2050
Heat Roadmap Europe
A low-carbon heating and cooling strategy

Heat Roadmap Europe

RE Scenarios and Results for decarbonising Heting and Cooling in the European Union

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 695989.

Based on presentation by Rasmus Lund & Brian Vad Mathiesen, Aalborg University

Agenda

- Heating and cooling in Europe
- The *Heat Roadmap Europe* project series
- Strategies in the European Union
- Approach and Methods
  - Interaction between energy models
  - Scenario structure
  - Cost balance: Savings vs. supply
- Results
  - Reduction of thermal demands
  - Heat pumps vs. DH
  - General results

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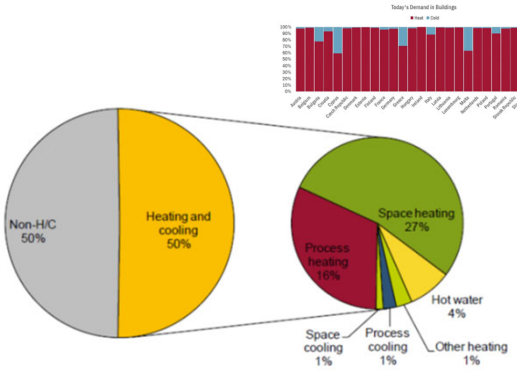
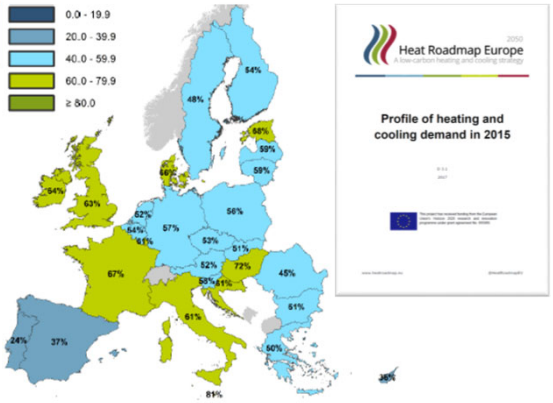
Heating vs other sectors



Heating and cooling demand in 2015 in the EU28 by end-use compared to total final energy demand
- Large share for All Member States (not just the 'cold' North)
- Overall cooling share in general is 10-15%



Heating and cooling demand in 2015 in the EU28 by end-use compared to total final energy demand

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HRE 1, 2, 3, 4

- Study 1 (2012): will district heating play a role in the decarbonisation of the European energy system?
- Study 2 (2013): what is the balance between heat savings and heat supply at an EU level?
- Study 3 (2015, STRATEGO WP2): low-carbon heating and cooling strategies for five member states
- Study 4 (2016-2019): integrated low-carbon heating and cooling strategies for 14 member states

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HRE4 – A large collaboration

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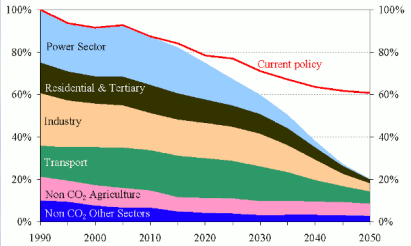
Targets and challenges in Europe

- Long-term target (2011)
  - 80-95% reduction of CO emissions in the energy sector
- Short term in the energy union (2015)

  Security of supply, solidarity and trust (gas, oil electricity)
  - An integrated marked (electricity)
  - Energy efficiency (first)
  - Lower CO2 emissions
  - Research and innovation



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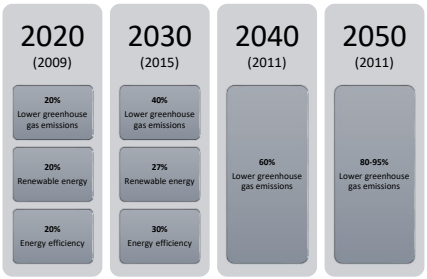
Focus in Europe

- Energy Savings (energy efficiency first principle)
- More electricity in the energy system
- More distributed production
- Gas in a transition
- Contribution from nuclear
- Much more Renewable Energy
- Reductions in energy imports and prices
- More investments – less costs for fuels
- Increasing electricity prices until 2030 – then decreases
- Large reductions in emissions is technically and economically possible.



