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National Programme for Turkey 2013 –  
Instrument for Pre-Accession Assistance

**Technical Assistance for  
Developed Analytical Basis for Formulating  
Strategies and Actions Towards  
Low Carbon Development**

**Project Identification No: EuropeAid/136032/IH/SER/TR**

**Contract No: TR2013/0327.05.01-01/001**

**Component 3 – Outcomes of the WG consultation meeting  
with the buildings sector's stakeholders**

Ankara 2019



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## Abbreviations

GYODER	The Association of Real Estate and Real Estate Investment Companies
LCDTR	Technical Assistance for Developed Analytical Basis for Formulating Strategies and Actions Towards Low Carbon Development
MENR	Ministry of Energy and Natural Resources
MoEU	Ministry of Environment and Urbanization (Beneficiary)
TAT	Technical Assistance Team



## 1. Summary of the Meeting

<b>Name of the Project:</b>	Technical Assistance for Developed Analytical Basis for Formulating Strategies and Actions towards Low Carbon Development	
<b>Project ID Number</b>	TR2013/0327.05.01-01/001	
<b>Date and Time</b>	06 March, 14:00	
<b>Location</b>	Ministry of Environment and Urbanization, 6 <sup>th</sup> floor Meeting room, Ankara, Turkey	
<b>Name of the Meeting</b>	Consultation meeting with stakeholders on Building sector	
<b>Participants</b>	Ministry of Environment and Urbanization (MoEU) (Beneficiary)	Gürcan Seçgel, Head of Unit, MoEU Hakan Aydoğan, Expert, MoEU Bülent Yalazı, Head of Unit, MoEU Yeliz Tanış, Engineer, MoEU Yıldız Ağaya Çağan, Architect
	Ministry of Energy and Natural Resources (MENR)	Ali Osman Kılınçaslan, Coordinator, MENR Aslı Oğuz, Engineer, MENR Eda Coşkun Gül, Engineer, MENR
	Technical Assistance Team (TAT)	Mykola Raptsun, TL, LCDTR Özge Yılmaz, SE-Building, LCDTR Parham Poyanfar, SE-Building, LCDTR Aynur Tokel, SE-data, LCDTR Teksin Öztekin, Translator, LCDTR Elif Seyhan – Project Assistant



## 2. Discussion Topics

TIMES model structure for the buildings sector, baseline projection approach, data availability and gaps.

## 3. Outcomes

Following the welcoming speech by Mr. Segel, the buildings sector experts zge Yılmaz presented building sector TIMES model structure, base year (2015) status of heating system distribution and fuel used in residential buildings, efficiencies of electrical equipments and heating system technologies, provincial level population projection and floor area projection till 2050.

After discussion with stakeholders, the meeting participants agreed that;

- The presentation made by building sector expert will be sent to all participants till end of the day for their comments and feedback,
- Participants will review approaches and data provided in the presentation, and send their comments/feedbacks together with their responses to questions provided in the presentation till Friday (8<sup>th</sup> of March 2019),
- Regarding floor area demand projection household size can also be considered,
- GYODER and Association of Construction Materials Manufacturer Floor area demand projection can be requested to analyse usability in the baseline floor area projection till 2050.

ANNEX  
Presentation(s)



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Technical Assistance for Developed Analytical Basis for  
Formulating Strategies and Actions towards  
Low Carbon Development



# Sectoral GHG emission mitigation action assessments & modelling structure, data availability and gaps: Buildings Sector

Özge Yılmaz, Building Sector Senior Expert

6 March 2019, 14:00; MoEU, Ankara



REPUBLIC OF TURKEY  
MINISTRY OF ENVIRONMENT  
AND URBANISATION

# Building Sector: GHG mitigation actions

Suggested Actions	Selection Criteria		
	Status in NCCAP	Cost Effective* (EUR/tCO <sub>2</sub> )	Mitigation Potential* (MtCO <sub>2</sub> )
Increasing the use of energy efficient devices in buildings (higher than A +)	√	-205	0.9
Improving the energy performance of existing buildings (improved insulation and energy efficient windows)	√	-152 & -157	4.5 & 11.2
Energy efficient buildings - heating and cooling system	√	-300 (cooling) -42 & -106 (heating)	1.0 (cooling) 1.2 & 6.9 (heating)

