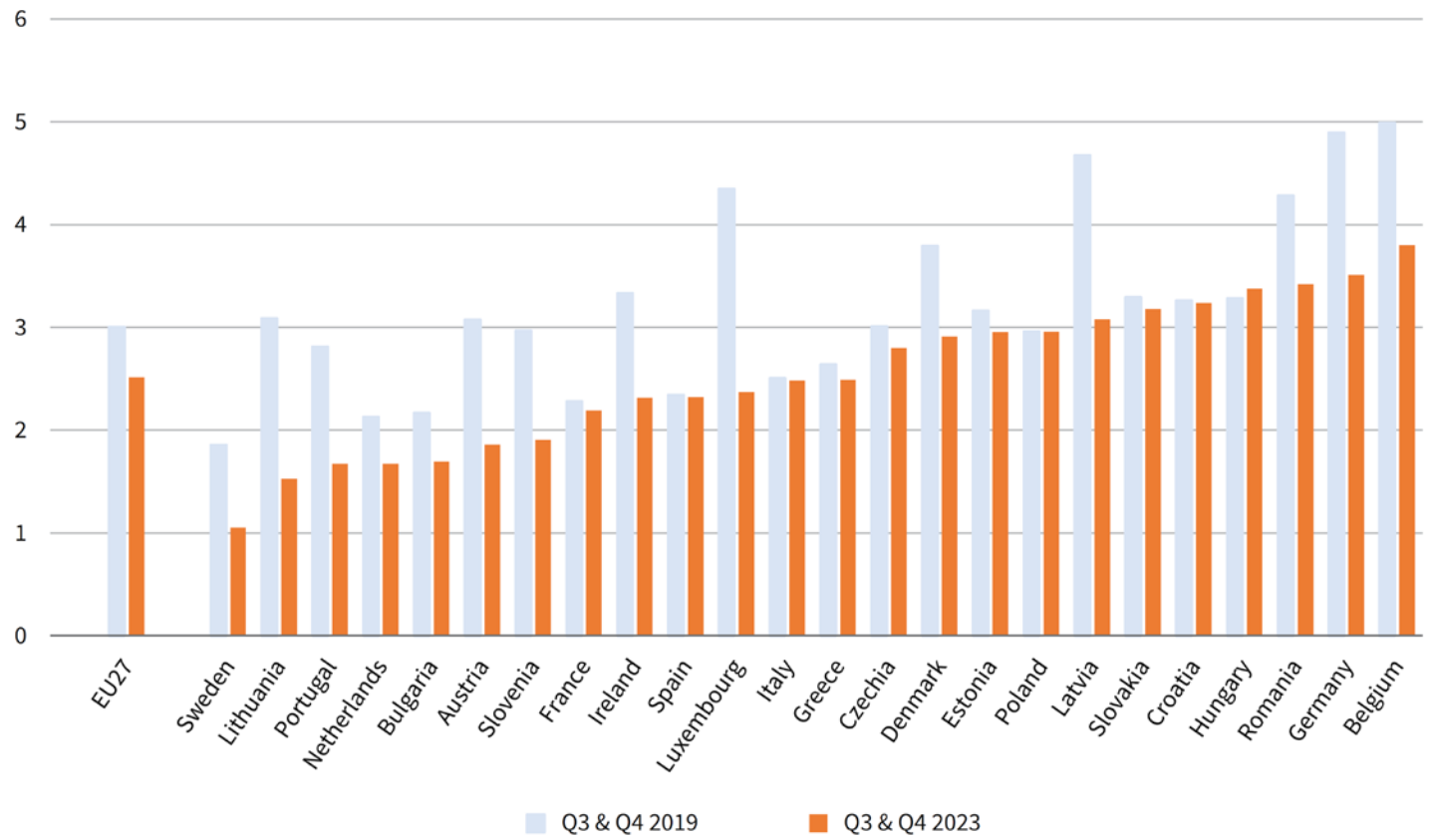
Παράδειγμα εκτίμησης αποδοτικότητας σε σύγκριση με λέβητες αερίου, για διαφορετικές τιμές συντελεστή συμπεριφοράς.