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An EU Strategy for Heating and Cooling

- A first attempt a holistic approach to the heating and cooling sectors
- The first move from only looking at buildings to also looking at buildings as part of the energy system
- Energy savings, energy efficiency, electricity AND district heating is mentioned in the first line of the European Commission's new Vision for Heating and Cooling
- Synergies by looking across sectors is in focus

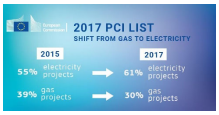

EUROPEAN COMMISSION

Brussels, 16.2.2016
COM(2016) 51 final

COMMUNICATION FROM THE COMMISS
PARLIAMENT, THE COUNCIL, THE EUROPE
COMMITTEE AND THE COMMITTE

An EU Strategy on Heating a

{SWD(2016) 24 final



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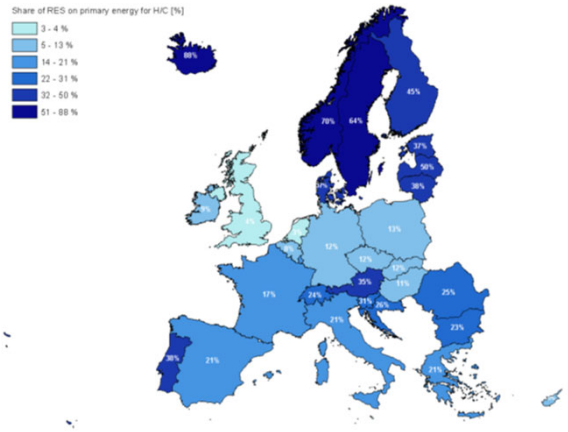
Heating and Cooling Can Have Very High Renewable Energy Penetrations



Source: Mapping and analyses of the current and future heating-cooling fuel deployment, 2016

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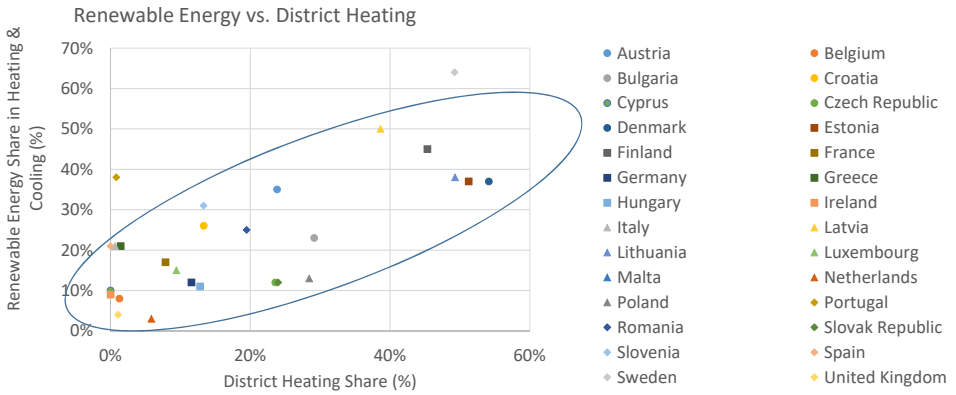
Renewable Energy vs. District Heating



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Why isn't it happening?

