





# Testing Hydrogen admixture for Gas Applications

# WP3: Compiling of results from all tasks and development of further statistics at EU and country level

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# List of abbreviations

#### Non-Technical

WP

Work Package

### **Technical**

СНР	Combined heat and power
FC	Fuel Cell
НР	(Gas) Heat Pump
H <sub>2</sub>	Hydrogen
H gas / Lgas	Family of gases of "High calorific value" distributed in EU having specification close to methane (G20) by opposition to L gas (Family of gases of "Low calorific value")

# 1. Introduction

This report is part of the Task 3.5.2 "Overall analysis and reporting of test results" (Subtask leader: DGC; Subtask duration: M6-M36), as described in the project's Grant Agreement.

The work is aiming at reporting extensively on the WP activities and results including the following points:

- Part 1 Test results and analysis. This work is reported in D3.8<sup>1</sup> and D3.9<sup>2</sup> (short- and long-term results)
- Part 2 Collating/Compiling results by segments, impact profile and appliances number by country with different H2 %

This part will evaluate the percentage of market at risk in the different EU countries with different H2NG scenarios. It will be based on the EU mapping of technologies (WP2) and the results testing of WP3.

• Part 3 Limitations of the work and main conclusions This part will discuss the limitation of the conclusion of part 2 and the extend of the extrapolation of the results, applied to the whole EU park of appliances.

Limitations are due to the size and nature of the samples tested compared to the existing population, to the method, the uncertainties on results obtained & their interpretation, etc. **Note that limitations due to the experimental aspects are discussed in deliverable D3.8**.

<sup>&</sup>lt;sup>1</sup> <u>THyGA D3.8 Segment of technologies by segment report on the impact of the different H2 concentrations on</u> safety, efficiency, emissions and correct operation

<sup>&</sup>lt;sup>2</sup> THyGA D3.9 Long term effect of H2 on appliances tested





# Collating/Compiling results by segments, impact profile and appliances number by country with different H2 %.

The results from the THyGA "short-term" test campaign, over almost 3 years of laboratory activity, shall be combined with the market data including details by country.

Doing so we can view the volume of appliances that are ready for different scenarios of use of H2 in the grid.

The work is based on the test of 102 appliances (burners), it covers almost all the segments identified at the beginning of the project /1/ according to their type (boiler, water heater...) and combustion specificities (partially premix, fully premix...).

In practise, it combines the results of the D3.8 "Segment of technologies by segment report on the impact of the different H2 concentrations on safety, efficiency, emissions and correct operation" with the D2.1 "Market segmentation of domestic and commercial natural gas appliances".

#### **Deliverable situation for WP3**

Table 1 gives the public deliverables listed in the Grant Agreement for WP3. The present report is the deliverable D3.10 "Compiling of results from all tasks and development of further statistics at EU and country level".

Table 1: List of public deliverables from the THyGA project 's WP3

D3.5	Intermediate segment of technologies by segment report on the impact of the different H2 concentrations on safety, efficiency, emissions and correct operation	<u>Report</u>
D3.6	Intermediate long-term effect of H2 on appliances tested	Report
D3.7	Testing done on components (new and taken from existing installation) from different countries including statistics on results obtained for the leakage testing	<u>Report</u>
D3.8	Segment of technologies by segment report on the impact of the different H2 concentrations on safety, efficiency, emissions and correct operation	<u>Report</u>
D3.9	Long term effect of H2 on appliances tested	Report
D3.10	Compiling of results from all tasks and development of further statistics at EU and country level	<u>Report</u>

# 2. Market data

The segmentation given in this report is based on many hypotheses, several from past documents or experts' opinion but many are not backed by open studies. The objective is not reach exact distribution of market population per country and segment of appliance but rather to give an idea of the efforts to be made to reach feasibility for H2NG blends in European countries.

### 2.1 Segmentation and market data

The market data comes from a technology segmentation discussed and developed in WP2, based on standards and technology used for the appliances and the burners, as shown in  $D2.1^3$ . As mentioned, the data from /1/ is used as input for this report. Some of the data have however been re-discussed in

<sup>&</sup>lt;sup>3</sup> THyGA Deliverable 2.1: Market segmentation of domestic and commercial natural gas appliances





the light of new information and the overall table for the input is the following (market data are in 1000 of appliances), updated from D2.1 (addition of population).

Table 2: Market segmentation and appliance population (Europe + UK) per THyGA segment

THyGA Segme nt	Type of appliance	Category	Burner type	Standard	Total Appliance Population
101		Open flued (former EN 297)	Partial premix/conv (atmos. & fanned)		13.588
102			Low NOx technology burners		2.012
103			Full premix		152
104			Partial premix/conv (atmos. & fanned)		25.333
105	BOILERS	Room-sealed (former EN 483)	Low NOx technology burners	EN 15502	1.972
106			Full premix		1.781
107		Condensing boiler	Partial premix fanned		2.920
108		(former EN 677)	Full premix (including CCB)		56.492
109		Forced-draught / Jet burner boiler (former EN 303-3)	Jet burner		1.129
201	WATER	Instantaneous open flued	Partial premix/atmos		10.462
202		Instantaneous room-sealed	Partial premix/fanned	EN 26	4.484
203	S	Storage open flued	Partial premix/atmos		2.185
204		Storage room- sealed	Partial premix/fanned	EN 89	936
501		Independent gas- fired convection heaters type B	heating & decoration	EN 613	4.678
502	Space	Independent gas- fired convection heaters type C	heating & decoration, balanced	EN 613	1.839
503	Heaters	Decorative fuel- effect gas appliance/burner	heating & decoration	EN 13278 + EN 509	2.529
504		Independent gas- fired flueless space heaters	heating & decoration	EN 14829	98
601		Stirling Engines			15
602	СНР	Internal Combustion Engine CHP Micro Gas Turbine heat			41
603			heating & electricity production	EN 50465	1
604		PEM FC			5
605		SO FC			3
701	НР	Engine HP	Heating	EN 16905	48





702		Adsorption			3
703		Absorption		EN 12309	9
801		Commercial Dryers		EN 12752- 1 and -2	unknown
802		Infrared Radiant Heaters (former EN 416-1)	non-domestic, tube radiant heaters	EN 416	375
803		Infrared Radiant Heaters (former EN 419-1)	non-domestic, luminous radiant heaters	EN 419	375
804		Infrared Radiant Heaters (former EN 777-1)	non-domestic, tube radiant heaters	EN 416	375
804bis	OTHER	Radiant strip	with fan driven burners and recirculation fans	EN 17082	375
805		Air heaters (former EN 1020)	non-domestic, forced convection, fan, <300kW	EN 17082	495
806		Air heaters (former EN 525)	non-domestic, forced convection, <300kW	EN 17082	495
807		Air Heaters <70kW (former EN778)	Ducted warm air; forced convection air heaters	EN 1518	510
808		domestic washing machines		EN 1518	2
809		domestic dryers		EN 12752- 1 and -2	2
301		Surface burner (cooktops) with	Single ring		13.030
302		atmospheric burner or "Venturi" burner	Single crown		16.287
303		(vertical venturi burner)	Multi ring (mainly double or triple ring)		3.257
304		Surface burner	Single ring		541
305		(cooktops) with partially premix	Single crown		676
306	COOKER S	burner (long horizontal venturi)	Multi ring (mainly double or triple ring)	EN 30-x	135
307		Cavity burner	Atmospheric burner		2.697
308		"tubular" (ovens, freestanding	"Venturi" burner		1.156
309		ranges)	Partially premixed		27.712
310		Cavity burner	Atmospheric burner		9.139
311		(ovens,	"Venturi" burner		3.917
312		freestanding ranges)	Partially premixed		14.658
401		Open burners and	Circular burner with vertical slots		120
402		wok burners	Circular burner with holes	EN 203-2-1	120
403		Mixed ovens	Draught burners		120
404		Ovens	Tubular or circular burners	EN 203-2-2	120
405	CATERIN G	Boiling pans / pasta cookers	Microperforated burner	EN 203-2-3 EN 203-2- 11	120
406		Fryers	Premix burner	EN 203-2-4	120
407		Salamanders / Rotisseries	Ceramic or blue flame burners	EN 203-2-7	120
408		Brat pans	multi-ramp tubular slot burners	EN 203-2-8	120





409	Covered burners (griddles, solid tops, pancake cookers)	Tubular burner or multi-ramp tubular burner	EN 203-2-9	120
410	Barbecues	Chargrill with burner tubes w/ holes on top	EN 203-2- 10	120

Grouping the segment in appliance types, as proposed in the Deliverable D3.8 ana leads to Table 3 and Table 4.

 Table 3: Market segmentation and appliance population (Europe + UK) per appliance type

Boilers	105.380
Water heaters	18.066
Space heaters	9.144
СНР	64
HP	60
Radiant and air heaters	3.004
Cookers	93.205
Catering	1.200
TOTAL APPLIANCES	230.122

Table 4: Market segmentation and appliance population (Europe + UK) per appliance type, including sub-segments defined in D3.8

B		
	100a Boilers fully premix	58.425
Boilers	110b Boilers not premix	42.971
	100c Low Nox technology	3.984
Water bestere	200a Water heaters (excluding low NOx)	16.982
water neaters	200b Water heaters Low NOx	1.084
Space heaters	500 Space heater	9.144
СНР	600 Combined Heat and Power (CHP)	64
HP	700 Gas Heat Pump (GHP)	60
Radiant and air heaters	800 radiant heater & Commercial air heaters	3.004
Washing machines	Dryers and washing machines	
Cookers	300 Cookers domestic	93.205
Catarian	400a Catering equipment - premix	144
Catering	400b Catering equipment - not premix	1.056
TOTAL APPLIANCES		230.122

The total number of appliances applies for the EU and UK together. The values are covering the following countries that are the European countries using most gas:

- AUSTRIA (AUS)
- BELGIUM (BEL)
- CZECH REPUBLIC (CZ R)





- DENMARK (DEN)
- FRANCE (FRA)
- GERMANY (GER)
- GREECE (GRE)
- HUNGARY (HUN)
- IRELAND (IRE)
- ITALY (ITA)
- POLAND (POL)
- PORTUGAL (POR)
- ROMANIA (ROM)
- SLOVENIA (SLO)
- SPAIN (SPA)
- UNITED KINGDOM (UK)

There is a major gas country missing in this list which is The Netherlands. The reason of this absence is the fact that mainly low calorific value gas (Lgas) is used in this country and it is therefore out of the scope for this study.

More countries using H gas are missing but they should represent only a very small part of the total market /3/.

# 2.2 Market data (distribution by country)

The WP2 has given an overall information at EU level. However national market information was also available from other sources, such as /GASQUAL/, already used in D1.2 and we have taken this existing information to make a distribution by country.

The distribution key (in % of the total) is either from:

- The real data from the Gasqual project /3/ (reflecting the EU market in ca 2010)
- Averages (in yellow): when it was not available from the Gasqual we have used hypothesis that the distribution will follow the known average distribution for either boiler, space heater or cookers as indicated in Table 5.





Table 5: Distribution/share of appliances on the national markets (in % of the total number of appliances of the same type installed in the EU)