Συνολικό κόστος θέρμανσης για διάρκεια ζωής 20 χρόνια

Πηγή: *Rosenow J, Barnes J, Galvin R, O'Mara S, Lowes R. Total cost of ownership of heat pumps and policy choice: The case of Great Britain. iScience. 2025 Feb 21;28(2).*

Κρίσιμος παράγοντας ο λόγος κόστους ηλεκτρισμού/αερίου

Figure 5: Ratio of electricity to gas prices for household consumers, selected Member States, € per kWh, Q3 and Q4 2019 and Q3 and Q4 2023



Source: *Eurostat [nrg_pc_202] for gas: consumption from 20 to 199 gigajoules; [nrg_pc_204] for electricity: consumption bracket 2,500–4,999 kWh*

Eurofound (2024), Decarbonisation of residential heating and cooling: The heat pump challenge, Eurofound research paper, Publications Office of the European Union, Luxembourg.

Οι Χώρες της ΕΕ εχουν εφαρμόσει διάφορες πολιτικές προώθησης

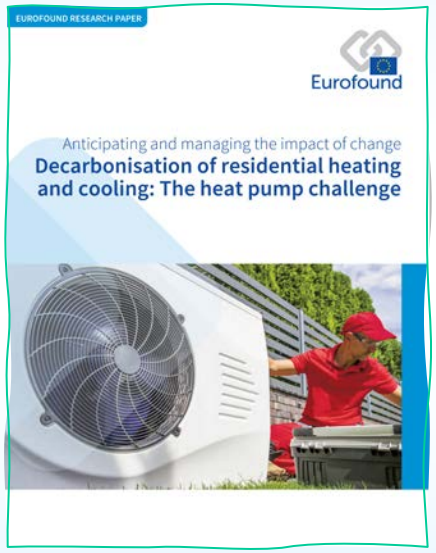


Table 5: Examples of heat pump subsidies in selected Member States

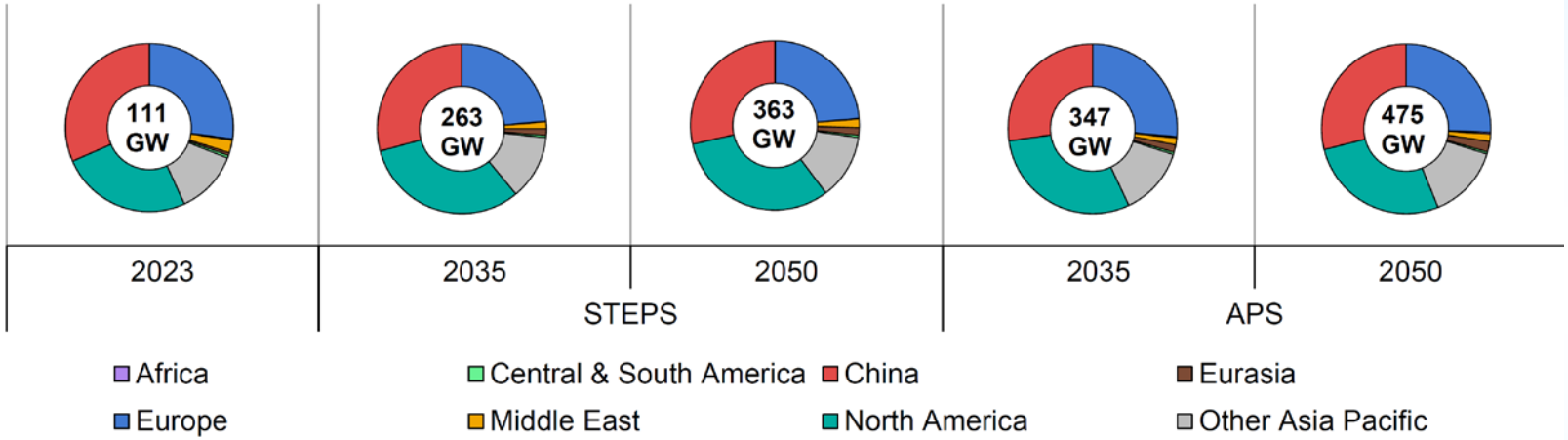
Country	Heat pump-specific subsidy	Comment
Austria	Air-to-water heat pump: €16,000 Water-to-water or brine-to-water heat pump: €23,000	Additional new subsidies have been implemented. These include a €5,000 drilling bonus if a heat pump is installed. Through the combination of federal and regional state subsidies and tax benefits, it is expected that on average, three-quarters of the total investment costs will be covered by the subsidies
Czechia	Minimum financial support is CZK 60,000 (approx. €2,400) and maximum CZK 140,000 (approx. €5,600). Depending on the real energy savings, the owner can save up to 50% of the total eligible costs (depending on the type of heat pump)	The source of funding in the new programming period 2021–2027 is the NextGenerationEU Fund, through its National Recovery Plan. Eligible applicants are owners of family homes and apartment buildings (both natural and legal entities)
Denmark	Subsidy of up to DKK 27,000 (approx. €3,600) depending on the type of pump It is also possible to apply for a subsidy of up to DKK 25,000 (approx. €3,350) in cases where the household wishes to lease a heat pump rather than purchase it outright	The Heat Pump Fund will administer a total of approximately DKK 745.5 million (approx. €99.99 million) between 2023 and 2026