- Heating is complex
- Heating is local
- Heating is long term
- Lack of knowledge
- Heat savings and district heating have large investment costs
- Heating is cultural, ownership problems and profit margins

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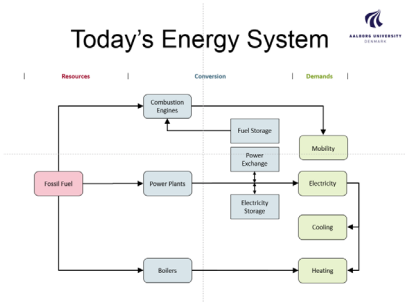
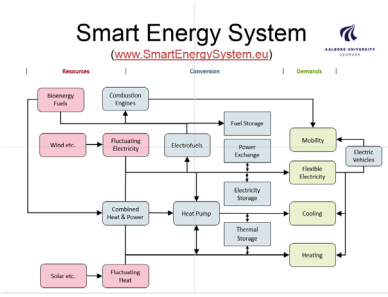
Our Purpose

- Creating scientific **evidence** to support long-term energy strategies at local, national, and EU level and empower the transition to a low-carbon energy system
- By **quantifying** the impact of various alternatives for addressing the heating and cooling sectors





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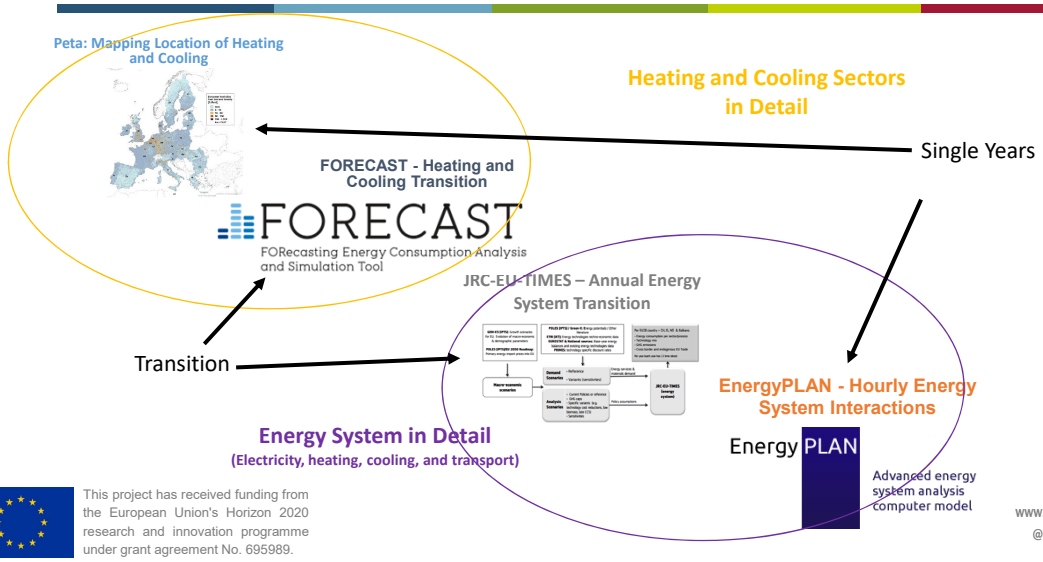
Relationship Between the Energy Models



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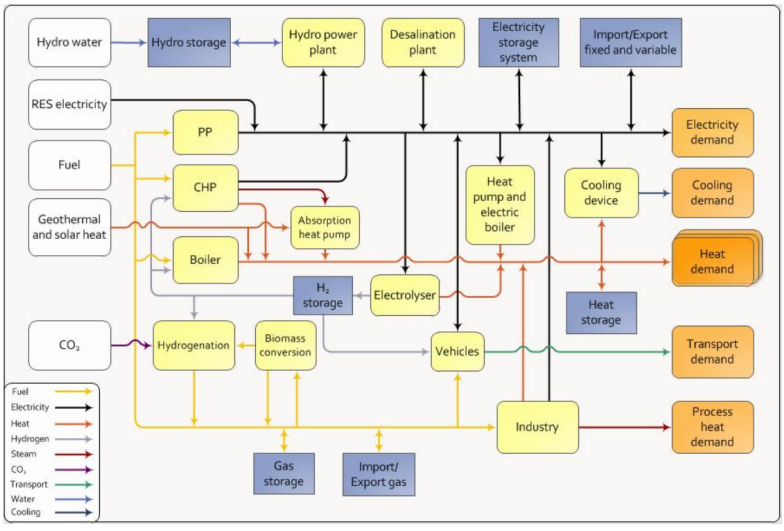
Energy system dynamics

