

**WHO IS PAYING FOR DECARBONIZING THE DUTCH
RESIDENTIAL SECTOR?
A DETAILED COST-BENEFITS ANALYSIS OF THE DUTCH
AMBITIONS TO PHASE OUT NATURAL GAS | CASPER
TIGCHELAAR**

› HOW THE DUTCH BECAME ATTACHED TO NATURAL GAS

AND WHY THEY
WANT TO GET RID
OF IT NOW



› OUR COST AND BENEFIT ANALYSIS A DASHBOARD FOR MUNICIPALITIES

- › Municipalities making plans to phase out natural gas.
 - › Need information for citizens on the cost and benefits.
- › TNO study:
 - › a Dashboard for municipalities to give insight in 'end-user' cost:
 - › a balance of costs and benefits (running costs, financial benefits and energetic benefits)
 - › 315 reference situations based on different dwelling types, EPC's and consumption profiles.
 - › perspective of a homeowner, a tenant and a landlord.
- › Acknowledgement:
 - › Casper Tigchelaar, Arjan Zwamborn, Vera Rovers, Robin Niessink and Evie Cox (all TNO)

DASHBOARD EINDGEBRUIKERSKOSTEN STARTANALYSE				
INPUT				OUTPUT
Eigendom	Label			effect energieverbruik
koopwoning	A B C			eindgebruikerskosten
particuliere huurwoning	D E F			energiekosten
sociale huurwoning	G			investeringen
Verbruikscategorie				jaarlijkse baten
midden laag hoog				jaarlijkse kosten
rijwoning hoek	eigenaar-bewoner	A	midden	afsluitbijdrage gasnet
rijwoning hoek	eigenaar-bewoner	A	midden	bijdrage aansluitkosten warmtenet
rijwoning hoek	eigenaar-bewoner	A	midden	inductiekookplaat en pannenset
rijwoning hoek	eigenaar-bewoner	A	midden	installatie aanpassen
rijwoning hoek	eigenaar-bewoner	A	midden	isolatie
rijwoning hoek	eigenaar-bewoner	A	midden	lt-afgifte
rijwoning hoek	eigenaar-bewoner	A	midden	ventilatiesysteem aanpassen
rijwoning hoek	eigenaar-bewoner	A	midden	woningaanpassing koken
rijwoning hoek	eigenaar-bewoner	A	midden	btw
rijwoning hoek	eigenaar-bewoner	A	midden	totaal investering
rijwoning hoek	eigenaar-bewoner	A	midden	totaal subsidie
rijwoning hoek	eigenaar-bewoner	A	midden	totaal investering [min sub]
rijwoning hoek	eigenaar-bewoner	B	midden	afsluitbijdrage gasnet
rijwoning hoek	eigenaar-bewoner	B	midden	bijdrage aansluitkosten warmtenet
rijwoning hoek	eigenaar-bewoner	B	midden	inductiekookplaat en pannenset
rijwoning hoek	eigenaar-bewoner	B	midden	installatie aanpassen
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rijwoning hoek	eigenaar-bewoner	B	midden	btw
rijwoning hoek	eigenaar-bewoner	B	midden	totaal inves
rijwoning hoek	eigenaar-bewoner	B	midden	totaal subsidie
rijwoning hoek	eigenaar-bewoner	B	midden	totaal investering [min sub]