Finland	Subsidy of €4,000 when oil-based or gas-based heating is replaced by a geothermal heat pump, air-to-water heat pump or district heating	By February 2024, approximately 26,600 applications had been approved for replacing oil heating and 1,038 for replacing gas heating
Germany	If a fossil fuel heating system is replaced with a climate-friendly heating system, 30% of the costs can be funded	Applicants can receive an additional 20% of their costs if they replace old systems by the end of 2028 (the 'climate speed bonus'). A 5% efficiency bonus for heat pumps (only for heat pumps with natural refrigerants such as R290 propane, e.g. NovaAir or geothermal heat pumps) is also available. Private households with an annual taxable income of less than €40,000 can receive another bonus (to a maximum of 30% of their income) if they renovate their own home. All three bonuses can be combined and granted to one applicant. Total funding is limited to 70% of the costs for installing an energy- and eco-friendly heating system For single-family homes or for the first party in a multi-family home, investment costs can be subsidised up to a maximum of €30,000. For multi-family homes, the maximum eligible expenditure is increased by €15,000 each for the 2nd to 6th residential unit and by €8,000 each from the 7th residential unit. For example, an applicant can receive up to €31,500 for a new heat pump in an apartment building with two parties and up to €42,000 with three parties
Ireland	Subsidies vary depending on type of dwelling and heat pump type	Technical assistance grant of €200 available for homes built before 2007. A heat pump bonus of €2,000 is available if work is done as part of a deep retrofit

Eurofound (2024), Decarbonisation of residential heating and cooling: The heat pump challenge, Eurofound research paper, Publications Office of the European Union, Luxembourg.

Πώς καλύπτονται οι ανάγκες για εγκατάσταση νέων αντλιών θερμότητας;

Εκτιμώμενη Εξέλιξη Παγκόσμιας Ζήτησης

Global demand for heat pumps by country/region in the Stated Policies and Announced Pledges Scenarios, 2023-2050