- Hourly resolution
- Sector integration
- Aggregated
- Smart energy system approach



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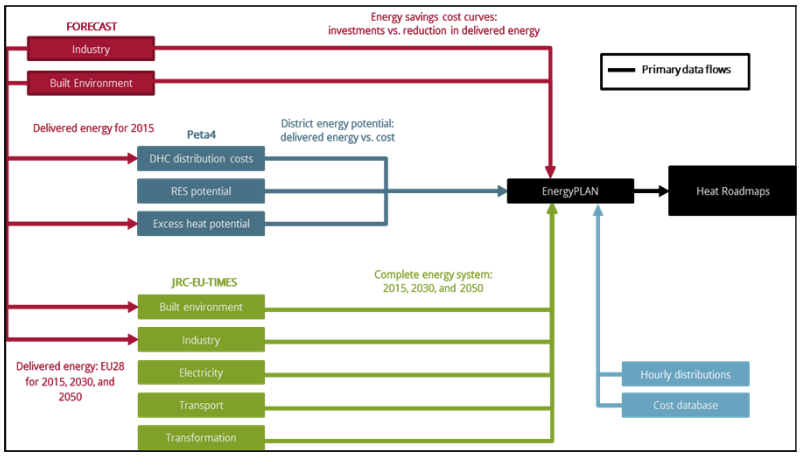
Data flows between models



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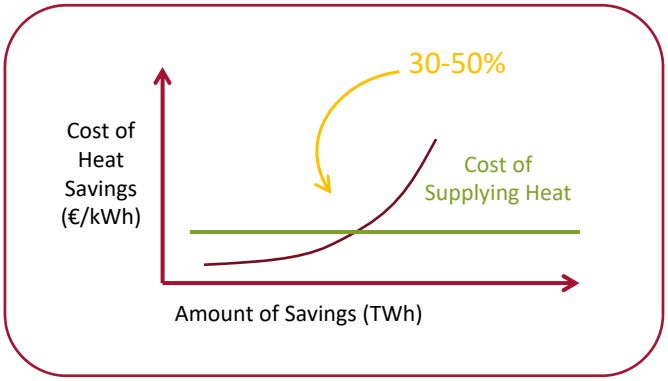
Balance between savings and supply

- Savings
  - Residential
  - Service
  - Industry
- Supply
  - Heat pumps
  - District heating



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Balance between savings and supply

- Reductions in demand do not affect the HP / DH balance and vice versa
- Industry and service savings generally feasible
- Residential savings differ between countries
- DH feasible in all countries but different levels

France: total energy system costs (M€/year)		Residential sector space heating savings (additional to a 30% reduction already in the Baseline)					
		0	5%	10%	15%	20%	25%
Percentage of market share covered by DH	0%	175532	175582	175266	175452	175883	175978
	5%	175219	175263	174932	175104	175529	175608
	11%	174875	174898	174548	174699	175099	175162
	18%	174566	174570	174197	174329	174706	174752
	26%	174327	174317	173922	174037	174394	174418
	34%	174197	174168	173752	173852	174191	174200
	42%	174190	174142	173709	173789	174107	174101
	51%	174400	174334	173878	173940	174240	174216
	59%	175121	175038	174562	174604	174885	174844
	68%	176559	176454	175961	175986	176246	176185
	79%	185911	185790	185275	185282	185524	185443

