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Johra, Hicham

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Hicham Johra

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1. Foreword

The aim of this technical report is to present an overview of the current domestic hot water production systems that are typically in use in the residential buildings of the different countries of the world. One can clearly observe the large potential for the use of renewable energy sources and the energy efficiency improvement of the domestic hot water production systems it in many of those countries.

The data of this report originates from various types of publications reporting typical domestic hot water production systems and energy sources in different countries. Nonetheless, this information is rarely established from large national surveys of dwellings. It should therefore be used as an estimate rather than a precise statistical overview. Many countries are not included in the table as it was impossible to find any information about them regarding domestic hot water production.

2. Current Typical Energy Sources and Systems for Domestic Hot Water Production in the Different Countries

Table 1 presents a list of the typical energy sources and systems that are currently used for the production of domestic hot water (DHW) in different countries. The share of each entry (indicated in between parentheses if known) corresponds to the percentage of the system / energy source that is currently installed and used in the existing residential building stocks. It should be noted that the entries in the "energy sources" column do not necessarily correspond to the entries in the "production systems" column. However, the entries in the "storage" column correspond to the entries in the "production systems" column. For each country, the entries are ranked from the most significant (highest share) at the top, to the least significant (lowest share) at the bottom (except some few exceptions).

One can observe in **Table 1** that many countries use fossil fuel-based boilers that typically have limited energy efficiency. In addition, many DHW production systems are low-cost decentralized tankless on-demand units placed in the bathroom to provide hot water for showering only, or low-efficiency fossil fuel burners. It should also be noted that many people in the rural areas of developing countries do not have easy access to running water or sometimes potable water, and thus access to domestic hot water for sanitation is not a priority. It is common to not have access to domestic hot water production in the rural areas of developing countries with warm climate all year long. This overview clearly emphasizes the large potential for implementation of energy-efficient DHW production systems such as heat pumps, centralized production units, solar thermal collectors or heat recovery units, powered by renewable and sustainable energy sources such as decarbonized district heating networks, decarbonized electricity grids, sustainably harvested firewood, solar radiation or waste heat [1].

Table 1: *Typical energy sources and systems currently used for the production of domestic hot water of residential buildings in different countries.*

Countries	Energy sources for DHW production (share)	Systems for DHW production (share)	DHW storage	References
Albania	Electricity (86%)	Electrical boiler	-	[2]
	Liquified Petroleum Gas (8%)	Gas boiler	-	[2]
	Wood (5%)	Wood stove	-	[2]
	Oil (0.5%)			[2]
	Kerosene (0.4%)			[2]
	Solar thermal (0.1%)	Flat plate solar collector	Yes	[2]
Algeria	Gas	Gas boiler	-	[3]
	Electricity	Electric boiler	-	[3]
Argentina	Natural gas (85.4%)	Gas boiler	-	[4]
	Liquified Petroleum Gas (12%)			[4]
	Electricity (1.5%)	Electric boiler	-	[4]

	Wood (1%)	Wood boiler	-	[4]
Armenia	Gas (78%)	Boiler	-	[5]
	Electricity			[5]
Australia	Gas (45%)	Gas boiler with storage (24%)	Yes	[6]
		Tankless on-demand gas boiler (21%)	No	[6]
	Electricity (42%)	Electric boiler with storage (36%)	Yes	[6]
		Tankless on-demand electric boiler (3%)	No	[6]
		Electric heat pump (3%)	Yes	[6]
	Solar thermal (13%)	Solar collector with electric boiler (10%)	Yes	[6]
		Solar collector with gas boiler (3%)	Yes	[6]
Austria	Electricity (25.5% - 30%)	DHW production combined with space heating (56%)	-	[7][8]
	Natural gas (19.5% - 22%)	Separate DHW production (28%)	-	[7][8]
	District heating (15% - 16.5%)	DHW production combined with space heating in winter only (16%)	-	[7][8]
	Wood pellets (11% - 17.5%)	Solar collector and heat pump (12.5%)	Yes	[7][8]
	Oil and liquid gas (14% - 16%)			[7][8]
Bahrain	Electricity	Boiler	-	[9]
Bangladesh	Biomass	Stove [a]	-	[10]
	Oil, gas, coal, electricity	Boiler [b]	-	[10]
Barbados	Solar thermal (35%)	Solar collector (35%)	Yes	[11]
	Gas and electricity (15%)	Electric or gas boiler (15%)	-	[11]
	No DHW (52%)	No DHW (52%)	-	[11]
Belarus	District heating (70%)	District heating heat exchanger	-	[12]
Belgium	Gas (40.5%)	Boiler	-	[7]
	Oil (30.4%)			[7]
	Electricity (28.7%)			[7]
	Coal (0.3%)			[7]
	Wood (0.3%)			[7]
Botswana	Electricity	Electrical boiler	Yes	[13]
Brazil	Electricity	Electric boiler for shower (73%) [c]	-	[14]
Burundi	Biomass (mostly wood)	-	-	[15]
Canada	Natural gas (47%)	Tankless on-demand gas boiler (47%)	No	[16][17]