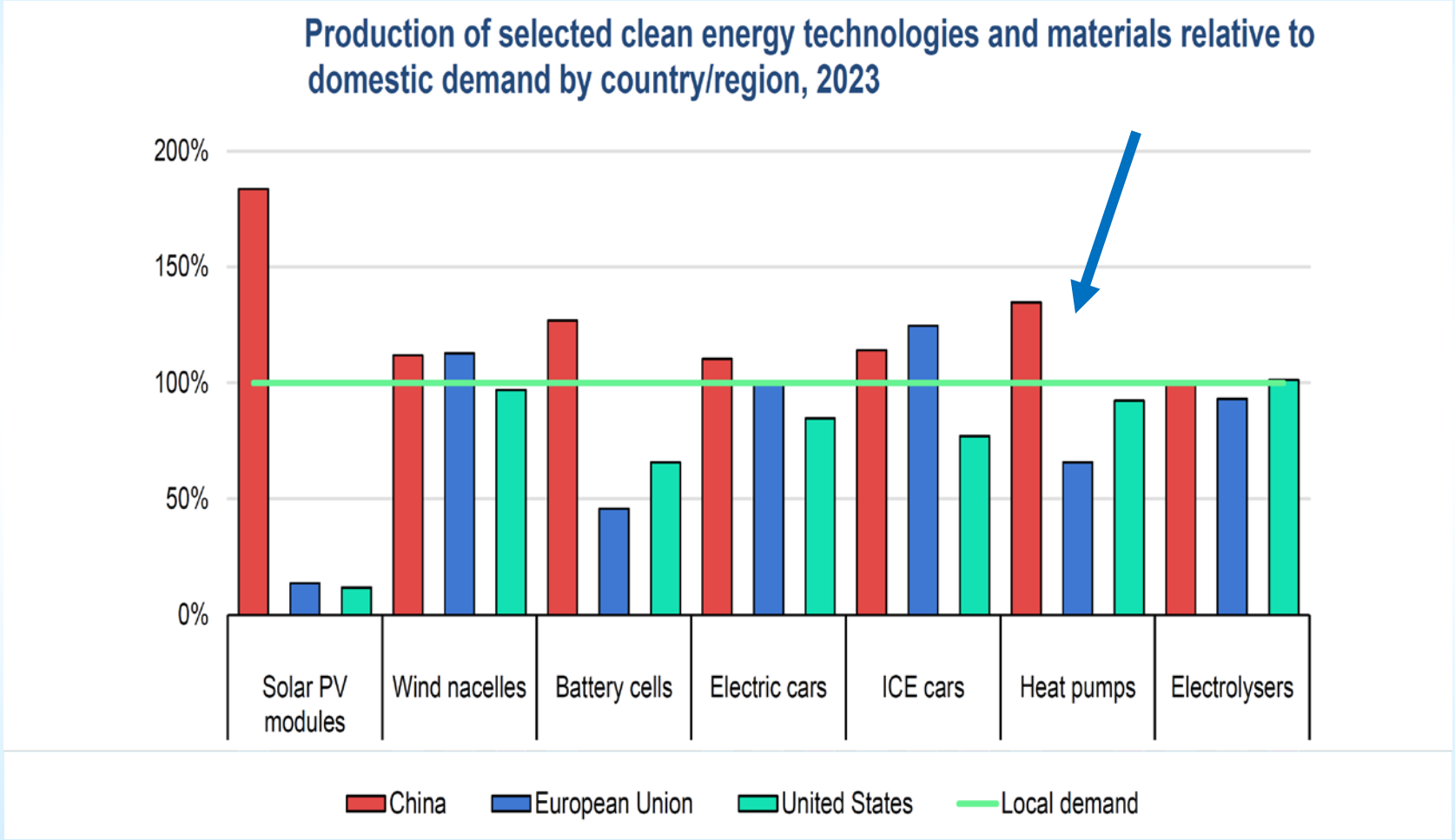


Notes: STEPS = Stated Policies Scenario; APS = Announced Pledges Scenario. The numbers in the middle of the pie chart refer to global demand.

Demand for heat pumps increases in all scenarios, primarily in the major heat markets in advanced economies and China, while demand in other EMDEs remains low.