THyGA Segment	Type of appliance	Total Appliance Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ΙΤΑ	POL	POR	ROM	SLO	SPA	UK	KEY
101		100%	0,8%	4,9%	6,2%	0,2%	26,5%	0,9%	0,1%	7,6%	0,2%	22,4%	7,0%	<i>0,9%</i>	0,6%	3,1%	8,8%	10,0%	real data Gasqual
102		100%	5,6%	4,1%	2,4%	0,0%	8,6%	50,0%	0,0%	1,8%	0,0%	16,0%	4,4%	0,0%	0,1%	0,4%	6,6%	0,0%	real data Gasqual
103		100%	1,2%	0,0%	4,3%	0,0%	27,3%	0,0%	0,0%	3,1%	0,6%	46,0%	1,9%	0,0%	0,0%	3,7%	6,8%	5,0%	real data Gasqual
104		100%	0,2%	1,6%	1,5%	0,3%	10,3%	0,1%	0,3%	0,7%	1,9%	25,2%	0,4%	0,2%	5,0%	0,4%	9,6%	42,2%	real data Gasqual
105	BOILERS	100%	3,2%	2,6%	1,1%	0,5%	6,4%	35,7%	0,0%	0,3%	0,0%	34,7%	0,5%	0,0%	1,3%	0,1%	13,7%	0,0%	real data Gasqual
106		100%	0,3%	0,0%	1,0%	0,0%	10,2%	0,0%	0,0%	0,3%	6,9%	51,8%	0,0%	0,0%	0,0%	0,3%	7,5%	21,6%	real data Gasqual
107		100%	0,0%	0,0%	0,0%	0,0%	0,0%	20,0%	0,0%	0,0%	0,0%	20,0%	0,0%	0,0%	0,0%	0,0%	0,0%	60,0%	real data Gasqual
108		100%	2,7%	2,9%	0,8%	1,8%	4,5%	22,5%	0,0%	0,3%	0,3%	7,4%	1,1%	0,0%	0,3%	0,5%	0,2%	54,7%	real data Gasqual
109		100%	1%	3%	2%	1%	12%	9%	0%	2%	1%	20%	2%	0%	2%	1%	7%	35%	Boiler avg
201		100%	0,7%	5,9%	0,9%	0,0%	11,2%	5,6%	0,1%	2,1%	0,0%	13,1%	8,9%	12,8%	1,0%	0,3%	33,2%	4,0%	real data Gasqual
202	WATER	100%	0,7%	6,0%	0,9%	0,0%	11,2%	5,6%	0,0%	2,1%	0,0%	13,1%	8,9%	12,8%	1,0%	0,3%	33,2%	4,0%	real data Gasqual
203	HEATERS	100%	0,8%	5,0%	6,3%	0,1%	15,6%	28,6%	0,0%	9,3%	14,0%	0,9%	8,5%	0,4%	0,0%	2,5%	1,8%	6,3%	real data Gasqual
204		100%	0,8%	4,9%	6,6%	0,0%	15,6%	28,7%	0,0%	9,0%	13,9%	0,8%	8,2%	0,8%	0,0%	2,5%	1,6%	6,6%	real data Gasqual
501		100%	0,0%	5,2%	0,0%	0,0%	5,2%	5,2%	0,0%	5,2%	5,2%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	73,9%	real data Gasqual
502	Space	100%	0,0%	10,5%	0,0%	0,0%	10,5%	10,5%	0,0%	10,5%	10,5%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	47,7%	real data Gasqual
503	Heaters	100%	0,0%	6,7%	0,0%	0,0%	6,7%	6,7%	0,0%	6,7%	6,7%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	66,7%	Space heater avg
504		100%	0,0%	6,7%	0,0%	0,0%	6,7%	6,7%	0,0%	6,7%	6,7%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	66,7%	Space heater avg
601		100%	1%	3%	2%	1%	12%	9%	0%	2%	1%	20%	2%	0%	2%	1%	7%	35%	Boiler avg
602		100%	1%	3%	2%	1%	12%	9%	0%	2%	1%	20%	2%	0%	2%	1%	7%	35%	Boiler avg
603	CHP	100%	1%	3%	2%	1%	12%	9%	0%	2%	1%	20%	2%	0%	2%	1%	7%	35%	Boiler avg
604		100%	1%	3%	2%	1%	12%	9%	0%	2%	1%	20%	2%	0%	2%	1%	7%	35%	Boiler avg
605		100%	1%	3%	2%	1%	12%	9%	0%	2%	1%	20%	2%	0%	2%	1%	7%	35%	Boiler avg
701			1%	3%	2%	1%	12%	9%	0%	2%	1%	20%	2%	0%	2%	1%	7%	35%	Boiler avg
702	HP	100%	1%	3%	2%	1%	12%	9%	0%	2%	1%	20%	2%	0%	2%	1%	7%	35%	Boiler avg
703			1%	3%	2%	1%	12%	9%	0%	2%	1%	20%	2%	0%	2%	1%	7%	35%	Boiler avg
801		100%	1%	3%	2%	1%	12%	9%	0%	2%	1%	20%	2%	0%	2%	1%	7%	35%	Boiler avg
802	OTHER		1%	3%	2%	1%	12%	9%	0%	2%	1%	20%	2%	0%	2%	1%	7%	35%	Boiler avg
803	C III LI	100%	1%	3%	2%	1%	12%	9%	0%	2%	1%	20%	2%	0%	2%	1%	7%	35%	Boiler avg
804			1%	3%	2%	1%	12%	9%	0%	2%	1%	20%	2%	0%	2%	1%	7%	35%	Boiler avg





804bis		100%	1%	3%	2%	1%	12%	9%	0%	2%	1%	20%	2%	0%	2%	1%	7%	35%	Boiler avg
805	1		1%	3%	2%	1%	12%	9%	0%	2%	1%	20%	2%	0%	2%	1%	7%	35%	Boiler avg
806	1	100%	1%	3%	2%	1%	12%	9%	0%	2%	1%	20%	2%	0%	2%	1%	7%	35%	Boiler avg
807	1		1%	3%	2%	1%	12%	9%	0%	2%	1%	20%	2%	0%	2%	1%	7%	35%	Boiler avg
808		100%	1%	3%	2%	1%	12%	9%	0%	2%	1%	20%	2%	0%	2%	1%	7%	35%	Boiler avg
809		100%	1%	3%	2%	1%	12%	9%	0%	2%	1%	20%	2%	0%	2%	1%	7%	35%	Boiler avg
301		100%	1%	1%	3%	0%	18%	4%	0%	3%	0%	37%	<b>8%</b>	0%	0%	1%	<b>6%</b>	1 <b>9</b> %	real data Gasqual
302		100%	1%	1%	3%	0%	18%	4%	0%	3%	0%	37%	<b>8%</b>	0%	0%	1%	<b>6%</b>	<b>19%</b>	real data Gasqual
303		100%	1%	1%	3%	0%	18%	4%	0%	3%	0%	37%	8%	0%	0%	1%	<b>6%</b>	<b>19%</b>	real data Gasqual
304		100%	1%	1%	3%	0%	18%	4%	0%	3%	0%	37%	8%	0%	0%	1%	<b>6%</b>	<b>19%</b>	real data Gasqual
305		100%	1%	1%	3%	0%	18%	4%	0%	3%	0%	37%	8%	0%	0%	1%	<b>6%</b>	<b>19%</b>	real data Gasqual
306		100%	1%	1%	3%	0%	18%	4%	0%	3%	0%	37%	8%	0%	0%	1%	<b>6%</b>	<b>19%</b>	real data Gasqual
307	COOKERS	100%	1%	1%	3%	0%	18%	4%	0%	3%	0%	37%	8%	0%	0%	1%	<b>6%</b>	<b>19%</b>	real data Gasqual
308		100%	1%	1%	3%	0%	18%	4%	0%	3%	0%	37%	8%	0%	0%	1%	<b>6%</b>	<b>19%</b>	real data Gasqual
309		100%	1%	1%	3%	0%	18%	4%	0%	3%	0%	37%	8%	0%	0%	1%	<b>6%</b>	<b>19%</b>	real data Gasqual
310		100%	1%	1%	3%	0%	18%	4%	0%	3%	0%	37%	8%	0%	0%	1%	<b>6%</b>	<b>19%</b>	real data Gasqual
311		100%	1%	1%	3%	0%	18%	4%	0%	3%	0%	37%	8%	0%	0%	1%	<b>6%</b>	<b>19%</b>	real data Gasqual
312		100%	1%	1%	3%	0%	18%	4%	0%	3%	0%	37%	8%	0%	0%	1%	<b>6%</b>	<b>19%</b>	real data Gasqual
401		100%	1%	1%	3%	0%	18%	4%	0%	3%	0%	37%	8%	0%	0%	1%	6%	19%	
402		100%	1%	1%	3%	0%	18%	4%	0%	3%	0%	37%	8%	0%	0%	1%	6%	19%	
403		100%	1%	1%	3%	0%	18%	4%	0%	3%	0%	37%	8%	0%	0%	1%	6%	19%	
404		100%	1%	1%	3%	0%	18%	4%	0%	3%	0%	37%	8%	0%	0%	1%	6%	19%	
405		100%	1%	1%	3%	0%	18%	4%	0%	3%	0%	37%	8%	0%	0%	1%	6%	19%	
406	CATERING	100%	1%	1%	3%	0%	18%	4%	0%	3%	0%	37%	8%	0%	0%	1%	6%	19%	Cooker avg
407		100%	1%	1%	3%	0%	18%	4%	0%	3%	0%	37%	8%	0%	0%	1%	6%	19%	
408		100%	1%	1%	3%	0%	18%	4%	0%	3%	0%	37%	8%	0%	0%	1%	6%	19%	
409		100%	1%	1%	3%	0%	18%	4%	0%	3%	0%	37%	8%	0%	0%	1%	6%	19%	
410		100%	1%	1%	3%	0%	18%	4%	0%	3%	0%	37%	8%	0%	0%	1%	6%	19%	





# 2.3 Further calculations to take into account the findings from testing

In order to be able to treat all segments apart with their own conclusions, as described in D3.8, we had the need to rework some of the market data that were aggregated in THyGA market analysis from D2.1.

- For catering equipment, it was necessary to separate the technologies according the type of burner (full premix or not) as this is a parameter that is impacting the sensitivity to H2.
- Some repartition of aggregated numbers was needed to clarify the segments' expected values.

The original data have therefore been reworked so to refine the picture with a differentiation of some segments of appliances as indicated in the next table.

THyGA Segment	Type of appliance	Category	Burner type	Total Europe Population	Source: THyGA	Key for splitting per segment	Catering: % premix
101			Partial premix/conv (atmos. & fanned)	13 588	THyGA D2.1		
102		Open flued (former EN 297)	Low NOx technology burners	2 012	THyGA D2.1		
103			Full premix	152	THyGA D2.1		
104			Partial premix/conv (atmos. & fanned)	25 333	THyGA D2.1		
105	BOILERS	Room-sealed (former EN 483)	Low NOx technology burners	1 972	THyGA D2.1		
106			Full premix	1 781	THyGA D2.1		
107		Condensing boiler	Partial premix fanned	2 920	THyGA D2.1		
108		(former EN 677)	Full premix (including CCB)	56 492	THyGA D2.1		
109		Forced-draught / Jet burner boiler (former EN 303-3)	Jet burner	1 129	THyGA D2.1		
201		Instantaneous open flued	Partial premix/atmos	10 462	THyGA D2.1:	70%	
202	WATER	Instantaneous room- sealed	Partial premix/fanned	4 484	Total = 14945	30%	
203	HEATERS	Storage open flued	Partial premix/atmos	2 185	THyGA D2.1:	70%	
204		Storage room-sealed	Partial premix/fanned	936	Total = 3121	30%	
501		Independent gas-fired convection heaters type B	heating & decoration	4 678	THyGA D2.1		
502	Space Heaters	Independent gas-fired convection heaters type C	heating & decoration, balanced	1 839	THyGA D2.1		
503		Decorative fuel-effect	heating & decoration	2 529	THyGA D2.1		
504		Independent gas-fired	heating & decoration	98	THyGA D2.1		
601		Stirling Engines		15	THyGA D2.1		
602		Internal Combustion		41	THyGA D2.1		
603	СНР	Micro Gas Turbine	heating & electricity production	1	THyGA D2.1		
604		PEM FC		5	THyGA D2.1		
605		SO FC		3	THyGA D2.1		
701		Engine HP		48		80%	
702	HP	Adsorption	Heating	3	THyGA D2.1: Total = 60	5%	
703		Absorption		9		15%	
801	OTHER	Commercial Dryers		unknown	THyGA D2.1		
802	OTHER	Infrared Radiant Heaters (former EN 416-1)	non-domestic, tube radiant heaters	375		25%	

Table 6: Key to distribute aggregated numbers to sub-segments





		Infrared Padiant Heaters	non-domestic,				
803		(former EN 419-1)	luminous radiant heaters	375		25%	
804		Infrared Radiant Heaters (former EN 777-1)	non-domestic, tube radiant heaters	375	THyGA D2.1: Total = 1500	25%	
804bis		Radiant strip	with fan driven burners and recirculation fans	375		25%	
805		Air heaters (former EN 1020)	non-domestic, forced convection, fan, <300kW	495		33%	
806		Air heaters (former EN 525)	non-domestic, forced convection, <300kW	495	THyGA D2.1: Total = 1500	33%	
807		Air Heaters <70kW (former EN778)	Ducted warm air; forced convection air heaters	510		34%	
808		domestic washing machines		2	THyGA D2.1		
809		domestic dryers		2	THyGA D2.1		
301		Surface burner	Single ring	13 030		40%	
302		(cooktops) with atmospheric burner or	Single crown	16 287	THyGA D2.1: Total = 32574	50%	
303		"Venturi" burner (vertical venturi burner)	Multi ring (mainly double or triple ring)	3 257	10001 02077	10%	
304		Surface burner	Single ring	541		40%	
305		(cooktops) with partially premix burner (long	Single crown	676	THyGA D2.1: Total = 1352	50%	
306	COOKERS	horizontal venturi)	Multi ring (mainly double or triple ring)	135		10%	
307	COORERS	Ossita harren "tashadar"	Atmospheric burner	2 697	THyGA D2.1:	70%	
308		(ovens, freestanding	"Venturi" burner	1 156	Total = 3853	30%	
309		ranges)	Partially premixed	27 712	THyGA D2.1		
310		Cavity burner "metal	Atmospheric burner	9 139	THyGA D2.1:	70%	
311		sheet" (ovens,	"Venturi" burner	3 917	Total = 13056	30%	
312		neestanding ranges)	Partially premixed	14 658	THyGA D2.1		
401		Open burners and wok	Circular burner with vertical slots	120		10%	0%
402		burners	Circular burner with holes	120		10%	0%
403		Mixed ovens	Draught burners	120		10%	30%
404		Ovens	Tubular or circular burners	120		10%	30%
405		Boiling pans / pasta cookers	Microperforated burner	120		10%	30%
406	CATERING	Fryers	Premix burner	120	THyGA D2.1: Total = 1200	10%	30%
407		Salamanders / Rotisseries	Ceramic or blue	120	10101 - 1200	10%	0%
408		Brat pans	multi-ramp tubular	120		10%	0%
409		Covered burners (griddles, solid tops, pancake cookers)	Tubular burner or multi-ramp tubular burner	120		10%	0%
410		Barbecues	Chargrill with burner tubes w/ holes on top	120		10%	0%