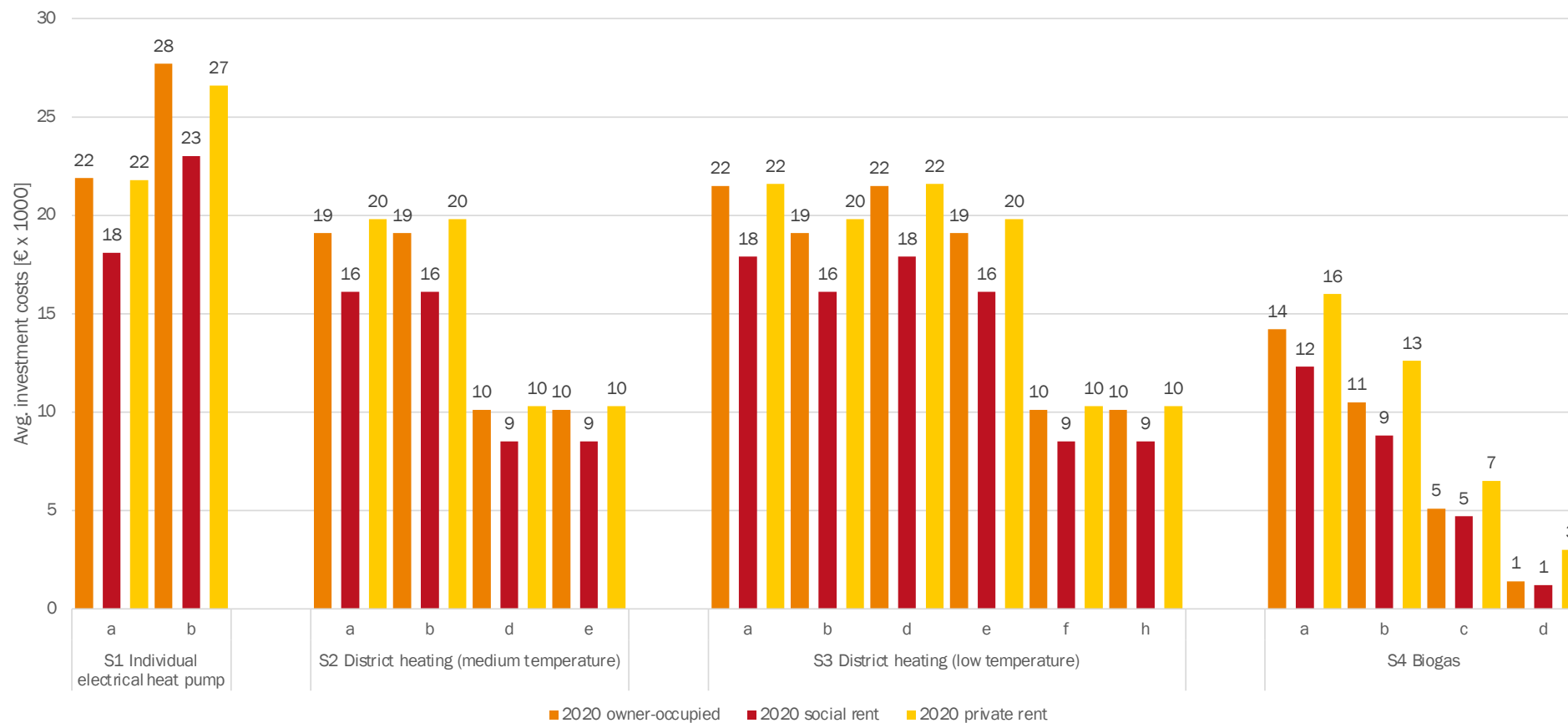
› 14 STRATEGIES FOR PHASING OUT NATURAL GAS AN OVERVIEW

Code	Space heating alternatives	Variant code	Space heating installation	Insulation level *)
S1	Individual electrical heat pump	S1a	Air-water heat pump	B+
		S1b	Borehole heat pump	B+
S2	District heating (medium temperature)	S2a	MT waste heat	B+
		S2b	MT geothermal energy	B+
		S2d	MT waste heat	D+
		S2e	MT geothermal energy	D+
		S3a	LT heat source, supplied at 30 °C	B+
S3	District heating (low temperature)	S3b	LT heat source, supplied at 70 °C	B+
		S3d	ATES, supplied at 50 °C	B+
		S3e	SWH+ATES, supplied at 70 °C	B+
		S3f	LT heat source, supplied at 70 °C	D+
		S3h	SWH+ATES, supplied at 70 °C	D+
		S4a	Hybrid heat pump	B+
S4	Individual central heating fuelled by Biogas	S4b	Condensing boiler	B+
		S4c	Hybrid heat pump	D+
		S4d	Condensing boiler	D+

*) B+ = Entire building envelop well insulated; D+ Parts of building envelop insulated

INVESTMENT COSTS

WEIGHTED AVERAGE (EXCLUDING SUBSIDIES) PER DWELLING PER STRATEGY BY OWNERSHIP



› WHO PAYS THE BILL?