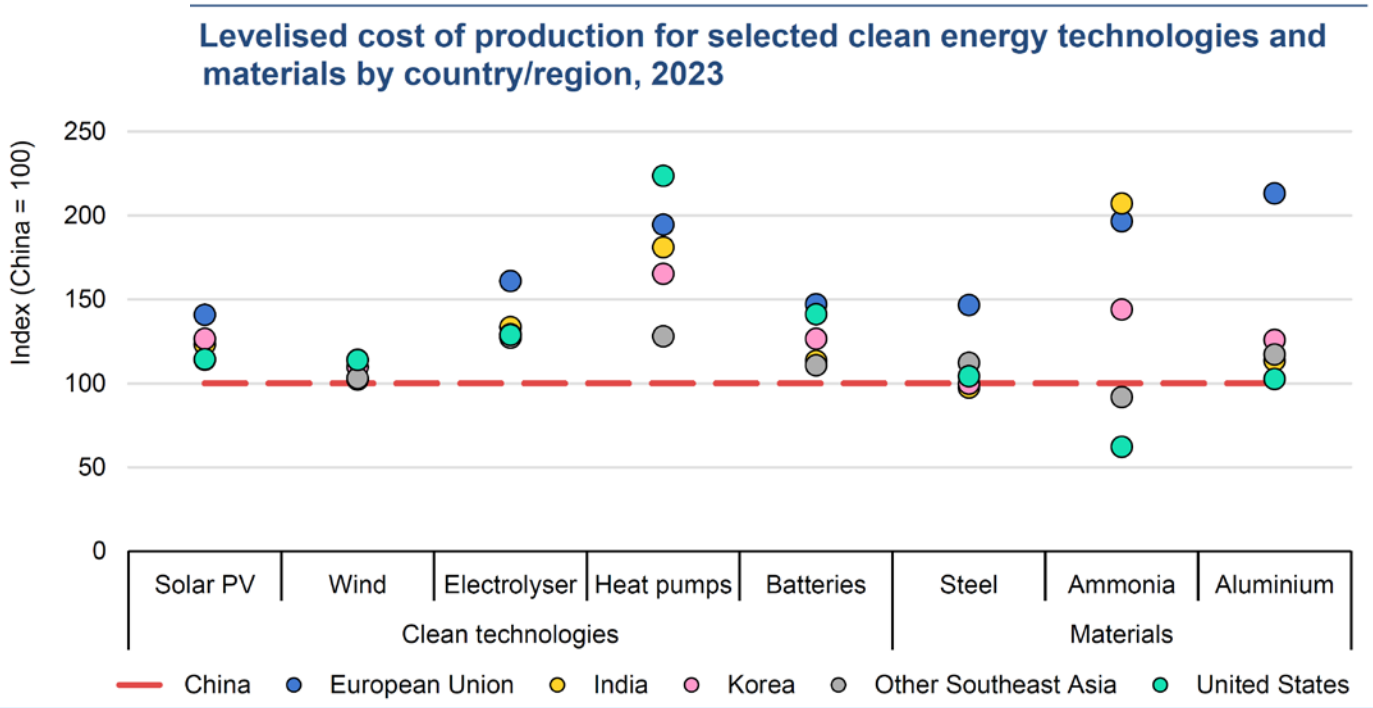
Πηγή:https:IEA Energy Technology Perspectives 2024