# 2.4 Final table

The hypothesis from Table 5 and Table 6 were used to evaluate the appliance population per country, as shown in





#### Table 7: Appliance repartition per country (Europe + UK)

_										2	020 (TI	HyGA)								
THyGA Segment	Type of appliance	Category	Burner type	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	UK
101		Open flued	Partial premix/conv (atmos. & fanned)	13 588	113	663	837	28	3 600	117	16	1 026	21	3 046	950	123	81	415	1 194	1 356
102		(former EN 297)	Low NOx technology burners	2 012	113	82	49	0	173	1 006	0	37	0	322	89	0	2	8	133	0
103			Full premix	152	2	0	7	0	41	0	0	5	1	70	3	0	0	6	10	8
104	BOILERS	Room-sealed	Partial premix/conv (atmos. & fanned)	25 333	61	407	377	71	2 607	33	73	181	488	6 380	105	58	1 266	111	2 426	10 690
105		(former EN 483)	Low NOx technology burners	1 972	62	51	22	9	126	704	0	7	0	685	9	0	25	2	269	0
106			Full premix	1 781	6	0	18	0	181	0	0	6	123	923	0	0	0	6	134	385
107		Condensing	Partial premix fanned	2 920	0	0	0	0	0	584	0	0	0	584	0	0	0	0	0	1 752
108		677)	Full premix (including CCB)	56 492	1 507	1 647	450	993	2 564	12 689	18	158	187	4 187	642	6	187	292	88	30 880
109		Forced-draught / Jet burner boiler (former EN 303-3)	Jet burner	1 129	14	31	27	7	140	100	2	25	11	231	25	4	27	12	79	393
201		Instantaneous open flued	Partial premix/atmos	10 462	76	620	96	3	1 172	587	6	225	3	1 366	932	1 343	107	29	3 473	423
202	WATER	Instantaneous room-sealed	Partial premix/fanned	4 484	33	267	41	2	502	252	2	96	2	586	399	575	46	13	1 487	180
203	HEATERS	Storage open flued	Partial premix/atmos	2 185	17	109	138	3	341	625	0	203	305	19	185	9	1	54	39	138
204		Storage room- sealed	Partial premix/fanned	936	8	46	61	0	146	269	0	84	130	8	77	8	0	23	15	61
501	Space	Independent gas- fired convection heaters type B	heating & decoration	4 678	0	245	0	0	245	245	0	245	245	0	0	0	0	0	0	3 455
502	Heaters	Independent gas- fired convection heaters type C	heating & decoration, balanced	1 839	0	192	0	0	192	192	0	192	192	0	0	0	0	0	0	878





503		Decorative fuel- effect gas appliance/burner	heating & decoration	2 529	0	168	0	0	168	168	0	168	168	0	0	0	0	0	0	1 687
504		Independent gas- fired flueless space heaters	heating & decoration	98	0	7	0	0	7	7	0	7	7	0	0	0	0	0	0	65
601		Stirling Engines		15	0	0	0	0	2	1	0	0	0	3	0	0	0	0	1	5
602		Internal Combustion Engine	heating &	41	1	1	1	0	5	4	0	1	0	8	1	0	1	0	3	14
603	СНР	Micro Gas Turbine	electricity production	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
604		PEM FC		5	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	2
605		SO FC		3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
701		Engine HP		48	1	1	1	0	6	4	0	1	0	10	1	0	1	1	3	17
702	HP	Adsorption	Heating	3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
703		Absorption		9	0	0	0	0	1	1	0	0	0	2	0	0	0	0	1	3
801		Commercial Dryers		unknown																
802		Infrared Radiant Heaters (former EN 416-1)	non-domestic, tube radiant heaters	375	5	10	9	2	46	33	1	8	4	77	8	1	9	4	26	131
803		Infrared Radiant Heaters (former EN 419-1)	non-domestic, luminous radiant heaters	375	5	10	9	2	46	33	1	8	4	77	8	1	9	4	26	131
804		Infrared Radiant Heaters (former EN 777-1)	non-domestic, tube radiant heaters	375	5	10	9	2	46	33	1	8	4	77	8	1	9	4	26	131
804bis	OTHER	Radiant strip	with fan driven burners and recirculation fans	375	5	10	9	2	46	33	1	8	4	77	8	1	9	4	26	131
805		Air heaters (former EN 1020)	non-domestic, forced convection, fan, <300kW	495	6	14	12	3	61	44	1	11	5	101	11	2	12	5	35	172
806		Air heaters (former EN 525)	non-domestic, forced convection, <300kW	495	6	14	12	3	61	44	1	11	5	101	11	2	12	5	35	172





807		Air Heaters <70kW (former EN778)	Ducted warm air; forced convection air heaters	510	6	14	12	3	63	45	1	11	5	104	12	2	12	5	36	178
808		domestic washing machines		2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
809		domestic dryers		2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
301		Surface burner	Single ring	13 030	74	83	339	13	2 374	517	4	359	0	4 862	994	0	0	178	759	2 474
302		atmospheric	Single crown	16 287	93	104	423	17	2 968	646	5	449	0	6 077	1 242	0	0	223	948	3 092
303		burner or "Venturi" burner (vertical venturi burner)	Multi ring (mainly double or triple ring)	3 257	19	21	85	3	594	129	1	90	0	1 215	248	0	0	45	190	618
304		Surface burner	Single ring	541	3	3	14	1	99	21	0	15	0	202	41	0	0	7	31	103
305		partially premix	Single crown	676	4	4	18	1	123	27	0	19	0	252	52	0	0	9	39	128
306	COOKERS	burner (long horizontal venturi)	Multi ring (mainly double or triple ring)	135	1	1	4	0	25	5	0	4	0	50	10	0	0	2	8	26
307		Cavity burner	Atmospheric burner	2 697	15	17	70	3	491	107	1	74	0	1 006	206	0	0	37	157	512
308		"tubular" (ovens, freestanding	"Venturi" burner	1 156	7	7	30	1	211	46	0	32	0	431	88	0	0	16	67	219
309		ranges)	Partially premixed	27 712	158	176	720	28	5 050	1 099	9	764	0	10 340	2 113	0	0	379	1 614	5 261
310		Cavity burner "metal sheet"	Atmospheric burner	9 139	52	58	238	9	1 665	362	3	252	0	3 410	697	0	0	125	532	1 735
311		(ovens,	"Venturi" burner	3 917	22	25	102	4	714	155	1	108	0	1 461	299	0	0	54	228	744
312		ranges)	Partially premixed	14 658	84	93	381	15	2 671	581	5	404	0	5 469	1 118	0	0	201	854	2 783
401		Open burners	Circular burner with vertical slots	120	1	1	3	0	22	5	0	3	0	45	9	0	0	2	7	23
402			Circular burner with holes	120	1	1	3	0	22	5	0	3	0	45	9	0	0	2	7	23
403	CATERING	Mixed ovens	Draught burners	120	1	1	3	0	22	5	0	3	0	45	9	0	0	2	7	23
404		Ovens	Tubular or circular burners	120	1	1	3	0	22	5	0	3	0	45	9	0	0	2	7	23
405		Boiling pans / pasta cookers	Microperforated burner	120	1	1	3	0	22	5	0	3	0	45	9	0	0	2	7	23





406	Fryers	Premix burner	120	1	1	3	0	22	5	0	3	0	45	9	0	0	2	7	23
407	Salamanders / Rotisseries	Ceramic or blue flame burners	120	1	1	3	0	22	5	0	3	0	45	9	0	0	2	7	23
408	Brat pans	multi-ramp tubular slot burners	120	1	1	3	0	22	5	0	3	0	45	9	0	0	2	7	23
409	Covered burners (griddles, solid tops, pancake cookers)	Tubular burner or multi-ramp tubular burner	120	1	1	3	0	22	5	0	3	0	45	9	0	0	2	7	23
410	Barbecues	Chargrill with burner tubes w/ holes on top	120	1	1	3	0	22	5	0	3	0	45	9	0	0	2	7	23





# 3. Details on the delayed ignition findings and consequences on segmentation

### 3.1 Delayed ignition findings

Because of findings on delayed ignition at the end of the project (see deliverable D3.8), we had to create two additional subgroups to cope with this phenomenon on some appliances, for which we concluded there was an issue with delayed ignition.

#### Not premix boilers:

The segment group 100b is now divided in two parts:

- 100b pt1 Subgroup of not premix boiler which are Impacted (by delayed ignition)
  - o 101: open flued boiler (former EN 297) partial premix/conv. without fan
  - 0 102: open flued boiler (former EN 297) partial premix without fan low NOx version
  - 104: room sealed boiler (former EN 483) partial premix/conv. without fan
  - 105: room sealed boiler (former EN 483) partial premix/conv. without fan low NOx version
- 100b pt2 Subgroup of not premix boiler which are NOT Impacted (by delayed ignition)
   = Same as above with fan + the other segments of the group 100b

The segment group 200 is now divided in two parts:

- 200 pt1 Subgroup of water heaters which are Impacted (by delayed ignition)
  - 201: open flued instantaneous water heater (former EN 26) partial premix/atm without fan
  - o 203: open flued accumulation water heater (former EN 89) partial premix/atm without fan
- 200 pt2 Subgroup of water heaters which are NOT Impacted (by delayed ignition)
   = the other segments of the group 200

As a result, the impact cards showing the % of H2 impacting the appliances are modified as following

#### Segment group 100b

NOT Impacted (by delayed

ianition)

- 100b pt1 Subgroup of not premix boiler <u>which are Impacted (by delayed ignition) (new one</u> <u>starting red from 20% (green until 15%))</u>
- 100b pt2 Subgroup of not premix boiler <u>which are NOT Impacted (by delayed ignition) (same</u> <u>as previous)</u>

Table 8: Conclusions for segment 100b (impact card) including delayed ignition results

Operational

					H2 %	Tested			
		0	0- <b>10</b>	10- <b>20</b>	20- <b>23</b>	23- <b>30</b>	30- <b>40</b>	40- <b>50</b>	50- <b>60</b>
100b pt1 Boilers Not premix	Safety			red from 15%					
Impacted (by delayed ignition)	Operational								
-									
					H2 % <sup>-</sup>	Tested			
		0	0-10	10- <b>20</b>	20- <b>23</b>	23- <b>30</b>	30- <b>40</b>	40- <b>50</b>	50- <b>60</b>
100b pt2 Boilers Not premix	Safetv								3





#### Segment group 200:

- 200 pt1 Subgroup of water heaters <u>that are Impacted (by delayed ignition) (new subgroup</u> <u>starting red from 20% (green until 15%))</u>
- 200 pt1 Subgroup of water heaters <u>that are NOT Impacted (by delayed ignition) (same as previous)</u>

Table 9: Conclusions for segment 200 (impact card) including delayed ignition results

					H2 % <sup>-</sup>	Tested			
		0	0-10	10- <b>20</b>	20- <b>23</b>	23- <b>30</b>	30- <b>40</b>	40- <b>50</b>	50- <b>60</b>
200 pt1 Water heater Impacted	Safety			red from 15%					
(by delayed ignition)	Operational								
		0	0- <b>10</b>	10- <b>20</b>	20- <b>23</b>	23- <b>30</b>	30- <b>40</b>	40- <b>50</b>	50- <b>60</b>
200 pt2 Water heaters NOT	Safety						1	1	1
Impacted (by delayed ignition)	Operational								

#### Segment group 500:

We extend the conclusion of the results of the tests of the appliance from segment 502 to the other segments of this group, since as far as we know we should expect the same results from them (red from 30%).

Table 10: Conclusions for segment 500 (impact card) including delayed ignition results

					H2 %	Tested			
		0	0- <b>10</b>	10- <b>20</b>	20- <b>23</b>	23- <b>30</b>	30- <b>40</b>	40- <b>50</b>	50- <b>60</b>
500 Space Heaters	Safety								1
Without delayed ignition results	Operational							flame aspect	

					H2 %	Tested			
		0	0- <b>10</b>	10- <b>20</b>	20- <b>23</b>	23- <b>30</b>	30- <b>40</b>	40- <b>50</b>	50- <b>60</b>
500 Space Heaters	Safety								
With delayed ignition results	Operational							flame aspect	

#### 3.2 Population sensitive to delayed ignition

**The % of appliance per segment concerned with delayed ignition issues** gives the proportion of appliances supposed to be sensitive to delayed ignition calculated, applied on the appliance population given in section 2.4.

To our best knowledge, the two segments where we indicate 0% in Table 11 don't exist without fan.

Table 11: Percentage of appliances impacted by delayed ignition issues

Category	Burner type	Standard	% of appliance per segment concerned with delayed ignition
	Partial premix/conv (atmos. & fanned)		10%
Open flued (former EN 297)	Low NOx technology burners		10%
	Full premix	EN 45502	
	Partial premix/conv (atmos. & fanned)	EN 15502	0%
Room-sealed (former EN 483)	Low NOx technology burners		0%
	Full premix		





Condensing boiler (former EN	Partial premix fanned		
677)	Full premix (including CCB)		
Forced-draught / Jet burner boiler (former EN 303-3)	Jet burner		
Instantaneous open flued	Partial premix/atmos	EN 26	20%
Instantaneous room-sealed	Partial premix/fanned	EN 20	
Storage open flued	Partial premix/atmos		20%
Storage room-sealed	Partial premix/fanned	EN 89	
Independent gas-fired convection heaters type B	heating & decoration	EN 613	50%
Independent gas-fired convection heaters type C	heating & decoration, balanced	EN 613	50%
Decorative fuel-effect gas appliance/burner	heating & decoration	EN 13278 + EN 509	50%
Independent gas-fired flueless space heaters	heating & decoration	EN 14829	50%

# 4. Sensitivity of the different segments to various % of H2.

The analyse of the test results from /2/ is given in Table 12 (THyGA results without delayed ignition) and Table 13 (expected sensibility to delayed ignition, without taking into account the previous results).