	Electricity (47%)	Electric heat pump	Yes	[16][17]
	Oil (5%)	Electric, gas or oil boiler	Yes	[16][17]
	Solar Thermal	Solar collector with conventional boiler	Yes	[16]
Chile	Liquified petroleum gas	Gas boiler	-	[18]
	Natural gas			[18]
China		Decentralized individual shower boiler (89%)	-	[19]
	Electricity	Electric boiler (47% - 70%) [b]	-	[19]
	Gas	Gas boiler (12% - 41%) [b]	-	[20]
		Centralized DHW production (6% - 30%) [b, d]	-	[20]
	Solar thermal	Solar collector (2% - 20%)	-	[20]
	Coal	Coal boiler (0% - 7%)	-	[20]
		District heating (0% - 4%) [b]	-	[20]
Cuba	Electricity (80%)	Electric boiler (80%)	-	[21]
Cyprus	Solar thermal (82%)	Solar collector (82%)	Yes	[7][22]
		Solar collector with conventional boiler (9.9%)	-	[7]
	Electricity, gas, oil	Electric, gas or oil boiler (6.3%)	-	[7]
Czech Republic	District heating (34.4%)	District heating heat exchanger (34.4%)	-	[7]
	Electricity	Electric boiler (33.4%)	-	[7]
	Gas (25.5%)	Gas boiler (25.5%)	-	[7]
	Solar thermal (0.23%)	Solar collector (0.23%)	-	[7]
Denmark	District heating (60%)	District heating instantaneous heat exchanger (60%)	No	[23]
	Electricity	Heat pump combined with space heating	Yes	[23]
	Electricity, gas, oil	Electric, gas or oil boiler [e]	Yes	[23]
Ecuador	Electricity	Boiler	-	[24]
	Liquified petroleum gas			[24]
Ethiopia	Wood (95.4%)	Firewood stove	-	[25]
	Kerosene (3%)	Boiler	-	[25]
	Electricity (1.5)			[25]
	Liquified petroleum gas (0.1%)			[25]
France	Electricity (46.5%)	Electric boiler with small storage tank (29.9%)	Yes	[7][26]