DIFFERENT INVESTORS FOR DIFFERENT CONCEPTS

	1. Energy production	2. Transport	3. In-house equipment	4. Insulation
All-electric	Wind, solar, etc. Utility company and Government (subsidy)	Grid reinforcement Grid operator	Heat pump, induction cooking, low temperature radiator Homeowner/ landlord	Insulation Homeowner/ landlord
District heating	Geothermal, biomass Utility company and Government (subsidy)	Grid operator	Heat delivery set Homeowner/ landlord	Insulation Homeowner/ landlord
Biogas	Biogas, hydrogen Utility company and Government (subsidy)	Adjusting natural gas grid Grid operator	Adjustment condensing boiler Homeowner/ landlord	Insulation Homeowner/ landlord

Investment outside home

home related investment

Size and profitability

Good

Mediocre

Bad

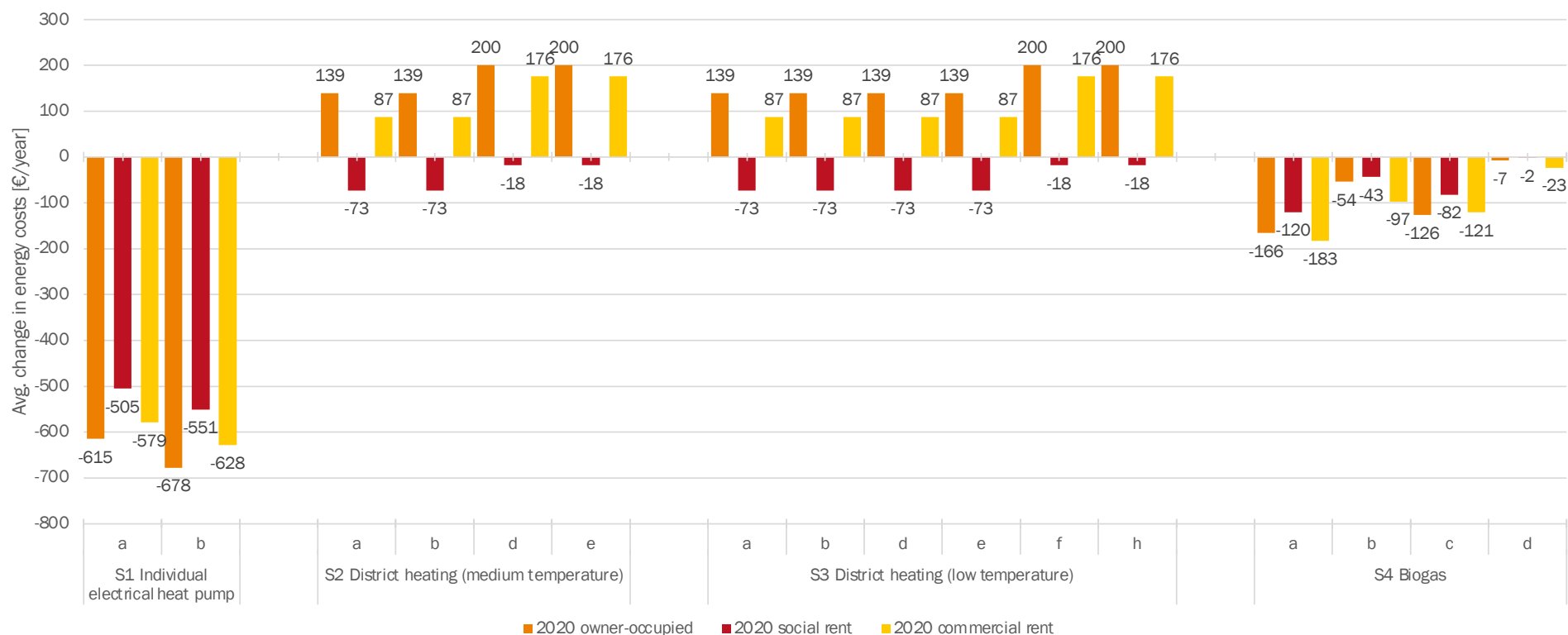
› COST AND BENEFITS DIFFER PER TARGET GROUP

ANNUAL COSTS AND BENEFITS ARE:

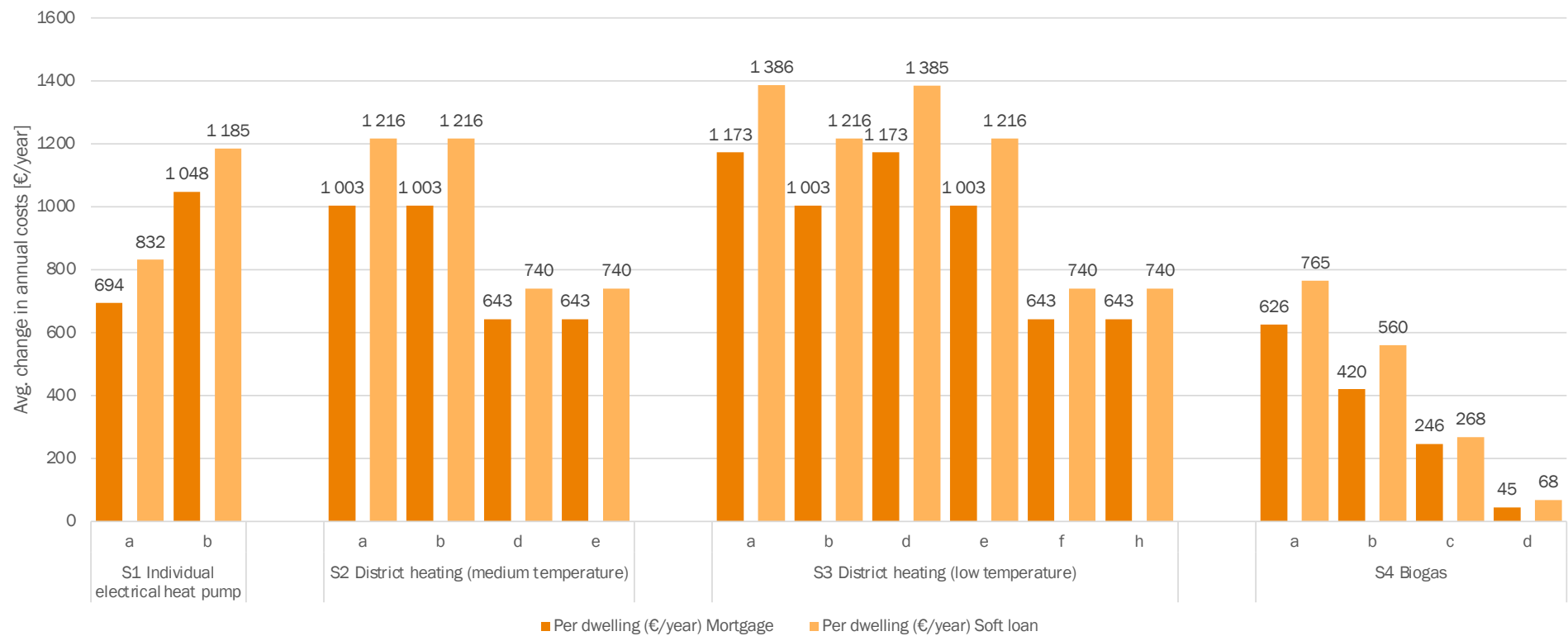
	Government	Utility/ grid operators	Home owner	Landlord	Tenant
Costs:	Subsidy	Capital cost	Capital costs	Capital costs	Additional rental costs
	Additional rent allowance	Maintenance costs	Maintenance costs	Maintenance costs	Energy costs
	Additional rent deduction	Energy costs	Energy costs		
Benefits:	Additional VAT	Monthly fees	Energy savings	Additional rental income	Energy Savings
		Energy sales	Additional rent deduction		Additional rent allowance