Table 12: THyGA results summarized per segment, without delayed ignition

Test results	-
Not tested	
Adjustment not tested extensively	
No issues	
Operational issues but no safety issues	
Safety issues	
Safety issues on adjustment	





-					THyGA conclusions							
	Type of appliance	Category	Burner type	Standard	Natural gas	10%H2 in NG	20%H2 in NG	30%H2 in NG	40%H2 in NG	50%H2 in NG	60%H2 in NG	
101			Partial premix/conv (atmos. & fanned)		Nairraar	Naizzuez	Naizzuez	Naizzuez	al izzuez but na za	al izzuez but na za	Safety irruer	
102		Open flued (former EN 297)	Low NOx technology burners		Nairruar	Nairsuor	Naizzuez	Naizzuez	al irruor but nara	al izzuez but na za	Safety irruer	
103			Full premix		Nairruar	Naizzuez	ty izzuez an adjuz	ty izzuez an adjuz	Safety izzuez	Safety izzuez	Safety irruer	
104			Partial premiz/conv (atmos. & fanned)		Nairruor	Nairraer	Naizzuez	Naizzuez	al izzuez but naza	al izzuez but na za	Safety irruer	
105	BOILERS	Room-sealed (former EN 483)	Low NOx technology burners	EN 15502	Nairraar	Naizzuez	Naizzuez	Naizzuez	al izzuez but na za	al izzuez but na za	Safety irruer	
106			Fall premix		Nairruar	Nairsuor	ty irzuer an adjur	ty irzuwana dijur	Safety izzuez	Safety izzuez	Safety irruer	
107		Condensing boiler (former EN	Partial premix fanned		Naizzuez	Naissuor	Naizzuez	Neizzuez	al irruor but nara	al irruor but na ra	Safety irruer	
108		677)	Full premix (including CCB)		Naizzuez	Nairraer	ty irzuer on adjur	ty izzuez un adjuz	Safety izzuez	Safetyizzuez	Safety irruer	
109		Forced-draught / Jet burner boiler (former EN 303-3)	Jet burner		Naizzuez	Naissuer	Naizzuez	Naizzuez	al üzvez but naza	al izzuez but na za	Safety irruer	
201		Instantaneous open flued	Partial premix/atmos		Naizzuez	Naizzuez	Naizzuez	Naizzuez	Safety izzuez	Safety izzuez	Safety irruer	
202	WATER	Instantaneous room-sealed	Partial premix/fanned	CH 20	Naizzuez	Naizzuaz	Naizzuez	Naizzuez	Safety irruer	Safety irruer	Safety irruer	
203	HEATERS	Storage open flued	Partial premiz/atmos	EN 99	Nairruar	Naizzuez	Naizzuez	Naizzuez	Safety izzuez	Safety izzuez	Safety irruer	
204		Storage room-sealed	Partial premix/fanned	LH 03	Nairruar	Nairraer	Naizzuez	Naizzuez	Safety irruer	Safety irruer	Safety irruer	
501		Independent gas-fired convection	heating & decoration	EN 613	Nairsuor	Nairsuor	Naizzuez	Naizzuez	al üzvez but naza	alizzuezbutnaza	Safety irruer	
502	Space	Independent gas-fired convection heaters tune C	heating & decoration, balanced	EN 613	Naizzuez	Naizzuez	Naizzuez	Noizzuez	al izzuez but naza	al izzuez but na za	Safety irruer	
503	Heaters	Decorative fuel-effect gas appliance/burner	heating & decoration	EN 13278 • EN 50	Naizzuez	Naizzuez	Naizzuez	Naizzuez	al izzuez but naza	al izzuez but naza	Safety irruer	
504		Independent gas-fired flueless space heaters	heating & decoration	EN 14829	Nairruar	Naissuos	Naizzuoz	Naizzuoz	al izzuez but naza	al irruor but nara	Safety izzuez	
601		Stirling Enginee			Nottested	Nottested	Nottested	Nottortod	Nattortod	Nattortod	Nattortod	
602		Internal Combustion Engine			Naizzuez	Naissuor	Naizzuez	Naizzuez	Naizzuez	Nattortod	Nattortod	
603	CHP	Micro Gas Turbine	heating & electricity production	EN 50465	Nairruar	Naissuor	Naizzuez	Nattested	Nattested	Nattortod	Nattortod	
604		PEM FC			Naizzuez	Naissuor	Naizzuez	Naizzuez	Naizzuez	Nattortod	Nattorted	
605		SO FC			Nairruar	Nairraar	Naizzuez	Safety izzuez	Safety izzuez	Safety izzuez	Safety irruer	
701		Engine HP		EN 16905	Naizzuez	Naissuor	Naizzuez	Naizzuez	Naizzuez	Nattortod	Nattortod	
702	HP	Adsorption	Heating	FN 12309	Nairruar	Naissuor	Naizzuez	Naizzuez	Naizzuez	Natterted	Nattorted	
703		Absorption		LH 12303	Naizzuez	Naissuor	Naizzuez	Naizzuez	Naizzuez	Nattortod	Nattortod	
801		Connercial Dryers		EN 12752-1 and -2	Nottested	Nottested	Not tested	Nottested	Nattortod	Nattortod	Nattorted	
802		Infrared Radiant Heaters (former EN 416-1)	non-domestic, tube radiant heaters	EN 416	Nairruar	Naizzuez	Naizzuoz	Naizzuoz	Nairruor	Noirruer	Nairruor	
803		Infrared Radiant Heaters (former EN 419-1)	non-domestic, luminous radiant heaters	EN 419	Naizzuez	Naizzuez	Naizzuoz	Naizzuez	Naizzuoz	Naizzuez	Noirruar	
804	OTHER	Infrared Radiant Heaters (former EN 777-1)	non-domestic, tube radiant heaters with ran driven purners and recirculation	EN-416	Naizzuez	Naizzuez	Neizzuez	Neizzuez	Neizzuez	Noirruar	Naizzuez	
oU4bis		Hadiant strip	ton-domestic, forced convection, ran.	EN 1/1/5	Naizzuez	Nairruar	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Nairruar	
805		Air heaters (former EN 1020)	ASD-domestic, forced convection.	EN 17082	Nairruor	Nairruar	Naizzuez	Nairruor	Nairruor	Nairruer	Nairruar	
806		Air neaters (former EN 525) Air neaters (106w (rormer	Ducted warm air; forced convection air	EN 17082	Nairruar	Nairruar	Naizzuez	Naizzuez	Nairruar	Nairruar	Nairruar	
108		FW778)	haster	EM 11082	Nairruar	Nairruar	Nairruor	Neirruar	Nairruar	Nairruar	Nairruar	
800		domestic washing machines		ERI 1510	Nottested	Matterted	Notterted	Matterted	Natterted	Matterted	Notterted	
809		aomestic dryers		CH 1518	Nottested	Nottested	Nattortod	Nattortod	Nattortod	Nattortod	Nattortod	
301		Surface burner (cooktops) with	Single ring		Nairruar	Nuizzuez	Nairruar	Safety izzuez	Safety issues	Safety issues	Safety izzuez	
302		atmospheric burner or "Venturi"	Single crown		Neirruar	Neizzuez	Neirruar	Safety issues	Safety issues	Safety issues	Safety irruer	
303		Denner (vertical venceri berker)	Multi ring (mainly double or triple ring)		Nairruer	Noirruer	Naizzuez	Safety issues	Safety issues	Safety issues	Safety irsuer	
304		Surface burner (cooktops) with	Single ring		Nairruer	Nairruer	Nairruar	Safetyüzuez	Safety izzuez	Safetyizzuez	Safety izzuez	
305		parcially premix burner (long horizontal venturi)	single crown		Neirruor	Neizzuez	Neirruor	Safety irsuer	Safety issues	Safetyirruer	Safetyirruer	
306	COOKERS		Atmospheric bureau	EN 30-x	Netro	Netro	Neissuer	Safety üsues Safety üsues	Safety üsues Cofectular	Safety issues	Safety irsuer	
301		Cavity burner "tubular" (ovens,	"Westeri" bereer		Neissuer	Nairrea	Neissia	Safety usues	Safetyuzuer	Safety usues	Safety usues	
300		freestanding ranges)	Partially premited		Nation	Naiseus	National	Safety usues	Safety usues	Safety usues	Safety usues	
310			Atmospheric burner		Nairmar	Neirres	Nairmar	Safaty inves	Safety urger	Safety usues	Safety usues	
311		Cavity burner "metal sheet"	"Venturi" burner		Nairmar	Nairmor	Nairmar	Safatying	Safetyinger	Safatying	Safatying	
312		(ovens, freestanding ranges)	Partially premited		Nairmar	Nairmar	Neirmer	Safabajarra	Safabajara	Safabajarra	Safabuireuro	
401			Gircular burner with vertical clote		Nairros	Najerova	Nairros	Safetyuruur	Safetyuruur	Safetying	Safatuinus	
402		Open burners and wok burners	Circular burner with holes	EN 203-2-1	Nairrae	Nairraer	Nairrae	Safety irrest	Safety izznez	Safety izznez	Safety izznez	
403		Mixed ovens	Draught burners		Naizzvez	Nairryez	ty issues on a dise	ty issues on a dive	Safetyizzuer	Nottested	Nettested	
404		Ovens	Tubular or circular burners	EN 203-2-2	Naizzuez	Nairruer	Naizzuez	Safetvirruer	Safetvirruer	Safetvirruer	Safetvirruer	
405		Boiling pans / pasta cookers	Microperforated burner	EN 203-2-3 EN 2	Nairruer	Naizzuez	Naizzuez	Safetyirruer	Safetyizzuez	Safetyizzuez	Safetyizzuez	
406	CATERING	Freers	Premix burner	EN 203-2-4	Nairryer	Naizzuez	ty izzuez an adiuz	ty izzuez an adiuz	Safety issues	Nottested	Nottested	
407		Salamanders / Rotisseries	Ceramic or blue flame burners	EN 203-2-7	Naizzuez	Naizzuez	ty izzuez an adiuz	ty irzuer an adjur	Safetyizzuez	Nottested	Nottested	
408		Brat pans	multi-ramp tubular slot burners	EN 203-2-8	Nairruor	Nairruor	Nairruor	Safety izzuez	Safetyizzuez	Safety issues	Safety izzuez	
409		Covered burners (griddles, solid tops, pancake cookers)	Tubular burner or multi-ramp tubular burner	EN 203-2-9	Naissues	Naizzuez	Naissuos	Safety izzuez	Safety izzuez	Safety izzuez	Safety izzuez	
410		Barbecues	Chargrill with burner tubes w/ holes on	EN 203-2-10	Nairruar	Naizzuez	Naizzuez	Safety issues	Safetyizzuez	Safety issues	Safetyizzuez	