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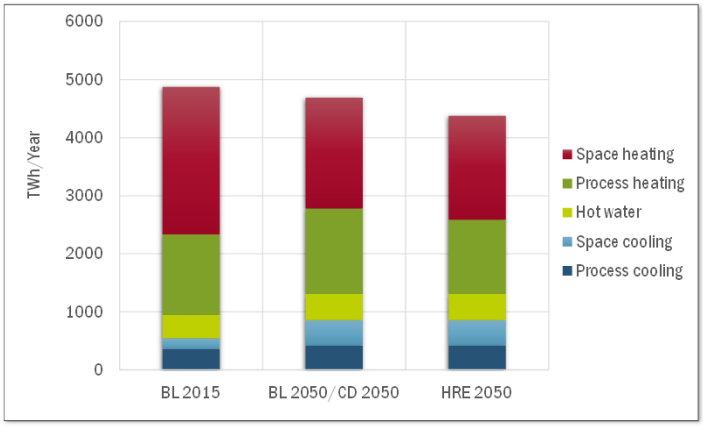
Development of thermal demands

- Total of 30% reduction in space and hot water demand
- More than current EU policy
- Combining refurbishment and new efficient buildings
- Cooling demands expected to increase



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Heat pumps and district heating shares

- Building Heat pumps
  - Increase in share from 1% to about half of the heat market
- DH supply
  - Increase from 12% to cover the other half of the heat market
- Fuel boilers and electric heating for heating should be limited as far as possible / eliminated

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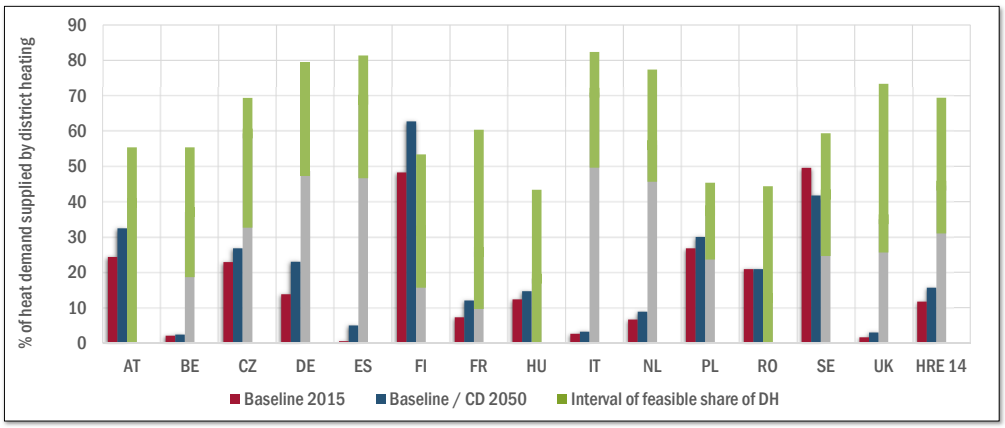
Feasible shares of DH



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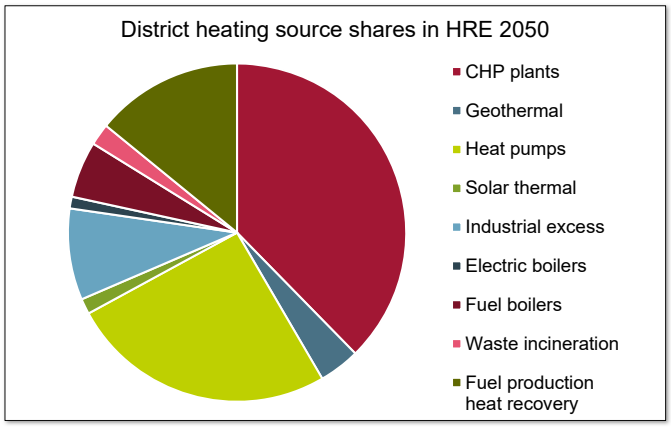
District heating production

- Large variety of heat sources
- The feasibility of DH is not dependent on any single heat source
- Cogeneration of heat and power production may decrease with increasing RES