› BENEFITS

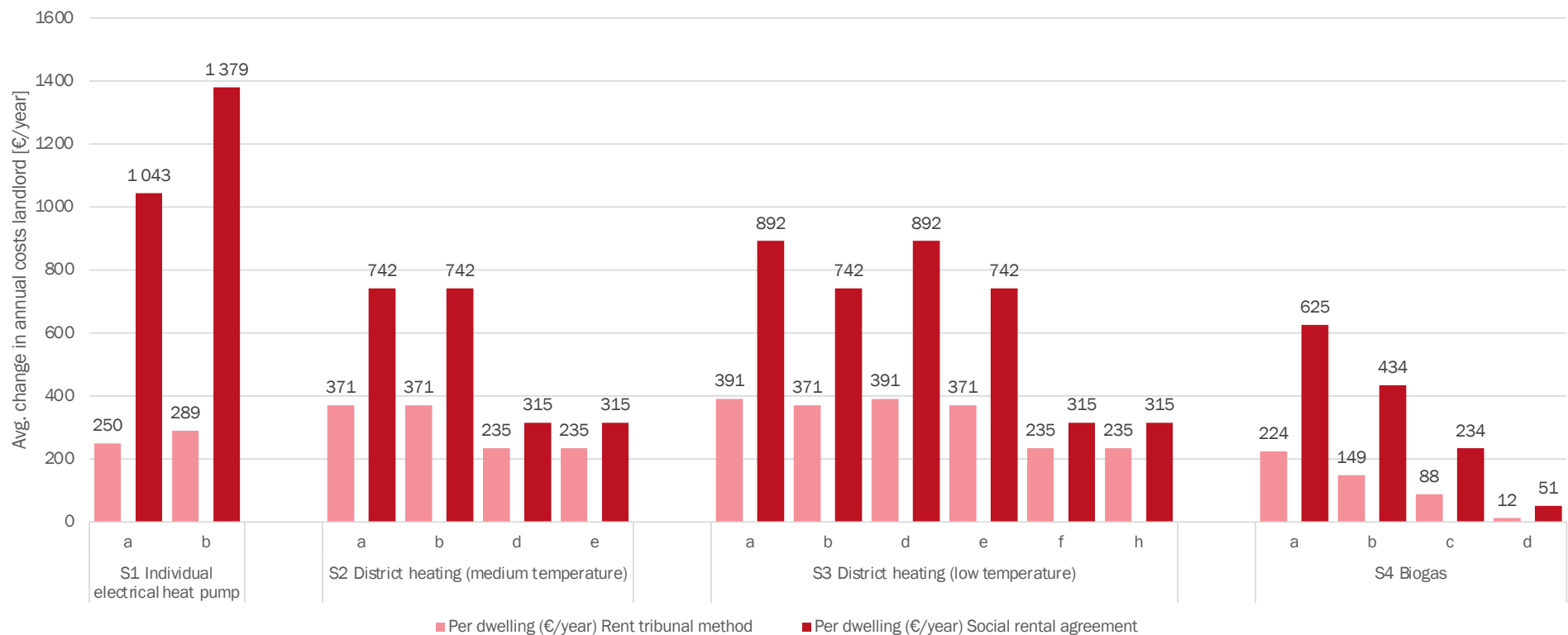
CHANGING ENERGY COSTS



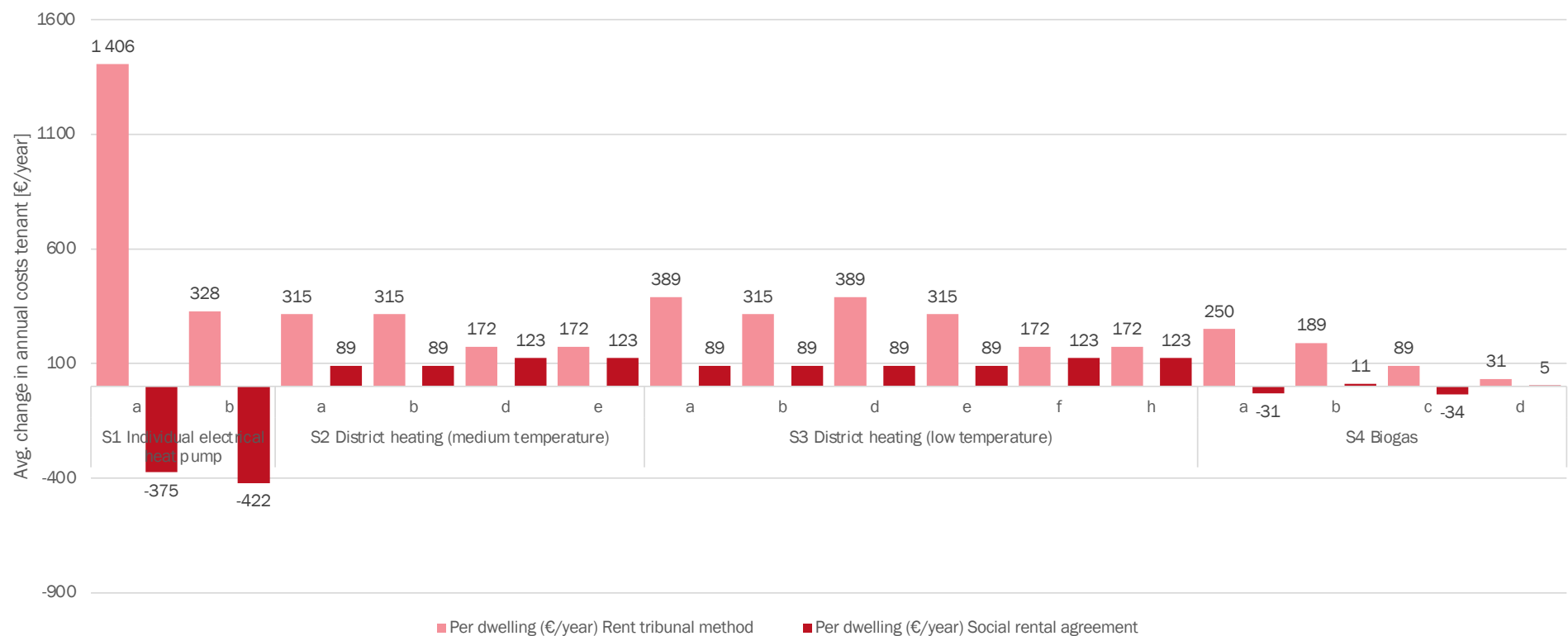
› TOTAL CHANGE IN ANNUAL COSTS HOME OWNER