Table 13: Potential delayed ignition issue





					THuGA conclusions									
								TYGA CONCIUSIO	ns					
	Type of ap	Category	Burner type	Standard	Natural gas	10%H2 in NG	20%H2 in NG	30%H2 in NG	40%H2 in NG	50%H2 in NG	60%H2 in NG			
101			Partial premiz/conv (atmos. & fanned)		Nuizzuez	Nairruor	Delayed ignition rick	Delayed ignition rick	Delayed ignition rick	Delayed ignition rick	Delayed ignition rick			
102		Open fixed (former FN 297)	Low NOx technology burners		Neissues	Nairmar	Delay edianitian rick	Delayediasiting side	Delayed igniting sigk	Delayed insisting side	Delayed insition risk			
102		open mee (ronner En zor)	E-II		Malance	Malanua	Malanua	Ne lanca	Malannak	Malannak	bergybergindam ak			
105					118 07 027	118 07 027	118 07 077	118 07 007	118 07 027	118 02 027	118 07 027			
104			Partial premiz/conv [atmos. & fanned]		Naizzuez	Naizzuez	Delayed ignition rirk	Delayed ignition rick	Delayed ignition rick	Delayed ignition rick	Delayed ignition rick			
105	BOILERS	Room-sealed (former EN 483)	Low NOx technology burners	EN 15502	Nuizzuez	Naizzuez	Delayed ignition rirk	Delayed ignition rick	Dolayod iqnition rirk	Delayed ignition rick	Delayed ignition rirk			
106			Full premix		Naizzuez	Naizzuez	Naizzuez	Noirruar	Naizzuez	Naizzuez	Nairruar			
107		Condensing boiler (former EN	Partial premix fanned		Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Nairruar			
108		677)	Full premix (including CCB)	1	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez			
		Forced-draught / Jet burner		1										
109		boiler (former EN 303-3)	Jet burner		Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Nairruar			
201		Instantaneous open flued	Partial premiz/atmos	E11 04	Nuizzuez	Naizzuez	Delayed ignition rick	Delayed ignition rick	Delayed ignition rick	Delayed ignition rick	Delayed ignition rick			
202	WATER	Instantaneous room-sealed	Partial premiz/fanned	EN 26	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Nairruar			
203	HEATERS	Storage open fixed	Partial premit/atmos		Nairroor	Nairmor	Dolayod igniting rick	Dolayod igniting rick	Dolayod ianiting rick	Dolay ad igniting rick	<b>Dolaxod</b> ignition rick			
004		a la		EN 89			bordy barquictair a k	Derey bergin claim a k	opia) parquicianta k	Deray Parquician Faik	Dela) Parquiciantak			
204		storage room-sealed	Partial premix/ranked		Neurver	Newsver	Neuruer	Neuruer	Neurour	Neuruar	Neuruer			
501		Independent gas-fired convection	heating & decoration	EN 613	Naizzuez	Naizzuez	Delayed ignition rick	Delayed ignition rick	Delayed ignition rick	Delayed ignition rick	Delayed ignition rick			
		Independent gas-fired convection												
502	Space	heaters type C	heating & decoration, balanced	EN 613	Naizzuez	Naizzuez	Delayed ignition rick	Delayed ignition rick	Delayed ignition rick	Delayed ignition rick	Delayed ignition rirk			
502	Heaters	Decorative fuel-effect gas	Lusing + descusion	EN 19979 - EN F			<b>.</b>		<b></b>					
503		appliance/burner	nearing & decoration	En 13210 + EN SU	Neurver	Heurver	verayed ignition rick	verayed ignition rick	Velayed ignition rick	verayed ignition rick	verayed ignition rick			
504		Independent gas-fired flueless	heating & decoration	FN 14829	Neissues	Nairmar	Delayed insidian state	Delayedianiting state	Dalayadianiting sists	Delayedinaiting side	Delayedianitian -i-t-			
		space heaters	activity a deconation	2.1. 1402.0	1002302	110 07 007	Service a reporting for R	Construction Lake	Service Internation	Construction for the	Servyea renition fulk			
601		Stirling Enginee			Nuizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez			
602		Internal Combustion Engine			Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Nairroor			
603	CHP	Micro Gas Turbine	heating & electricity production	EN 50465	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Nairruar			
604		PEM FC			Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez			
6.05		\$0 FC			Martana	Network	Martinerra	Melanus	Network	Network	Martinese			
805		SUFC		EN 45.00E	Hourser	Hearver	Hoursee	Hourver	Hourser	Hourver	Neuruer			
101		Engine HP		EN 16905	Nairruar	Nairruar	Naizzuez	Nairruar	Naizzuez	Naizzuez	Nairruar			
702	нр	Adsorption	Heating	EN 12309	Nuirruar	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Noirruar			
703		Absorption			Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Nairruar			
801		Commercial Dryers		EN 12752-1 and -2	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Nairruar			
000		Infrared Radiant Heaters (former	non-domestic take andiant besters	EN 416	Martana	Mathematic	Martinera	Malanasa	Mathematic	Mathematic	Mathematic			
002		EN 416-1)	non-domescic, cabe fadianc neacers	CR 410	118 07 027	118 07 027	118 07 027	1807007	118 02 022	118 07 027	ine or der			
803		Infrared Radiant Heaters (former	non-domestic, luminous radiant heaters	EN 419	Naizzvez	Naizzuez	Naizzuez	Naizzuez	Naizzvez	Naizzuez	Naizzuez			
		EN 419-1)												
804		Infrared Hadiant Heaters (former FM 777-1)	non-domestic, tube radiant heaters	EN-416	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez			
804bie	OTHER	Dadiant strin	with ran driven purners and recirculation	EM 17175	Materia	Martana	Medanica	Malanna	Matanaa	Madanasa	Mathematic			
004015			for-domestic, forced convection, ran,	CH 1115	100300	1003000	1003000	110 03 000	110 03 000	110 03 000	110 03 000			
005		Air heaters (rormer EN 1020)	AGE-domestic, forced convection.	EN 11002	Neurver	Newsver	Neurrer	Neuruar	Neurour	Neuruar	Neuruer			
806		Air heaters (former EN 525)	(300EW STR SIT FORCE CONVECTION SIT	EN 17082	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Nairruar			
807		FN778)	haster.	EN 17082	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez			
808		domestic washing machines		EN 1518	Naizzuez	Naizzuez	Noizzuez	Naizzuez	Naizzuez	Naizzuez	Noizzuez			
809		domestic dryers		EN 1518	Nuizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez			
201			eia ale aiz a											
301		Surface burner (cooktops) with	single ring		Neurver	Newswar	Mauruar	Newsver	Naizzuez	Neurver	Neizzuaz			
302		atmospheric burner or "Venturi"	Single crown		Neirruar	Nairruor	Nairruar	Nairruar	Nairruor	Naizzuez	Nairruar			
303		baraci (fertical festari barser)	Multi ring (mainly double or triple ring)		Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Neizzuez			
304		Surface burner (cooktops) with	Single ring		Nuizzuez	Nairruar	Naizzuez	Nairruar	Naizzuez	Naizzuez	Nairruar			
305		partially premix burner (long	Single crown		Naiszuez	Nairruar	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuaz			
306		horizontal venturi)	Multi ring (mainly double or triple ring)		Nairruar	Naizzuoz	Naizzuez	Naizzuez	Naizzuoz	Naizzuez	Naizzuaz			
307	COOKERS		Atmospheric burner	EN 30-1	Naizzuez	Naizzuez	Naizzuez	Naizzvez	Naizzuez	Naizzuez	Naizzuez			
308		Cavity burner "tubular" (ovens,	"Yesturi" burser		Naissnor	Nairmor	Naissuos	Naizmor	Naizense	Naizzuoz	Naizmar			
309		freestanding ranges)	Partially premited		National	National	Natara	National	National	National	National			
303			A second president and a second		1007007	HE DY GOT	He up day	HB UT VAT	110 07 007	110 07 067	110 07 067			
310		Cavity burner "metal sheet"	Atmospheric Durner		Nauruer	Naizzuez	Nourver	Neizzuez	Naizzuez	Neizzuez	Neizzuez			
311		(ovens, freestanding ranges)	"Yenturi" burner		Neirruar	Nairruar	Nairruar	Nairruar	Nairruor	Naizzuez	Nairrear			
312			Partially premixed		Nuizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez			
401		Ones have and with have	Circular burner with vertical slots	EN 203.2.1	Nairrea	Nairruar	Naizzuez	Naizzuez	Naizzuez	Noirruer	Neirzuez			
402		open parners and won parners	Circular burner with holes	LH 203-2-1	Nairruor	Naizzuez	Naissuer	Naizzuez	Naizzuez	Naizzuez	Neizzuez			
403		Mized ovens	Draught burners		Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuaz			
404		Ovens	Tubular or circular burners	EN 203-2-2	Naizzvez	Naizzvez	Naizzuez	Naizzvez	Naizzvez	Naizzvez	Naizzuez			
405		Boiling page / pasta conterc	Microperforated burger	EN 203-2-3 EN 2	Nairmar	Nairmar	Nairruor	Nairruor	Nairruar	Nairroor	Nairmar			
405	CATERING	France	Pramir burner	FN 203-2-4	Nelsense	National	Neiserre	National	National	National	Neissus			
+00		i iyeis		EN 203-2-4	10 07 967	Heuryer	10 02 002	Heuruar	110 07 967	110 07 967	Heuruar			
407		Salamanders / Rotisseries	Geramic or blue flame burners	EN 203-2-7	Nairruar	Nairruor	Nairruar	Nairruar	Naizzuez	Noirruar	Nairrear			
408		Brat pans	multi-ramp tubular slot burners	EN 203-2-8	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Naizzuez	Neizzuez			
409		Covered burners (griddles, solid	Tubular burner or multi-ramp tubular	EN 203-2-9	Naizzuez	Naizzuez	Naizzuez	Naizzvez	Naizzuez	Naizzvez	Naizzuez			
		tops, pancake cookers)	burner Libargrill with burner tubes w/ boles on											
I 410		Barbecnes	and gette and a second an ables of	FN 203-2-10	Nations	Nations	Nations	Nationa	Nations	Nations	Nations			

We can now combine the sensitivity to the population of appliance and have a view on how various scenarios of H2% will impact the EU & national parc of appliances. This can be done with or without taking the delayed ignition into consideration.

# 5. Scenarios of hydrogen blend in natural gas in Europe

In this section, we examine the impact of increasing % of H2 on the actual population of appliances. The figure indicates the absolute value of appliances (in 1000) by country.

The figures are including the delayed ignition issue and are assuming that adjustment becomes an issue from 20% of H2 but not below. The tables used for the figures are in annex1.

This also considers that the liability issue described in THyGA deliverables D4.1<sup>4</sup> and D6.5<sup>5</sup> is solved.

<sup>&</sup>lt;sup>4</sup> THyGA D4.1 Overview of the current EU certification/standardization framework and description of the identified issues

<sup>&</sup>lt;sup>5</sup> THyGA D6.5 Green Hydrogen" for Europe roadmap





# 5.1 Scenario 1: 10% H2



Figure 1:THyGA results per appliance, with 10%H2NG

With 10% H2, there is no safety issue observed from the calculation made with the tables given in the previous sections of this document.



### 5.2 Scenario 2: 20% H2

Figure 2: THyGA results per appliance, with 20%H2NG

With 20% H2 there is already a notable impact which is very different by country.

The adjustment is clearly the main issue followed by the delayed ignition (in terms of appliances concerned). **The % of population at risk at EU level is about 30%** and the % of national market can be as high as 81% (DK) or as low as 7% (Spain). This is very much related to the % of country-penetration of fully premix condensing boilers.

If the adjustment issue is solved, some mitigation solutions being proposed in deliverable D5.2<sup>6</sup>, we can see a very clear benefit the % of appliances without issues is jumping from 71% to 96% !

Table 14: Consolidated results with 20%H2NG in Europe+UK (data in 1000 appliances)

<sup>&</sup>lt;sup>6</sup> THyGA D5.2 Test report of the identified mitigation solution on problematic appliances





Situation 1: Adjustment not solved		
No issues	162 658	71%
Operational issues but no safety issues	0	0%
Safety issue	67 446	29%
Delayed ignition risk	8 661	4%
Safety issues on adjustment	58 785	26%
Safety issue (other)	0	0%
Situation 2: Adjustment solved		
No issues	221 442	<del>96</del> %
Operational issues but no safety issues	0	0%
Safety issue	8 661	4%
Delayed ignition risk	8 661	4%
Safety issues on adjustment	0	0%
Safety issue (other)	0	0%

The main population that gives issue with adjustment is the boiler, only 43% of boilers would give no problem and solving the issue will bring the number to 99% (the 1 % left is due to the late ignition issues on some boilers, as explained in section 3).



### 5.3 Scenario 3: 30% H2

Figure 3: THyGA results per appliance, with 30%H2NG

At 30% H2, the cookers are added to the share of population giving issues due to flash back occurrences. **The % of population at risk at EU level is about 70%** and the % of national market can be as high as 89% (DK) or as low as 12/14% (Portugal, Romania). Again, this is very much related to the % of penetration of fully premix condensing boilers added to the use of gas cooker.

Similarly, to the previous case the resolution of the adjustment issue will bring a clear improvement of the figures with population at risk decreasing from 70 to 45%.

Table 15: Consolidated results with 30%H2NG in Europe+UK (data in 1000 appliances)





Situation	1· Ad	iustment	not	solved
Situation	I. AU	justment	not	solveu

No issues	68 609	30%
Operational issues but no safety issues	0	0%
Safety issue	161 494	70%
Delayed ignition risk	8 661	4%
Safety issues on adjustment	58 785	26%
Safety issue (other)	94 048	41%

Situation 2: Adjustment solved		
No issues	127 394	55%
Operational issues but no safety issues	0	0%
Safety issue	102 709	45%
Delayed ignition risk	8 661	4%
Safety issues on adjustment	0	0%
Safety issue (other)	94 048	41%

Similarly, to the previous case, the resolution of the adjustment issue will bring a clear improvement of the figures with population at risk decreasing from 70 to 45%.

However, the 45% of appliances experiencing problems are cookers and with our segmentation we consider that the whole cooker population is at risk.



### 5.4 Scenario 4: 40% H2

Figure 4: THyGA results per appliance, with 40%H2NG

At 40% H2, most of the appliances that were still doing fine at 30% are experiencing **operational issues or other effects**. Those can be noise, difficulties of ignition etc.

So, there are not many appliances left that are still compatible with the H2NG blend. Also here, because the multiplication of other issues, solving adjustment issue will not help.

Only 1% of the appliance population is able to cope with 40% H2, and we are talking about appliances such as infrared heaters, air heaters as well as some of the space heaters and CHP. Despite the variety of technologies, they represent only a small part of the population (dominated by boilers and cookers).





Also, it could be noted that because those population are small there has been test only on a limited number thus making the conclusion weaker.