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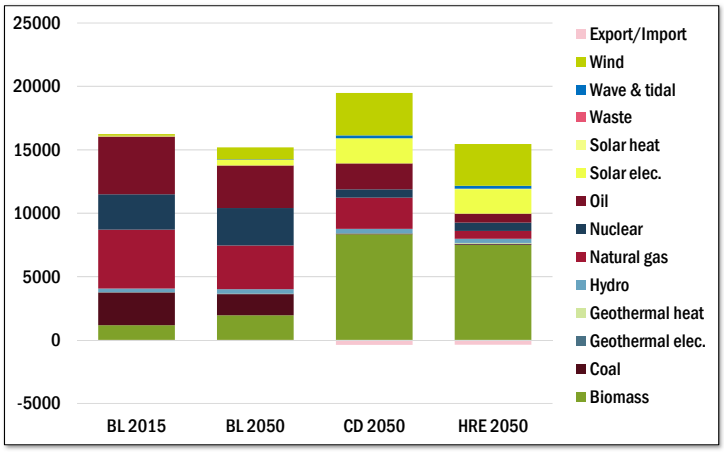
Primary energy supply

- Same range as 2015 but different sources
- Large reduction in fossil fuels
- Total reduction in fuel
  - But increase in biomass
  - This should be reduced further



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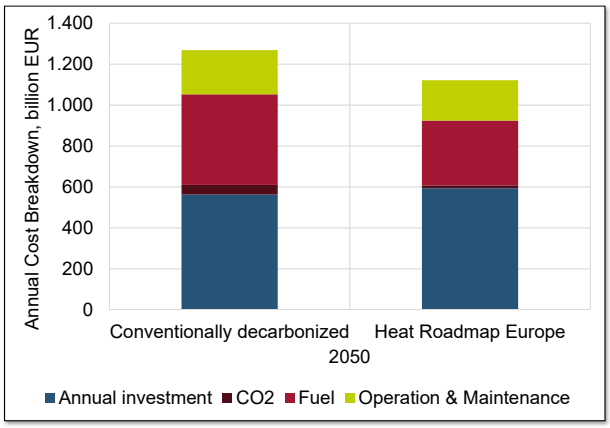
Total energy system costs

- Reduction of ~150 B€/year
- Increase in investment costs
  - Job creation
  - Reduced energy price fluctuation
- Decrease in fuel costs
  - Lower dependence on import of fossil fuels



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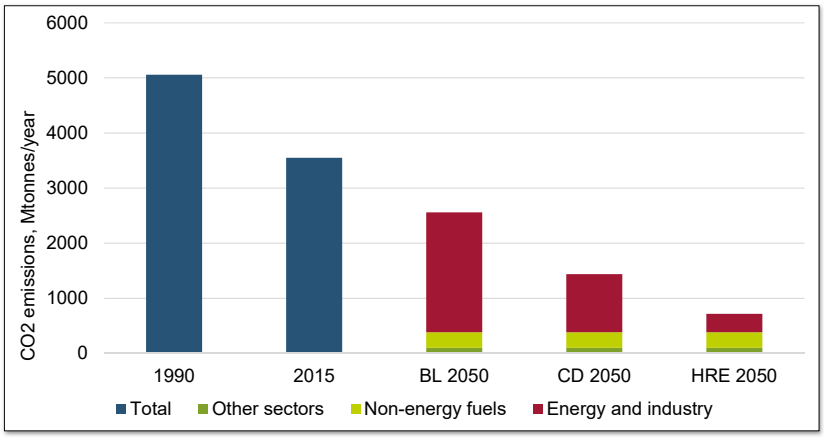
Emission comparaison



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More information

- Paardekooper, Lund, Mathiesen, Chang et al. *Heat Roadmap Europe 4: Quantifying the Impact of Low-Carbon Heating and Cooling Roadmaps*. Aalborg University Press

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