	Gas (38.4%)	DHW production combined with space heating (25.5%)	-	[7][26]
	Oil (9%)	Tankless on-demand gas boiler (6.5%)	No	[7][26]
Georgia	Electricity	Boiler	-	[27]
Germany	Gas (46.1%)	DHW production combined with space heating (77%)	-	[7]
	Oil (29.1%)	Tankless on-demand electric boiler (16.9%)	No	[7]
	Electricity (18.9%)	Electric boiler with storage tank (3.5%)	Yes	[7]
	Renewables (6.7%)	Tankless on-demand gas boiler (3.3%)	No	[7]
	District heating (2.7%)	Gas boiler with storage tank (2.2%)	Yes	[7]
	Wood & biomass (3%)	Heat pump (0.4%)	Yes	[7]
	Coal (0.3%)			[7]
Greece	Electricity (76%)	Electric boiler (47.5%)	-	[7][28]
	Solar thermal (28.5%)	Solar collector with conventional boiler (28.5%)	Yes	[7][28]
	Oil (17%)	Oil boiler (17%)	-	[7][28]
		Tankless on-demand boiler (6.9%)	No	[7][28]
Hong Kong (China)	Electricity, gas	Decentralized tankless on-demand boiler	No	[29][30]
Hungary	Electricity (54.2%)	Electric boiler (54.2%)	Yes	[7]
	Gas (33.5%)	Gas boiler (33.5%)	Yes	[7]
	District heating (1.3%)	District heating (1.3%)	-	[7]
Iceland	Geothermal district heating (90%)	District heating heat exchanger (90%)	-	[31]
	Electricity (10%)	Electric boiler (10%)	-	[31]
Iran	Natural gas (majority)			[32]
	Oil			[32]
Ireland	Gas (63.2%)	DHW production combined with heating system (98.6%)	-	[7]
	Electricity (25.7%)	Separated electric boiler (1.3%)	-	[7]
	Oil (4.8%)			[7]
	Solar thermal (1.6%)	Solar collector (1.6%)	Yes	[7]
	Coal (0.5%)			[7]
	Wood (0.1%)			[7]
Israel	Solar thermal (80%)	Solar collector (80%)	Yes	[33]
Italy	Electricity (41.7%)	DHW production combined with space heating (74.8%)	-	[7]

	Solar thermal (5.9%)	Solar collector (5.9%)	-	[7]
Japan	Gas (96.8%)	Gas boiler (96.8%)	-	[34]
	Electricity (3.2%)	Electric boiler (3.2%)	-	[34]
Kazakhstan	District heating	District heating heat exchanger	-	[35]
	Oil and gas	Boiler	-	[35]
Latvia	District heating (70%) [f]	District heating heat exchanger	-	[36]
Lebanon	Electricity (60% - 82%)	Boiler	-	[37]
	Diesel (25% - 31%)			[37]
	Gas, wood, solar thermal (5% - 9%)			[37]
	Solar thermal (1% - 2.8%)	Solar collector (5.9%)	Yes	[37]
Libya	Electricity	Electrical boiler	Yes	[38]
Lithuania	District heating	District heating heat exchanger	-	[39]
Malaysia	Electricity	Electrical boiler	-	[40]
Malta	Electricity	Electrical boiler	-	[41]
Mexico	Liquified Petroleum Gas (46%)	Tankless on-demand gas boiler [g]	No	[42]
		Gas boiler with storage tank	Yes	[42]
	Wood	Wood stove [a]	-	[42]
	Electricity (rare)	Electrical boiler (rare)	-	[42]
Mongolia	District heating	District heating heat exchanger	-	[43]
	Coal	Boiler	-	[43]
Montenegro	Wood and lignite coal (60%)	Stove	-	[44]
Mozambique	Electricity (46%) [b]	Boiler with storage [b, h]	-	[45]
	Biomass (41%) [b]	Tankless on-demand boiler [b, i]	-	[45]
	Liquified petroleum gas (11%) [b]	Stove and fireplace [b]	-	[45]
	Solar thermal (1.1%) [b]	Electric kettle [b]	-	[45]
	No DHW (1.3%) [b]	Solar collector [b]	Yes	[45]
Namibia	Biomass	Electric or gas boiler [b]	-	[46]
	Electricity	Biomass, gas or oil stove [a]	-	[46]
	Gas or Kerosene			[46]
	Solar thermal (2.3%)	Solar collector (2.3%)	-	[46]
New Zealand	Electricity (88%)	Boiler	-	[47]
	Natural gas (8%)			[47]