Table 16: Consolidated results with 40%H2NG in Europe+UK (data in 1000 appliances)

Situation 1: Adjustment not solved										
No issues	3 106	1%								
Operational issues but no safety issues	49 967	22%								
Safety issue	177 030	77%								
Delayed ignition risk	8 661	4%								
Safety issues on adjustment	0	0%								
Safety issue (other)	168 369	73%								

Situation 2: Adjustment solved										
No issues	3 106	1%								
Operational issues but no safety issues	49 967	22%								
Safety issue	177 030	77%								
Delayed ignition risk	8 661	4%								
Safety issues on adjustment	0	0%								
Safety issue (other)	168 369	73%								

# 6. Conclusions

Boilers (105 M. appliances installed) and cookers (93M.) are the two dominating appliance types that are installed in the (EU + UK), they represent 86% of the total population of gas appliances. Therefore, they are very much influencing the conclusion of the whole study.

It is also important to note that the following conclusions consider that liability of existing appliances is taken care of by Member States, it can be the case for low %H2 but will be much more problematic with higher levels. Solving liability could also allow to solve other problems listed below, for example by replacing appliances with delated ignition issues with new systems.

The first conclusion we can make is that, if we don't do anything with the issues observed, 20% H2 in the grid will already generate a number of issues.

If no preventive action on delayed ignition and adjustment is initiated, it would be safe to go below 15% or even 10% H2 to ensure the safety of the end user.

Simple solutions can solve the issue of **adjustment** and improve considerably the safety of **the boilers** and **catering equipment** using fully premix technologies.

However, the **delayed ignition of blends** could bring issue already at 15% H2 and more investigations and efforts need to be done to identify how this could be solved. One drastic measure is to remove those appliances from the buildings where they are installed before using Hydrogen blends.

Above 20%H2, cookers will also bring issues with Flash back. It is not clear if this can just be solved with the replacement of injectors.

**Above 30%H2,** several new issues are appearing including operational ones, impacting a very high proportion of the appliance population and this will therefore make a wide distribution of blends with 30% or above problematic.





# References

/1/ THyGA report D2.1 « Market segmentation of domestic and commercial natural gas appliances »

/2/ THyGA report D3.8 "Segment of technologies by segment report on the impact of the different H2 concentrations on safety, efficiency, emissions and correct operation"

/3/ GASQUAL Gasqual D6.1 Standardization in the field of gas qualities. Mandate CE M400. Phase I. Final report. CEN/BT/WG 197





# Annex1. Table of results for the scenarios

All results in this section are including delayed ignition results.

### 10% H2

#### **Total appliances**

Impact of H2NG blend for 10%H2 in NG in 2020 : TOTAL APPLIANCES	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	UK
Stock of appliances	230.122	2.590	5.222	4.651	1.231	29.796	21.599	151	5.335	1.915	54.270	10.686	2.136	1.818	2.295	15.064	71.365
20%H2NG certified	2.737	2.590	2.654	2.650	1.231	2.659	2.656	151	2.651	1.915	2.661	2.656	2.136	1.818	2.295	2.673	2.657
Not H2NG certified	227.385	0	2.568	2.001	0	27.136	18.943	0	2.683	0	51.609	8.031	0	0	0	12.391	68.707
Not tested	19	0	1	0	0	2	2	0	0	0	4	0	0	0	0	1	7
Adjustment not tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed ignition risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No issues	230.104	2.589	5.222	4.650	1.231	29.793	21.597	151	5.334	1.914	54.267	10.686	2.136	1.817	2.294	15.062	71.358
Operational issues but no safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues on adjustment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No safety issue if adjustment solved	230.104	2.589	5.222	4.650	1.231	29.793	21.597	151	5.334	1.914	54.267	10.686	2.136	1.817	2.294	15.062	71.358
Not tested	19	0	1	0	0	2	2	0	0	0	4	0	0	0	0	1	7



#### **Boilers**

Impact of H2NG blend for 10%H2 in NG in 2020 : Boilers	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	UK
Stock of appliances	105.380	1.878	2.881	1.785	1.108	9.432	15.234	108	1.444	830	16.427	1.824	191	1.588	851	4.333	45.464
20%H2NG certified	2.649	1.878	2.649	1.785	1.108	2.649	2.649	108	1.444	830	2.649	1.824	191	1.588	851	2.649	2.649
Not H2NG certified	102.731	0	232	0	0	6.783	12.585	0	0	0	13.778	0	0	0	0	1.684	42.815
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Adjustment not tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed ignition risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No issues	105.380	1.878	2.881	1.785	1.108	9.432	15.234	108	1.444	830	16.427	1.824	191	1.588	851	4.333	45.464
Operational issues but no safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues on adjustment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No safety issue if adjustment solved	105.380	1.878	2.881	1.785	1.108	9.432	15.234	108	1.444	830	16.427	1.824	191	1.588	851	4.333	45.464
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0







#### Water heaters

Impact of H2NG blend for 10%H2 in NG in 2020 : Water heaters	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	UK
Stock of appliances	18.066	133	1.043	336	8	2.161	1.732	8	607	441	1.979	1.593	1.935	154	119	5.014	803
20%H2NG certified	73	1	4	1	0	8	5	0	2	1	9	6	9	1	0	23	3
Not H2NG certified	17.993	133	1.038	335	8	2.152	1.726	8	605	441	1.970	1.587	1.926	153	119	4.991	800
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Adjustment not tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed ignition risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No issues	18.066	133	1.043	336	8	2.161	1.732	8	607	441	1.979	1.593	1.935	154	119	5.014	803
Operational issues but no safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues on adjustment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No safety issue if adjustment solved	18.066	133	1.043	336	8	2.161	1.732	8	607	441	1.979	1.593	1.935	154	119	5.014	803



#### Space heaters

Impact of H2NG blend for 10%H2 in NG in 2020 : Space heaters	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	UK
Stock of appliances	9.144	0	612	0	0	612	612	0	612	612	0	0	0	0	0	0	6.086
20%H2NG certified	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not H2NG certified	9.144	0	612	0	0	612	612	0	612	612	0	0	0	0	0	0	6.086
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Adjustment not tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed ignition risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No issues	9.144	0	612	0	0	612	612	0	612	612	0	0	0	0	0	0	6.086
Operational issues but no safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues on adjustment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No safety issue if adjustment solved	9.144	0	612	0	0	612	612	0	612	612	0	0	0	0	0	0	6.086
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0







#### CHP

	r																
Impact of H2NG blend for 10%H2 in NG in 2020 : CHP	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	UK
Stock of appliances	64	1	2	2	0	8	6	0	1	1	13	1	0	2	1	4	22
20%H2NG certified	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not H2NG certified	63	1	2	2	0	8	6	0	1	1	13	1	0	2	1	4	22
Not tested	15	0	0	0	0	2	1	0	0	0	3	0	0	0	0	1	5
Adjustment not tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed ignition risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No issues	49	1	1	1	0	6	4	0	1	0	10	1	0	1	1	3	17
Operational issues but no safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues on adjustment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No safety issue if adjustment solved	49	1	1	1	0	6	4	0	1	0	10	1	0	1	1	3	17
Not tested	15	0	0	0	0	2	1	0	0	0	3	0	0	0	0	1	5



#### ΗP







#### Air and radiant heaters

Impact of H2NG blend for 10%H2 in NG in 2020 : Radiant and air heaters	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	UK
Stock of appliances	3.004	38	83	72	18	372	267	5	67	30	614	68	9	73	32	210	1.046
20%H2NG certified	13	0	0	0	0	2	1	0	0	0	3	0	0	0	0	1	5
Not H2NG certified	2.991	37	83	72	18	370	266	5	66	30	611	67	9	73	32	209	1.041
Not tested	4	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Adjustment not tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed ignition risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No issues	3.000	38	83	72	18	372	267	5	67	30	613	68	9	73	32	210	1.045
Operational issues but no safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues on adjustment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No safety issue if adjustment solved	3.000	38	83	72	18	372	267	5	67	30	613	68	9	73	32	210	1.045
Not tested	4	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1



#### Cookers

Impact of H2NG blend for 10%H2 in NG in 2020 : Cookers	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	UK
Stock of appliances	93.205	533	593	2.422	95	16.985	3.696	30	2.570	0	34.777	7.107	0	0	1.275	5.428	17.695
20%H2NG certified	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not H2NG certified	93.205	533	593	2.422	95	16.985	3.696	30	2.570	0	34.777	7.107	0	0	1.275	5.428	17.695
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Adjustment not tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed ignition risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No issues	93.205	533	593	2.422	95	16.985	3.696	30	2.570	0	34.777	7.107	0	0	1.275	5.428	17.695
Operational issues but no safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues on adjustment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No safety issue if adjustment solved	93.205	533	593	2.422	95	16.985	3.696	30	2.570	0	34.777	7.107	0	0	1.275	5.428	17.695
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0







#### Catering

Impact o in 2020 :	of H2NG Caterii	i blend for 10%H2 in NG Ig	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	UK
Stock of	appliar	nces	1.200	7	8	31	1	219	48	0	33	0	448	92	0	0	16	70	228
20%H2N	G certi	ied	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not H2N	IG certi	ied	1.200	7	8	31	1	219	48	0	33	0	448	92	0	0	16	70	228
Not test	ed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Adjustm	ient no	tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed	Ignitio	n risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operatio	:S anal icc	uer hut no cofety ircuer	1.200	/	8	31	1	219	48	0	33	0	448	92	0	0	10	/0	228
Safety is	SUPS	des but no salety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety is	sues of	n adjustment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety is	sue	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No safet	ty issue	if adjustment solved	1.200	7	8	31	1	219	48	0	33	0	448	92	0	0	16	70	228
Not test	ed	Impact of H2NG blend for 10%H2 in NG in 2020 : Catering															0		
Stock of appliances, x1 000 units	450 400 350 300 250 200 150 100																		
S	50 0															_			
		AUS BEI	. CZ	R	DEN	FRA	GER	GRE	HUN	IR	E	ITA	POL	POR	ROM	SLO	SP/	4 ι	ЈК
		No issues Op	erational is	sues but n	o safety iss	ues 🗖 Ac	ljustment r	not tested e	extensively	Safet	y issues on	adjustmen	t 📕 Safe	ty issues	■ Not tes	ted 💻 De	elayed ignit	ion risk	





### 20% H2

#### **Total appliances**

Impact of H2NG blend for 20%H2 in NG in 2020 : TOTAL APPLIANCES	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	UK
Stock of appliances	230.122	2.590	5.222	4.651	1.231	29.796	21.599	151	5.335	1.915	54.270	10.686	2.136	1.818	2.295	15.064	71.365
20%H2NG certified	2.737	2.590	2.654	2.650	1.231	2.659	2.656	151	2.651	1.915	2.661	2.656	2.136	1.818	2.295	2.673	2.657
Not H2NG certified	227.385	0	2.568	2.001	0	27.136	18.943	0	2.683	0	51.609	8.031	0	0	0	12.391	68.707
Not tested	19	0	1	0	0	2	2	0	0	0	4	0	0	0	0	1	7
Adjustment not tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed ignition risk	8.661	41	526	135	4	986	660	3	498	370	614	327	283	30	59	835	3.291
No issues	162.658	1.032	3.046	4.032	234	25.956	8.233	131	4.659	1.234	48.339	9.686	1.847	1.601	1.927	13.974	36.726
Operational issues but no safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues on adjustment	58.785	1.516	1.649	483	993	2.852	12.704	18	178	310	5.314	673	6	187	308	253	31.341
Safety issue	8.661	41	526	135	4	986	660	3	498	370	614	327	283	30	59	835	3.291
No safety issue if adjustment solved	221.442	2.548	4.695	4.515	1.227	28.807	20.937	148	4.837	1.545	53.653	10.359	1.853	1.788	2.235	14.227	68.067
Not tested	19	0	1	0	0	2	2	0	0	0	4	0	0	0	0	1	7



#### **Boilers**

Impact of H2NG blend for 20%H2 in NG in 2020 : Boilers	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	UK
Stock of appliances	105.380	1.878	2.881	1.785	1.108	9.432	15.234	108	1.444	830	16.427	1.824	191	1.588	851	4.333	45.464
20%H2NG certified	2.649	1.878	2.649	1.785	1.108	2.649	2.649	108	1.444	830	2.649	1.824	191	1.588	851	2.649	2.649
Not H2NG certified	102.731	0	232	0	0	6.783	12.585	0	0	0	13.778	0	0	0	0	1.684	42.815
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Adjustment not tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed ignition risk	1.560	23	74	89	3	377	112	2	106	2	337	104	12	8	42	133	136
No issues	45.395	341	1.159	1.223	112	6.269	2.432	89	1.169	518	10.911	1.075	173	1.393	505	3.968	14.056
Operational issues but no safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues on adjustment	58.425	1.514	1.647	474	993	2.786	12.689	18	168	310	5.179	645	6	187	303	232	31.273
Safety issue	1.560	23	74	89	3	377	112	2	106	2	337	104	12	8	42	133	136
No safety issue if adjustment solved	103.820	1.855	2.806	1.697	1.105	9.055	15.121	106	1.338	828	16.090	1.720	179	1.580	809	4.201	45.329
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0