# Building Sector: Suggested actions based on preliminary examination

- Increasing the use of energy efficient devices in buildings (higher than A +)

Device	Share of electric consumption(%)*
Refrigerator	31.10
AC	15.00
Heater	9.30
Laundry	8.50
TV	6.70
Dish washer	3.50
Dryer	3.20
Lightning	11.70
Other	10.90

Refrigerator efficiency classes :

Class	EEI	Efficiency
A+++	21.9%	4.57
A++	27.0%	3.70
A+	37.0%	2.70
A	48.0%	2.08
B	64.5%	1.55
C	84.5%	1.18

1/7/2014 tarihinden İtibaren Enerji Verimlilik Sınıfları - Soğutucu

Enerji Verimlilik Sınıfı	Enerji Verimlilik Endeksi
A+++ (en verimli)	EEI < 22
A++	22 ≤ EEI < 33
A+	33 ≤ EEI < 42
A	42 ≤ EEI < 55
B	55 ≤ EEI < 75
C	75 ≤ EEI < 95
D	95 ≤ EEI < 110
E	110 ≤ EEI < 125
F	125 ≤ EEI < 150
G (en az verimli)	EEI ≥ 150

\*Retrieved from

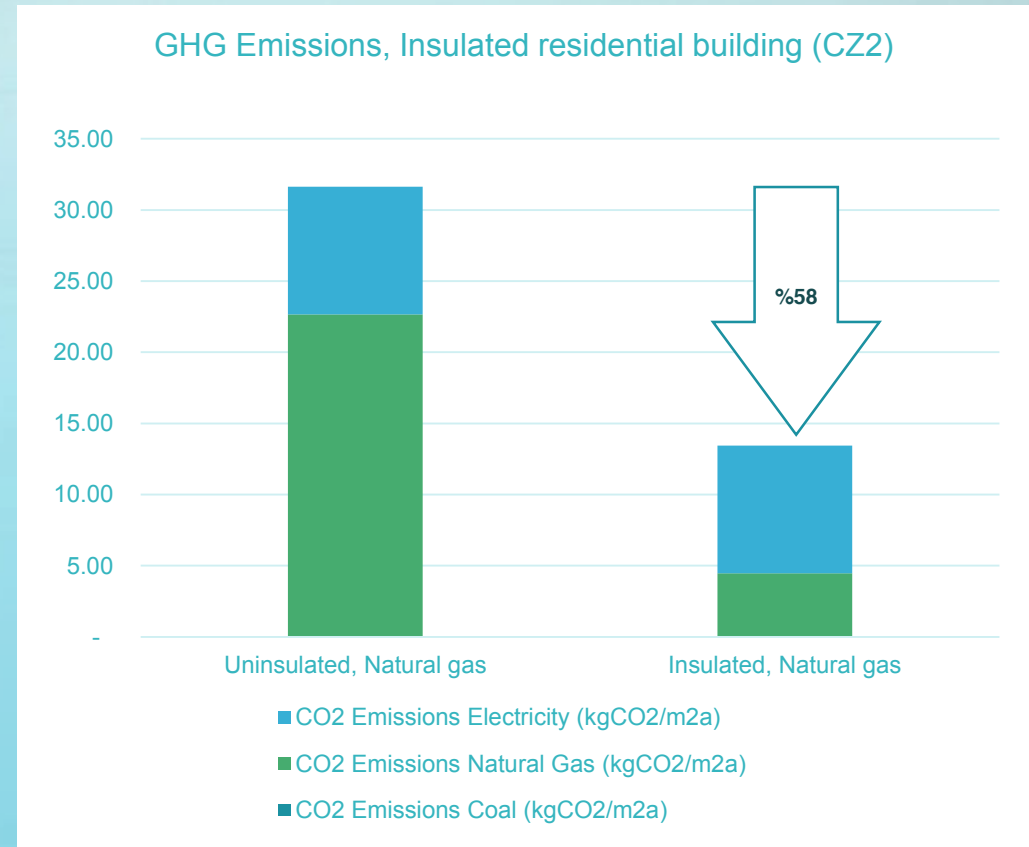
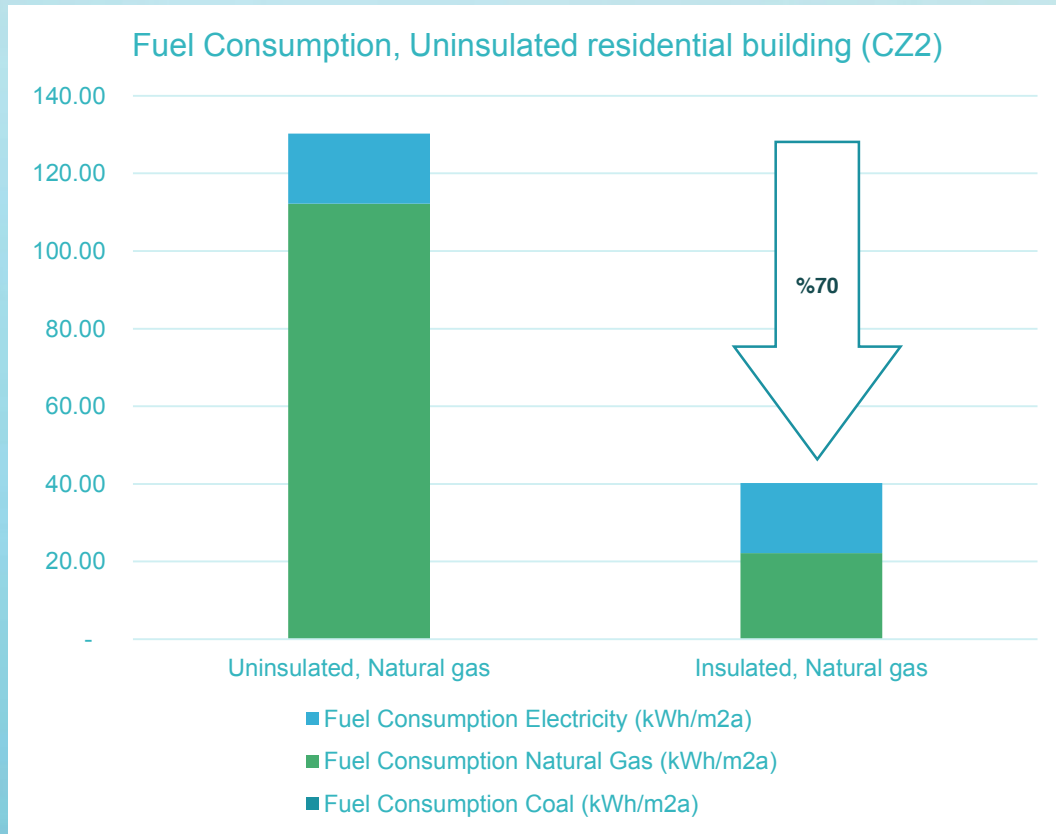
[http://www1.mmo.org.tr/resimler/dosya\\_ekler/728306c33e38495\\_ek.pdf](http://www1.mmo.org.tr/resimler/dosya_ekler/728306c33e38495_ek.pdf), Date of access: 30.01.2019

<http://www.resmigazete.gov.tr/eskiler/2012/06/20120622-18.htm>



# Building Sector: Suggested actions based on preliminary examination

Improving the energy performance of existing buildings (improved insulation and energy efficient windows)