Παραγωγή και τοπική ζήτηση τεχνολογιών ενεργειακής μετάβασης



Πηγή:https:IEA Energy Technology Perspectives 2024

Κόστη παραγωγής τεχνολογιών



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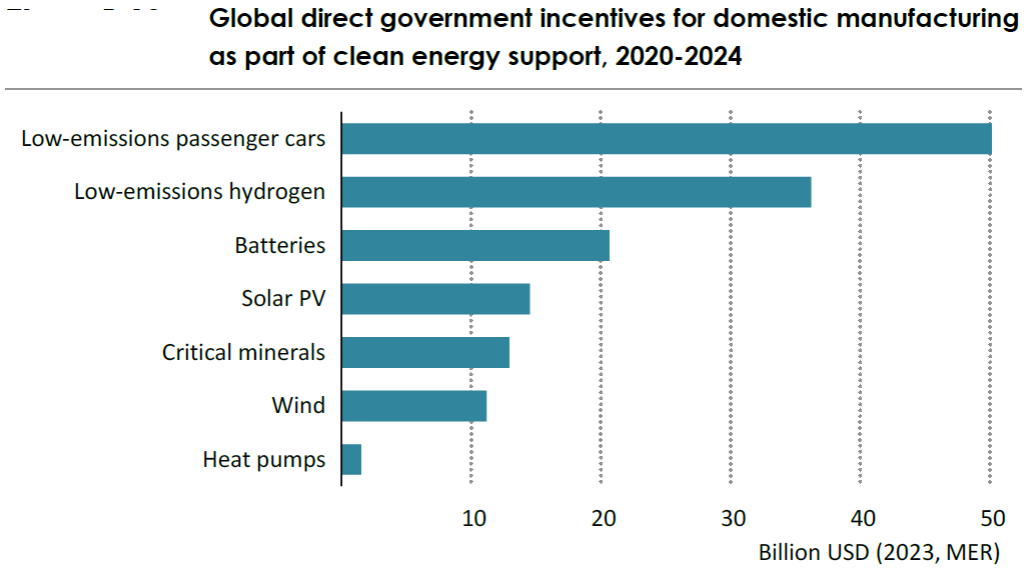
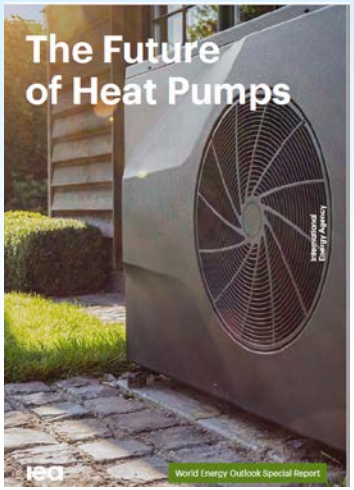
Η ανάπτυξη τεχνολογίας εχει κρατική υποστήριξη



Πηγή:https:IEA World Energy Outlook 2024

Παραπέρα Τεχνολογική Ανάπτυξη



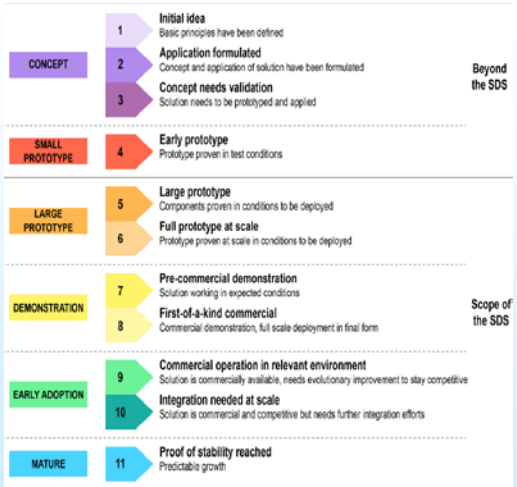


Table 1.2 ▷ **Industrial heat pump technology readiness by temperature range**

Temperature range	Technology readiness level (TRL)	Example process
<80 °C	TRL 11: Proof of market stability	Paper: De-inking Food: Concentration Chemical: Bio-reactions
80 °C to 100 °C	TRL 10: Commercial and competitive, but large-scale deployment not yet achieved	Paper: Bleaching Food: Pasteurisation Chemical: Boiling
100 °C to 140 °C	TRL 8-9: First-of-a-kind commercial applications in relevant environment	Paper: Drying Food: Evaporation Chemical: Concentration
140 °C to 160 °C	TRL 6-7: Pre-commercial demonstration	Paper: Pulp boiling Food: Drying Chemical: Distillation Various industries: Steam production
160 °C to 200 °C	TRL 8-9: First-of-a-kind commercial applications for small-scale MVR systems and heat transformers TRL 4-5: Early to large prototype	Various industries: High-temperature steam production
>200 °C	TRL 4: Early prototype	Various industries: High-temperature processes

Readiness level: TRL 1 to 5 | TRL 6 to 7 | TRL 8 to 11

Πηγή:https://www.iea.org/reports/the-future-of-heat-pumps

Ευχαριστώ για την Προσοχή σας!