#### Water heaters

Impact of H2NG blend for 20%H2 in NG in 2020 : Water heaters	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	UK
Stock of appliances	10.055	422	1.042	226		2.164	4 722		607		4.070	1.503	1.025	154		5.014	003
SLOCK OF appliances	18.000	133	1.045	330	0	2.101	1./32	0	607	441	1.979	1.593	1.935	154	119	5.014	803
20%H2NG certified	73	1	4	1	0	8	5	0	2	1	9	6	9	1	0	23	3
Not H2NG certified	17.993	133	1.038	335	8	2.152	1.726	8	605	441	1.970	1.587	1.926	153	119	4.991	800
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Adjustment not tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed ignition risk	2.529	19	146	47	1	303	242	1	85	62	277	223	270	22	17	702	112
No issues	15.537	115	897	290	7	1.858	1.489	7	522	380	1.702	1.370	1.665	132	102	4.312	691
Operational issues but no safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues on adjustment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issue	2.529	19	146	47	1	303	242	1	85	62	277	223	270	22	17	702	112
No safety issue if adjustment solved	15.537	115	897	290	7	1.858	1.489	7	522	380	1.702	1.370	1.665	132	102	4.312	691
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



#### Space heaters

Impact of H2NG blend for 20%H2 in NG in 2020 : Space heaters	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	UK
Stock of appliances	9.144	0	612	0	0	612	612	0	612	612	0	0	0	0	0	0	6.086
20%H2NG certified	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not H2NG certified	9.144	0	612	0	0	612	612	0	612	612	0	0	0	0	0	0	6.086
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Adjustment not tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed ignition risk	4.572	0	306	0	0	306	306	0	306	306	0	0	0	0	0	0	3.043
No issues	4.572	0	306	0	0	306	306	0	306	306	0	0	0	0	0	0	3.043
Operational issues but no safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues on adjustment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issue	4.572	0	306	0	0	306	306	0	306	306	0	0	0	0	0	0	3.043
No safety issue if adjustment solved	4.572	0	306	0	0	306	306	0	306	306	0	0	0	0	0	0	3.043
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0







#### СНР

Impact of H2NG blend for 20%H2 in 2020 : CHP	in NG Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	UK
Stock of appliances	64	1	2	2	0	8	6	0	1	1	13	1	0	2	1	4	22
20%H2NG certified	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not H2NG certified	63	1	2	2	0	8	6	0	1	1	13	1	0	2	1	4	22
Not tested	15	0	0	0	0	2	1	0	0	0	3	0	0	0	0	1	5
Adjustment not tested extensive	ly o	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed ignition risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Noissues	49	1	1	1	0	6	4	0	1	0	10	1	0	1	1	3	17
Operational issues but no safety	ssues 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues on adjustment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No safety issue if adjustment sol	/ed 49	1	1	1	0	6	4	0	1	0	10	1	0	1	1	3	17
Not tested	15	0	0	0	0	2	1	0	0	0	3	0	0	0	0	1	5
25 \$1 20 000 TX \$5 \$25 15																	
10 Land table tabl																	
0 AUS	BEL CZ	R E ssues but n	DEN 10 safety iss	FRA ues A	GER djustment i	GRE not tested	HUN	IRI	E I y issues on	TA adjustmer	POL nt Safe	POR ty issues	ROM	SLO ted D	SP elayed igni	A tion risk	UK

#### ΗP

Impact of H2NG blend for 20%H2 in NG in 2020 : HP	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	UK
Stock of appliances	60	1	2	1	0	7	5	0	1	1	12	1	0	1	1	4	21
20%H2NG certified	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not H2NG certified	59	1	2	1	0	7	5	0	1	1	12	1	0	1	1	4	21
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Adjustment not tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed ignition risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No issues	60	1	2	1	0	7	5	0	1	1	12	1	0	1	1	4	21
Operational issues but no safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues on adjustment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No safety issue if adjustment solved	60	1	2	1	0	7	5	0	1	1	12	1	0	1	1	4	21
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0







#### Air and radiant heaters

Impact of H2NG blend for 20%H2 in NG in 2020 : Radiant and air heaters	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	UK
Stock of appliances	3.004	38	83	72	18	372	267	5	67	30	614	68	9	73	32	210	1.046
20%H2NG certified	13	0	0	0	0	2	1	0	0	0	3	0	0	0	0	1	5
Not H2NG certified	2.991	37	83	72	18	370	266	5	66	30	611	67	9	73	32	209	1.041
Not tested	4	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Adjustment not tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed ignition risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No issues	3.000	38	83	72	18	372	267	5	67	30	613	68	9	73	32	210	1.045
Operational issues but no safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues on adjustment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No safety issue if adjustment solved	3.000	38	83	72	18	372	267	5	67	30	613	68	9	73	32	210	1.045
Not tested	4	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1



#### Cookers

Impact of H2NG blend for 20%H2 in NG in 2020 : Cookers	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	UK
Stock of appliances	93.205	533	593	2.422	95	16.985	3.696	30	2.570	0	34.777	7.107	0	0	1.275	5.428	17.695
20%H2NG certified	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not H2NG certified	93.205	533	593	2.422	95	16.985	3.696	30	2.570	0	34.777	7.107	0	0	1.275	5.428	17.695
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Adjustment not tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed ignition risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No issues	93.205	533	593	2.422	95	16.985	3.696	30	2.570	0	34.777	7.107	0	0	1.275	5.428	17.695
Operational issues but no safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues on adjustment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No safety issue if adjustment solved	93.205	533	593	2.422	95	16.985	3.696	30	2.570	0	34.777	7.107	0	0	1.275	5.428	17.695
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0







#### Catering

Impact of H2 in 2020 : Cate	IG blend for 20%H2 in NG ring	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	UK
Stock of appli	ances	1.200	7	8	31	1	219	48	0	33	0	448	92	0	0	16	70	228
20%H2NG cer	tified	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not H2NG cer	tified	1.200	7	8	31	1	219	48	0	33	0	448	92	0	0	16	70	228
Not tested		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Adjustment r	ot tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed ignit	ion risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No issues	successive and a soft a build a successive a	840	5	5	22	1	153	33	0	23	0	313	64	0	0	11	49	159
Operational I	ssues but no sarety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues	on adjustment	360	2	2	0	0	66	14	0	10	0	134	27	0	0	5	21	68
Safety issue	onaujustment	0	0	0	9	0	00	14	0	10	0	0	0	0	0	0	0	08
No safety issue	sty issue if adjustment solved         1 200         7         8         31         1         219         48         0         33         0         448         92         0         0         16         70           ited         0															228		
Not tested	tylissue if adjustmentsolved         1200         7         8         31         1         219         48         0         33         0         448         92         0         0         15         70           ted         0 <td>0</td>															0		
450 000 Stock of applian 000 S																		
0	AUS BE		R	DEN	FRA	GER	GRE	HUN	IR	E	ΠΑ	POL	POR	ROM	SLO	SP/	Α ι	JK
	No issues Op	erational is	sues but n	o safety iss	ues 🗖 Ac	djustment r	not tested e	extensively	Safet	/ issues on	adjustmen	t 📕 Safe	ty issues	■ Not tes	ted 🗖 De	elayed ignit	ion risk	





### 30% H2

#### **Total appliances**

Impact of H2NG blend for 30%H2 in NG in 2020 : TOTAL APPLIANCES	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	UK
Stock of appliances	230.122	2.590	5.222	4.651	1.231	29.796	21.599	151	5.335	1.915	54.270	10.686	2.136	1.818	2.295	15.064	71.365
20%H2NG certified	2.737	2.590	2.654	2.650	1.231	2.659	2.656	151	2.651	1.915	2.661	2.656	2.136	1.818	2.295	2.673	2.657
Not H2NG certified	227.385	0	2.568	2.001	0	27.136	18.943	0	2.683	0	51.609	8.031	0	0	0	12.391	68.707
Not tested	19	0	1	0	0	2	2	0	0	0	4	0	0	0	0	1	7
Adjustment not tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed ignition risk	8.661	41	526	135	4	986	660	3	498	370	614	327	283	30	59	835	3.291
No issues	68.609	494	2.448	1.588	138	8.817	4.503	101	2.066	1.234	13.248	2.515	1.847	1.601	641	8.497	18.871
Operational issues but no safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues	94.048	538	598	2.444	96	17.138	3.730	30	2.593	0	35.091	7.171	0	0	1.286	5.477	17.855
Safety issues on adjustment	58.785	1.516	1.649	483	993	2.852	12.704	18	178	310	5.314	673	6	187	308	253	31.341
Safety issue	102.709	579	1.125	2.580	100	18.124	4.390	33	3.090	370	35.705	7.498	283	30	1.345	6.312	21.146
No safety issue if adjustment solved	127.394	2.011	4.097	2.071	1.131	11.669	17.207	118	2.244	1.545	18.561	3.188	1.853	1.787	949	8.751	50.212
Not tested	19	0	1	0	0	2	2	0	0	0	4	0	0	0	0	1	7



#### **Boilers**

Impact of H2NG blend for 30%H2 in NG in 2020 : Boilers	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	UK
Stock of appliances	105.380	1.878	2.881	1.785	1.108	9.432	15.234	108	1.444	830	16.427	1.824	191	1.588	851	4.333	45.464
20%H2NG certified	2.649	1.878	2.649	1.785	1.108	2.649	2.649	108	1.444	830	2.649	1.824	191	1.588	851	2.649	2.649
Not H2NG certified	102.731	0	232	0	0	6.783	12.585	0	0	0	13.778	0	0	0	0	1.684	42.815
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Adjustment not tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed ignition risk	1.560	23	74	89	3	377	112	2	106	2	337	104	12	8	42	133	136
No issues	45.395	341	1.159	1.223	112	6.269	2.432	89	1.169	518	10.911	1.075	173	1.393	505	3.968	14.056
Operational issues but no safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues on adjustment	58.425	1.514	1.647	474	993	2.786	12.689	18	168	310	5.179	645	6	187	303	232	31.273
Safety issue	1.560	23	74	89	3	377	112	2	106	2	337	104	12	8	42	133	136
No safety issue if adjustment solved	103.820	1.855	2.806	1.697	1.105	9.055	15.121	106	1.338	828	16.090	1.720	179	1.580	809	4.201	45.329
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0







#### Water heaters

Impact of H2NG blend for 30%H2 in NG in 2020 : Water heaters	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	UK
Stock of appliances	18.066	133	1.043	336	8	2 161	1 732	8	607	441	1 979	1 5 9 3	1 935	154	119	5.014	803
20%H2NG certified	73	1	4	1	0	8	5	0	2	1	9	6	9	1	0	23	3
Not H2NG certified	17 993	133	1.038	335	8	2 152	1 726	8	605	441	1 970	1 587	1 926	153	119	4 991	800
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Adjustment not tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed ignition risk	2.529	19	146	47	1	303	242	1	85	62	277	223	270	22	17	702	112
No issues	15.537	115	897	290	7	1.858	1.489	7	522	380	1.702	1.370	1.665	132	102	4.312	691
Operational issues but no safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues on adjustment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issue	2.529	19	146	47	1	303	242	1	85	62	277	223	270	22	17	702	112
No safety issue if adjustment solved	15.537	115	897	290	7	1.858	1.489	7	522	380	1.702	1.370	1.665	132	102	4.312	691
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



#### Space heaters

Impact of H2NG blend for 30%H2 in NG in 2020 : Space heaters	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	UK
Stock of appliances	9.144	0	612	0	0	612	612	0	612	612	0	0	0	0	0	0	6.086
20%H2NG certified	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not H2NG certified	9.144	0	612	0	0	612	612	0	612	612	0	0	0	0	0	0	6.086
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Adjustment not tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed ignition risk	4.572	0	306	0	0	306	306	0	306	306	0	0	0	0	0	0	3.043
No issues	4.572	0	306	0	0	306	306	0	306	306	0	0	0	0	0	0	3.043
Operational issues but no safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues on adjustment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issue	4.572	0	306	0	0	306	306	0	306	306	0	0	0	0	0	0	3.043
No safety issue if adjustment solved	4.572	0	306	0	0	306	306	0	306	306	0	0	0	0	0	0	3.043
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0







#### СНР

Impact of H2NG blend for 30%H2 in NG in 2020 : CHP	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	UK
Stock of appliances	64	1	2	2	0	8	6	0	1	1	13	1	0	2	1	4	22
20%H2NG certified	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not H2NG certified	63	1	2	2	0	8	6	0	1	1	13	1	0	2	1	4	22
Not tested	15	0	0	0	0	2	1	0	0	0	3	0	0	0	0	1	5
Adjustment not tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed ignition risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No issues	46	1	1	1	0	6	4	0	1	0	9	1	0	1	0	3	16
Operational issues but no safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues	3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Safety issues on adjustment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issue	3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
No safety issue if adjustment solved	46	1	1	1	0	6	4	0	1	0	9	1	0	1	0	3	16
Not tested	15	0	0	0	0	2	1	0	0	0	3	0	0	0	0	1	5



#### ΗP

Impact of H2NG blend for 30%H2 in NG in 2020 : HP	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	UK
Stock of appliances	60	1	2	1	0	7	5	0	1	1	12	1	0	1	1	4	21
20%H2NG certified	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not H2NG certified	59	1	2	1	0	7	5	0	1	1	12	1	0	1	1	4	21
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Adjustment not tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed ignition risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No issues	60	1	2	1	0	7	5	0	1	1	12	1	0	1	1	4	21
Operational issues but no safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues on adjustment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No safety issue if adjustment solved	60	1	2	1	0	7	5	0	1	1	12	1	0	1	1	4	21
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0