› TOTAL CHANGE IN ANNUAL COSTS LANDLORD (SOCIAL HOUSING)

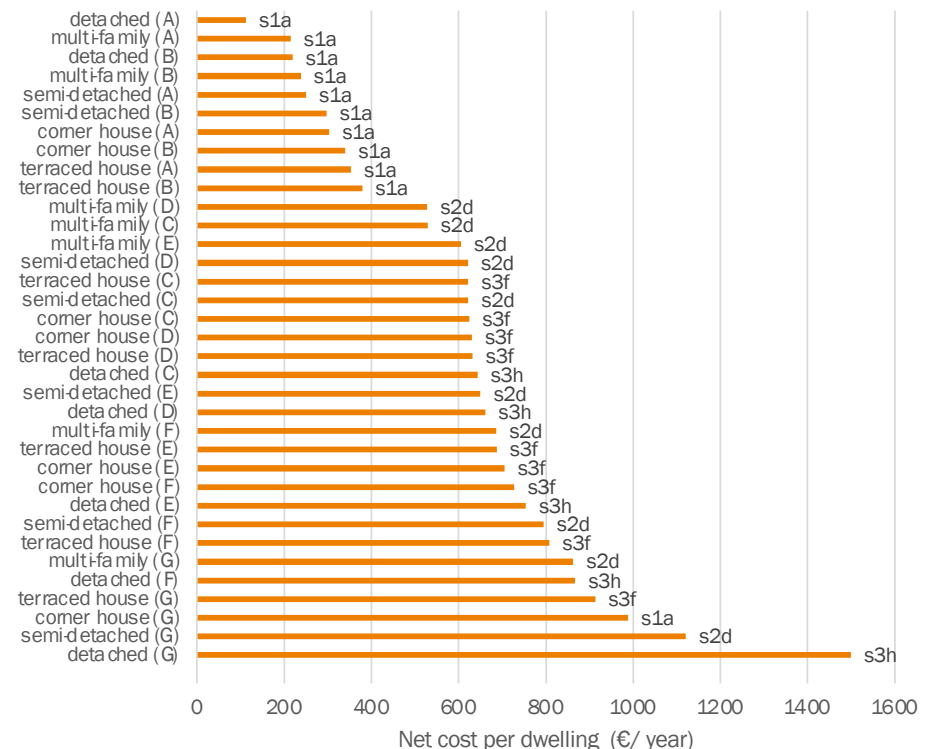


› TOTAL CHANGE IN ANNUAL COSTS TENANT (SOCIAL HOUSING)



› HOW TO DECARBONIZE THE DUTCH HOUSING STOCK LOOKING FOR A BARGAIN

- › We analysed the cheapest option to become carbon neutral for different dwelling types at 2020 prices.
 - › We excluded biogas options, since biogas is very scarce
- › No concept is cost-effective
 - › All-electric options are the least expensive options in well-insulated dwellings (EPC A or B)
 - › District heating is the least expensive in less-efficient dwellings
- › To compensate private households for additional cost a total sum of **55 billion euros** is needed on investment grants.
- › In an alternative scenario with higher energy prices and lower investment costs **18 billion euros** are needed



› SUBSIDY

WHAT IS THE EFFECT OF TODAY'S SUPPORT SCHEMES?