Nigeria	Wood	Stove	-	[48]
	Electricity	Boiler	-	[48]
Norway	Electricity (89%)	Electrical boiler	-	[7]
		Electrical heat pump	-	[7]
	Oil (9%)	Oil boiler	-	[7]
	District heating (2%)	District heating heat exchanger	-	[7]
Poland	District heating (42%) [f]	District heating heat exchanger	-	[49]
	Coal (39%) [f]	Boiler	-	[49]
	Gas			[49]
Serbia	District Heating	District heating heat exchanger	-	[44]
Slovenia	Oil	DHW production combined with space heating (65.3%)	-	[7]
	Gas	Tankless on-demand gas boiler (11.9%)	No	[7]
	Electricity	Electric boiler (10.3%)	-	[7]
		Air-to-water heat pump (7.4%)	Yes	[7]
	Solar thermal	Solar collector (1.7%)	Yes	[7]
Switzerland	Oil (36.6%)	Boiler	-	[50]
	Electricity (24.7%)	District heating heat exchanger (4%)	-	[50]
	Gas (22.4%)	Heat pump (2.1%)	-	[50]
	Wood and solar thermal (10.8%)	Solar collector (1.8%)	-	[50]
	District heating (4%)			[50]
South Africa	Electricity (66%)	Electric geyser (20.5%)	Yes	[51]
	Wood (15.6%)	Electric kettle (15.2%)	Yes	[51]
	Kerosene (9.2%)	Electric kettle and stove (4.6%)	Yes	[51]
	Kerosene + wood (5.4%)	Kerosene or wood stove	Yes	[51]
	Solar thermal (1%)	Solar geyser (1%)	Yes	[51]
Spain	Gas	Individual boiler (48%)	-	[7]
	Electricity	Non-Condensing boiler (32%)	-	[7]
		Electric boiler (15%)	-	[7]
		Centralized boiler (3%)	-	[7]
	Solar thermal (1%)	Solar collector (1%)	-	[7]
The Netherlands	Electricity	DHW production combined with space heating (80%)	-	[7][52]
	Gas	Electric boiler (4%)	-	[7][52]

		Centralized collective production (3%)	-	[7][52]
		Individual heat pump (1%)	-	[7][52]
		individual gas boiler (1%)	-	[7][52]
The U.K.	Gas (85%)	Gas or oil boiler (90%)	-	[7]
	Electricity (10%)	Electric boiler (10%)	-	[7]
	Oil (5%)			[7]
The U.S.A.	Piped natural gas (53%)	Gas boiler with storage tank (56%)	Yes	[53][54]
	Electricity (41%)	Electric boiler with storage tank (44%)	Yes	[53][54]
	Bottled gas (4%)	Tankless on-demand gas boiler (5%) [j]	No	[53][54]
Zimbabwe	Electricity	Electric boiler with storage tank [b, h]	Yes	[46]
	Wood	Electric stove [b, i]	-	[46]
	Kerosene	Wood or kerosene stove [a]	-	[46]

[a] In rural areas.

[b] In urban areas.

[c] Low installation cost.

[d] Centralized DHW systems are commonly installed in newly-built residential buildings.

[e] Gas and oil boilers are phased out and replaced by electrical heat pumps.

[f] Total heat supply to residential sector.

[g] More common in small apartments.

[h] High-income households.

[i] Low-income households.

[j] Share of new equipment installed in 2009.

3. Current Typical Energy Sources for Domestic Hot Water Production in the Different Countries

Table 2 presents an overview of the main energy sources for the production of domestic hot water of residential buildings in different countries.

Table 2: *Overview of the main energy sources (over 10% of the total share) for the production of domestic hot water of residential buildings in different countries.*

Countries	Gas	Oil	Coal	Biomass	Electricity	District heating	Solar thermal	Geothermy
Albania								
Algeria								
Argentina								
Armenia								
Australia								
Austria								
Bahrain								
Bangladesh								
Barbados								
Belarus								
Belgium								
Botswana								
Brazil								
Burundi								
Canada								
Chile								
China								
Cuba								
Cyprus								
Czech Republic								
Denmark								

Countries	Gas	Oil	Coal	Biomass	Electricity	District heating	Solar thermal	Geothermy
Ecuador								
Ethiopia								
France								
Georgia								
Germany								
Greece								
Hong Kong (China)								
Hungary								
Iceland								
Iran								
Ireland								
Israel								
Italy								
Japan								
Kazakhstan								
Latvia								
Lebanon								
Libya								
Lithuania								
Malaysia								
Malta								
Mexico								
Mongolia								
Montenegro								
Mozambique								
Namibia								
New Zealand								
Nigeria								
Norway								

Countries	Gas	Oil	Coal	Biomass	Electricity	District heating	Solar thermal	Geothermy
Poland								
Serbia								
Slovenia								
Switzerland								
South Africa								
Spain								
The Netherlands								
The U.K.								
The U.S.A.								
Zimbabwe								

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