#### Air and radiant heaters

Impact of H2NG blend for 30%H2 in NG in 2020 : Radiant and air heaters	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	UK
Stock of appliances	3.004	38	83	72	18	372	267	5	67	30	614	68	9	73	32	210	1.046
20%H2NG certified	13	0	0	0	0	2	1	0	0	0	3	0	0	0	0	1	5
Not H2NG certified	2.991	37	83	72	18	370	266	5	66	30	611	67	9	73	32	209	1.041
Not tested	4	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Adjustment not tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed ignition risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No issues	3.000	38	83	72	18	372	267	5	67	30	613	68	9	73	32	210	1.045
Operational issues but no safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues on adjustment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No safety issue if adjustment solved	3.000	38	83	72	18	372	267	5	67	30	613	68	9	73	32	210	1.045
Not tested	4	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1



#### Cookers

Impact of H2NG blend for 30%H2 in NG in 2020 : Cookers	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	ик
Stock of appliances	93.205	533	593	2.422	95	16.985	3.696	30	2.570	0	34.777	7.107	0	0	1.275	5.428	17.695
20%H2NG certified	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not H2NG certified	93.205	533	593	2.422	95	16.985	3.696	30	2.570	0	34.777	7.107	0	0	1.275	5.428	17.695
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Adjustment not tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed ignition risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operational issues but no safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues	93.205	533	593	2.422	95	16.985	3.696	30	2.570	0	34.777	7.107	0	0	1.275	5.428	17.695
Safety issues on adjustment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issue	93.205	533	593	2.422	95	16.985	3.696	30	2.570	0	34.777	7.107	0	0	1.275	5.428	17.695
No safety issue if adjustment solved	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0







#### Catering

Impact of H2NG in 2020 : Caterin	i blend for 30%H2 in NG <sup>1</sup> g	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	ик
Stock of applian	nces	1.200	7	8	31	1	219	48	0	33	0	448	92	0	0	16	70	228
20%H2NG certif	fied	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not H2NG certif	fied	1.200	7	8	31	1	219	48	0	33	0	448	92	0	0	16	70	228
Not tested		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Adjustment not	t tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed Ignition	n risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operational iss	ues hut no safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues	act but no surcey issues	840	5	5	22	1	153	33	0	23	0	313	64	0	0	11	49	159
Safety issues or	n adjustment	360	2	2	9	0	66	14	0	10	0	134	27	0	0	5	21	68
Safety issue         840         5         5         22         1         153         33         0         23         0         313         64         0         0         11           No safety issue if adjustment solved         360         2         2         9         0         66         14         0         10         0         134         27         0         0         5           Not tested         0														49	159			
Safety issue if adjustment solved         360         2         2         1         153         33         0         23         0         313         64         0         0         11           Nos afety issue if adjustment solved         360         2         2         9         0         66         14         0         0         0         0         0         5           Not tested         0														21	68			
Safety issue         B40         5         5         22         1         153         33         0         23         0         313         64         0         0         11           No safety issue if adjustment solved         360         2         2         9         0         66         14         0         10         0         134         27         0         0         5           Not tested         0														0	0			
450 400 nuits 300 300																		
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0	AUS BE		K .	DEN	FRA	GER	GRE	HUN	I IR	E	ITA	POL	POR	ROM	SLO	SP	A	UK





### 40% H2

#### **Total appliances**

Impact of H2NG blend for 40%H2 in NG in 2020 : TOTAL APPLIANCES	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	UK
Stock of appliances	230.122	2.590	5.222	4.651	1.231	29.796	21.599	151	5.335	1.915	54.270	10.686	2.136	1.818	2.295	15.064	71.365
20%H2NG certified	2.737	2.590	2.654	2.650	1.231	2.659	2.656	151	2.651	1.915	2.661	2.656	2.136	1.818	2.295	2.673	2.657
Not H2NG certified	227.385	0	2.568	2.001	0	27.136	18.943	0	2.683	0	51.609	8.031	0	0	0	12.391	68.707
Not tested	19	0	1	0	0	2	2	0	0	0	4	0	0	0	0	1	7
Adjustment not tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed ignition risk	8.661	41	526	135	4	986	660	3	498	370	614	327	283	30	59	835	3.291
No issues	3.106	39	86	75	19	385	276	5	69	31	634	70	10	76	33	217	1.081
Operational issues but no safety issues	49.967	341	1.465	1.223	112	6.575	2.738	89	1.475	824	10.911	1.075	173	1.393	505	3.968	17.099
Safety issues	168.369	2.169	3.144	3.217	1.096	21.848	17.923	55	3.293	690	42.107	9.213	1.671	319	1.697	10.042	49.887
Safety issues on adjustment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issue	177.030	2.210	3.671	3.352	1.099	22.834	18.583	58	3.790	1.060	42.721	9.541	1.953	349	1.756	10.877	53.177
No safety issue if adjustment solved	53.073	380	1.551	1.298	131	6.959	3.014	94	1.544	855	11.545	1.145	183	1.469	538	4.186	18.181
Not tested	19	0	1	0	0	2	2	0	0	0	4	0	0	0	0	1	7



#### **Boilers**

Impact of H2NG blend for 40%H2 in NG in 2020 : Boilers	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	UK
Stock of appliances	105.380	1.878	2.881	1.785	1.108	9.432	15.234	108	1.444	830	16.427	1.824	191	1.588	851	4.333	45.464
20%H2NG certified	2.649	1.878	2.649	1.785	1.108	2.649	2.649	108	1.444	830	2.649	1.824	191	1.588	851	2.649	2.649
Not H2NG certified	102.731	0	232	0	0	6.783	12.585	0	0	0	13.778	0	0	0	0	1.684	42.815
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Adjustment not tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed ignition risk	1.560	23	74	89	3	377	112	2	106	2	337	104	12	8	42	133	136
No issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operational issues but no safety issues	45.395	341	1.159	1.223	112	6.269	2.432	89	1.169	518	10.911	1.075	173	1.393	505	3.968	14.056
Safety issues	58.425	1.514	1.647	474	993	2.786	12.689	18	168	310	5.179	645	6	187	303	232	31.273
Safety issues on adjustment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issue	59.985	1.537	1.721	562	996	3.163	12.802	19	275	313	5.516	749	18	195	346	365	31.408
No safety issue if adjustment solved	45.395	341	1.159	1.223	112	6.269	2.432	89	1.169	518	10.911	1.075	173	1.393	505	3.968	14.056
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0







#### Water heaters

Impact of H2NG blend for 40%H2 in NG in 2020 : Water heaters	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA
Stock of appliances	18.066	133	1.043	336	8	2.161	1.732	8	607	441	1.979	1.593	1.935	154	119	5.014
20%H2NG certified	73	1	4	1	0	8	5	0	2	1	9	6	9	1	0	23
Not H2NG certified	17.993	133	1.038	335	8	2.152	1.726	8	605	441	1.970	1.587	1.926	153	119	4.991
Nottested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Adjustment not tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed ignition risk	2.529	19	146	47	1	303	242	1	85	62	277	223	270	22	17	702
No issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operational issues but no safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues	15.537	115	897	290	7	1.858	1.489	7	522	380	1.702	1.370	1.665	132	102	4.312
Safety issues on adjustment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issue	18.066	133	1.043	336	8	2.161	1.732	8	607	441	1.979	1.593	1.935	154	119	5.014
No safety issue if adjustment solved	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



#### Space heaters

Impact of H2NG blend for 40%H2 in NG in 2020 : Space heaters	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	UK
Stock of appliances	9.144	0	612	0	0	612	612	0	612	612	0	0	0	0	0	0	6.086
20%H2NG certified	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not H2NG certified	9.144	0	612	0	0	612	612	0	612	612	0	0	0	0	0	0	6.086
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Adjustment not tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed ignition risk	4.572	0	306	0	0	306	306	0	306	306	0	0	0	0	0	0	3.043
No issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operational issues but no safety issues	4.572	0	306	0	0	306	306	0	306	306	0	0	0	0	0	0	3.043
Safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues on adjustment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issue	4.572	0	306	0	0	306	306	0	306	306	0	0	0	0	0	0	3.043
No safety issue if adjustment solved	4.572	0	306	0	0	306	306	0	306	306	0	0	0	0	0	0	3.043
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0







#### CHP

Impact of H2NG blend for 40%H2 in NG in 2020 : CHP	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	UK
Stock of appliances	64	1	2	2	0	8	6	0	1	1	13	1	0	2	1	4	22
20%H2NG certified	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not H2NG certified	63	1	2	2	0	8	6	0	1	1	13	1	0	2	1	4	22
Not tested	15	0	0	0	0	2	1	0	0	0	3	0	0	0	0	1	5
Adjustment not tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed ignition risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No issues	46	1	1	1	0	6	4	0	1	0	9	1	0	1	0	3	16
Operational issues but no safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues	3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Safety issues on adjustment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issue	3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
No safety issue if adjustment solved	46	1	1	1	0	6	4	0	1	0	9	1	0	1	0	3	16
Not tested	15	0	0	0	0	2	1	0	0	0	3	0	0	0	0	1	5



#### ΗP

Impact of H2NG blend for 40%H2 in NG in 2020 : HP	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	UK
Stock of appliances	60	1	2	1	0	7	5	0	1	1	12	1	0	1	1	4	21
20%H2NG certified	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not H2NG certified	59	1	2	1	0	7	5	0	1	1	12	1	0	1	1	4	21
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Adjustment not tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed ignition risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No issues	60	1	2	1	0	7	5	0	1	1	12	1	0	1	1	4	21
Operational issues but no safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues on adjustment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No safety issue if adjustment solved	60	1	2	1	0	7	5	0	1	1	12	1	0	1	1	4	21
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0







#### Air and radiant heaters

			-														
Impact of H2NG blend for 40%H2 in NG in 2020 : Radiant and air heaters	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	UK
Stock of appliances	3.004	38	83	72	18	372	267	5	67	30	614	68	9	73	32	210	1.046
20%H2NG certified	13	0	0	0	0	2	1	0	0	0	3	0	0	0	0	1	5
Not H2NG certified	2.991	37	83	72	18	370	266	5	66	30	611	67	9	73	32	209	1.041
Not tested	4	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Adjustment not tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed ignition risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No issues	3.000	38	83	72	18	372	267	5	67	30	613	68	9	73	32	210	1.045
Operational issues but no safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues on adjustment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No safety issue if adjustment solved	3.000	38	83	72	18	372	267	5	67	30	613	68	9	73	32	210	1.045
Not tested	4	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1



#### Cookers

Impact of H2NG blend for 40%H2 in NG in 2020 : Cookers	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	UK
Stock of appliances	93.205	533	593	2.422	95	16.985	3.696	30	2.570	0	34.777	7.107	0	0	1.275	5.428	17.695
20%H2NG certified	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not H2NG certified	93.205	533	593	2.422	95	16.985	3.696	30	2.570	0	34.777	7.107	0	0	1.275	5.428	17.695
Not tested	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Adjustment not tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delayed ignition risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operational issues but no safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issues	93.205	533	593	2.422	95	16.985	3.696	30	2.570	0	34.777	7.107	0	0	1.275	5.428	17.695
Safety issues on adjustment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety issue	93.205	533	593	2.422	95	16.985	3.696	30	2.570	0	34.777	7.107	0	0	1.275	5.428	17.695
No safety issue if adjustment solved	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mark Assacts of																	







#### Catering

Impac in 2020	: of H2N( ) : Cateri	5 blend for 40%H2 in NG ng	Total Europe Population	AUS	BEL	CZ R	DEN	FRA	GER	GRE	HUN	IRE	ITA	POL	POR	ROM	SLO	SPA	UK
Stock	of applia	nces	1.200	7	8	31	1	219	48	0	33	0	448	92	0	0	16	70	228
20%H2	NG certi	fied	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not H	NG certi	fied	1.200	7	8	31	1	219	48	0	33	0	448	92	0	0	16	70	228
Not te	sted		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Adjust	ment no	t tested extensively	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delaye	dignitic	on risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Opera	ional ice	ues but no safety issues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety	issues	ides but no salety issues	1 2 0 0	7	8	31	1	219	48	0	33	0	448	92	0	0	16	70	228
Safety	issues o	n adiustment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Safety	issue	1	1.200	7	8	31	1	219	48	0	33	0	448	92	0	0	16	70	228
No saf	ety issue	if adjustment solved	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No safety issue it adjustment solved         0													0	0	0	0	0	0	0
es, x1 000 units	450 400 350 300																		
liance	250																		
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ock o	150																		
Sto	100																_	_	
	50		-																
	0	AUS BE	EL CZ	Z R	DEN	FRA	GER	GRE	HUN	I IR	E	ITA	POL	POR	ROM	SLO	SF	A	UK
		No issues O	perational is	sues but n	o safety iss	ues 🔳 Ao	djustment i	not tested	extensively	safet	y issues on	ı adjustmer	it 📕 Safe	ty issues	■ Not tes	sted 💻 D	elayed igni	tion risk	