- › Different subsidy schemes for different concepts.
- › Homeowners on average get a grant of 4-5 thousand euros for both all-electric and district heating options.
- › But relative support for district heating is higher.
- › The carbon reduction of district heating is lower.

Strategy and variant		Weighted average investment	Weighted average investment after subsidy	Absolute effect subsidy	Relative effect subsidy
		(1000€/dwelling)	(1000€/dwelling)	(1000€/dwelling)	(%)
S1 Individual electrical heat pump	a	22	18	-4	17%
	b	28	23	-5	18%
S2 District heating (medium temperature)	a	19	14	-5	25%
	b	19	14	-5	25%
	d	10	7	-4	33%
	e	10	7	-4	33%
S3 District heating (low temperature)	a	22	17	-5	27%
	b	19	14	-5	30%
	d	22	17	-5	27%
	e	19	14	-5	30%
	f	10	7	-4	41%
	h	10	7	-4	41%
S4 Biogas	a	14	11	-3	20%
	b	11	9	-2	17%
	c	5	4	-2	26%
	d	1	1	0	20%

› CONCLUSION

HOW COST-EFFECTIVE IS DECARBONIZING?

- › In our 2020 scenario:
 - › none of the 14 strategies were cost-effective for private homeowners in any of the 315 reference situations
 - › This is also true for rental homes. However, in that case the costs and benefits are split between landlords and tenants.
- › In our 2030 scenario
 - › We assumed a reduction of initial costs on energy efficiency measures, an increase of energy prices and a tax shift from electricity use to natural gas use.
 - › Over 3.2 million privately owned dwellings of the total of 4.5 million in the Netherlands can be renovated cost-effectively in this scenario. 2 million if biogas is excluded as an option.
- › Total investment needed for privately owned Dutch homes:
 - › 44 and 123 billion euros until 2050 must be invested,
 - › Cost savings can reduce this to between € 42 and 106 billion.
 - › But most costs can be offset by saving on energy bills!
 - › Selecting the most cost-effective strategies for each property type can significantly reduce annual net costs. Shifts in the energy tax from electricity to natural gas can also reduce costs.
 - › Taken together, the sum of unprofitable investments can be reduced to €18.3 billion for 4.5 million homes, or on average only about € 4100 per home.

› CONCLUSION

WHERE TO START FIRST?

- › Investments in insulation measures are not profitable in 2020 or in 2030
- › More expensive to renovate homes with an inferior Energy Performance Certificates (EPCs).
- › The recast EPBD aims to renovate the worst performing buildings first.
- › But from a pure cost-effectiveness optimization perspective, it is therefore recommended to start refurbishing A and B labelled homes, in order to meet the 2030 national target of refurbishing 1.5 million homes.
- › However, investments in energy efficiency serve multiple purposes, such as alleviating energy poverty and reducing the demand for scarce (renewable) energy sources.
- › Also, the absolute reduction of CO₂-emissions will be smaller compared to a strategy aimed at less efficient homes.
- › Consequently, a different prioritization than one from a pure financial standpoint may be desirable.

› **DISCLAIMER**

THINGS ARE VERY DIFFERENT NOW

- › Since we published our study and dashboard, energy prices have risen by over 200% in the Netherlands.
- › We haven't calculated the consequences yet
- › But this will have a massive effective on the costs off households in the Netherlands.
- › But also on the cost-effectiveness of phasing out natural gas.

- › The importance to phase out natural gas in the Netherlands has increased dramatically:
 - › To limit our dependency on Russian gas
 - › To prevent energy-poverty
 - › To fight climate change

› **THANKS FOR
YOUR ATTENTION**

TNO innovation
for life

To download the
Dashboard with specific
data on 315 reference
homes and to find details
on methodology and the
final report..

Go to:

[https://energy.nl/tools/das
hboard-
eindgebruikerskosten/](https://energy.nl/tools/dashboard-eindgebruikerskosten/)