# Building Sector: Suggested actions based on preliminary examination

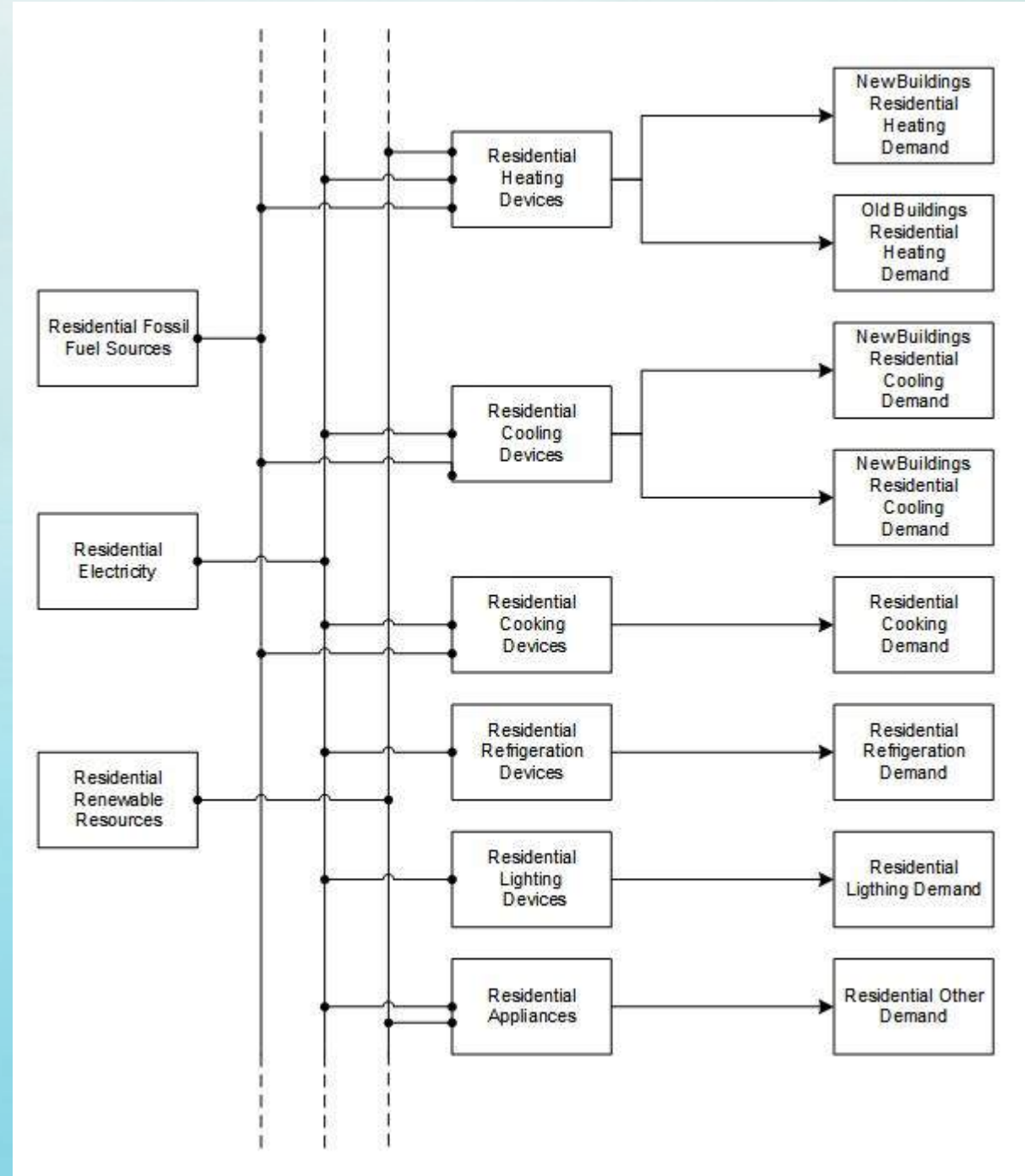
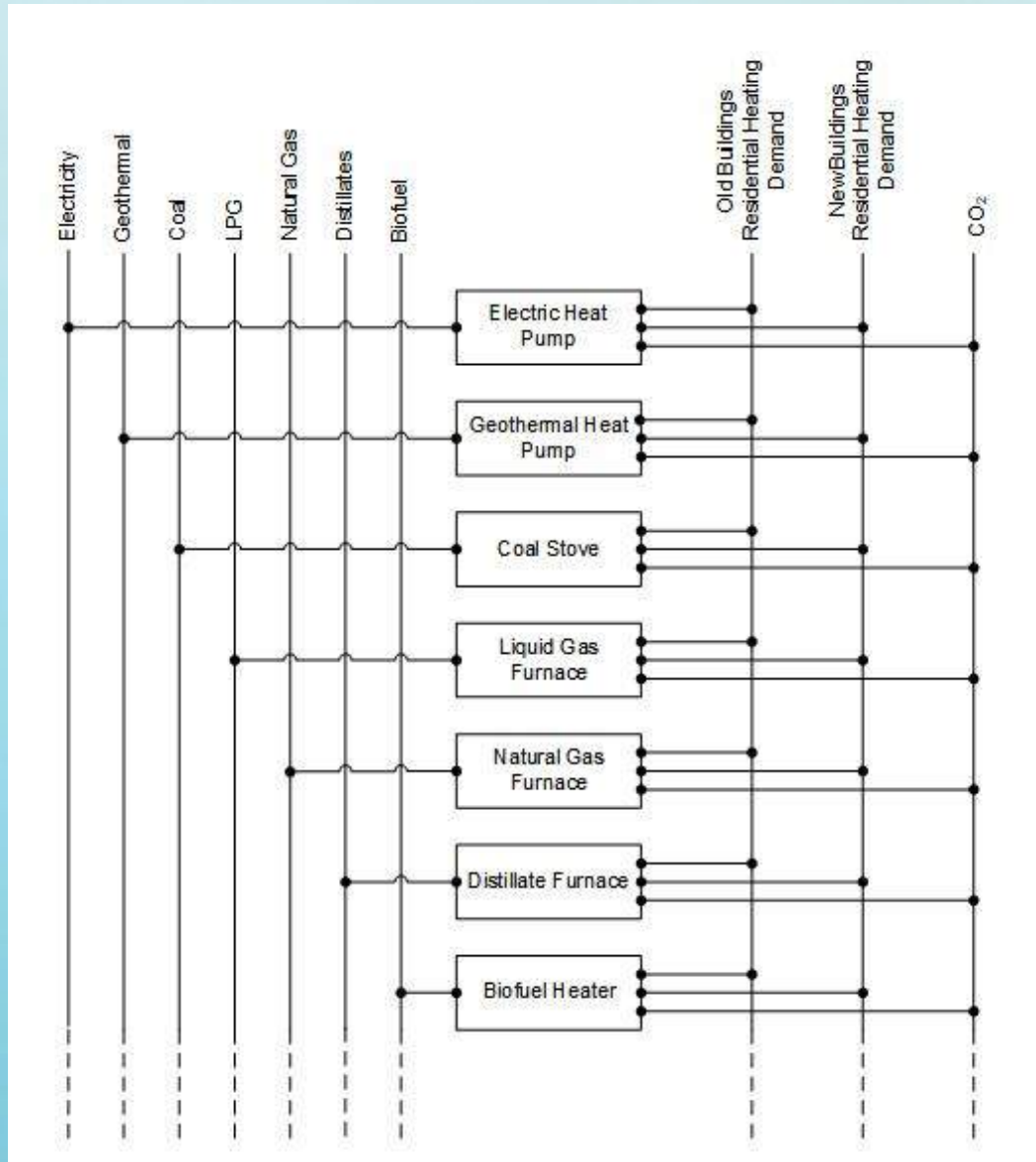
## Energy efficient buildings - heating and cooling system

Technology	Fuel	Unit	<2000	2000-2010	2010-2015
Boiler	Natural gas	AFUE	78%	82%	90%
Boiler	Fuel Oil	AFUE	78%	82%	90%
Bucket Stove	Coal	AFUE	53%	53%	53%
Stove- Top fired	Coal	AFUE	45%	45%	45%
Stove- Bottom fired	Coal	AFUE	35%	35%	35%
Gas stove	Natural gas	AFUE	55%	55%	55%
Water heater (with tank)	Natural gas	EF	52%	57%	60%
Water heater(anlık)	Natural gas	EF	62%	62%	82%
Water heater	Electric	EF	86%	90%	90%
Heat pump with air tank (AC)	Electric	EER	2,63	2,87	2,87
Air source heat pump	Electric	COP	1,99	2,25	2,4
Chiller (air-cooled)	Electric	EER	2,85	2,95	3,73
Chiller (water-cooled)	Electric	EER	4,7	5,25	5,98

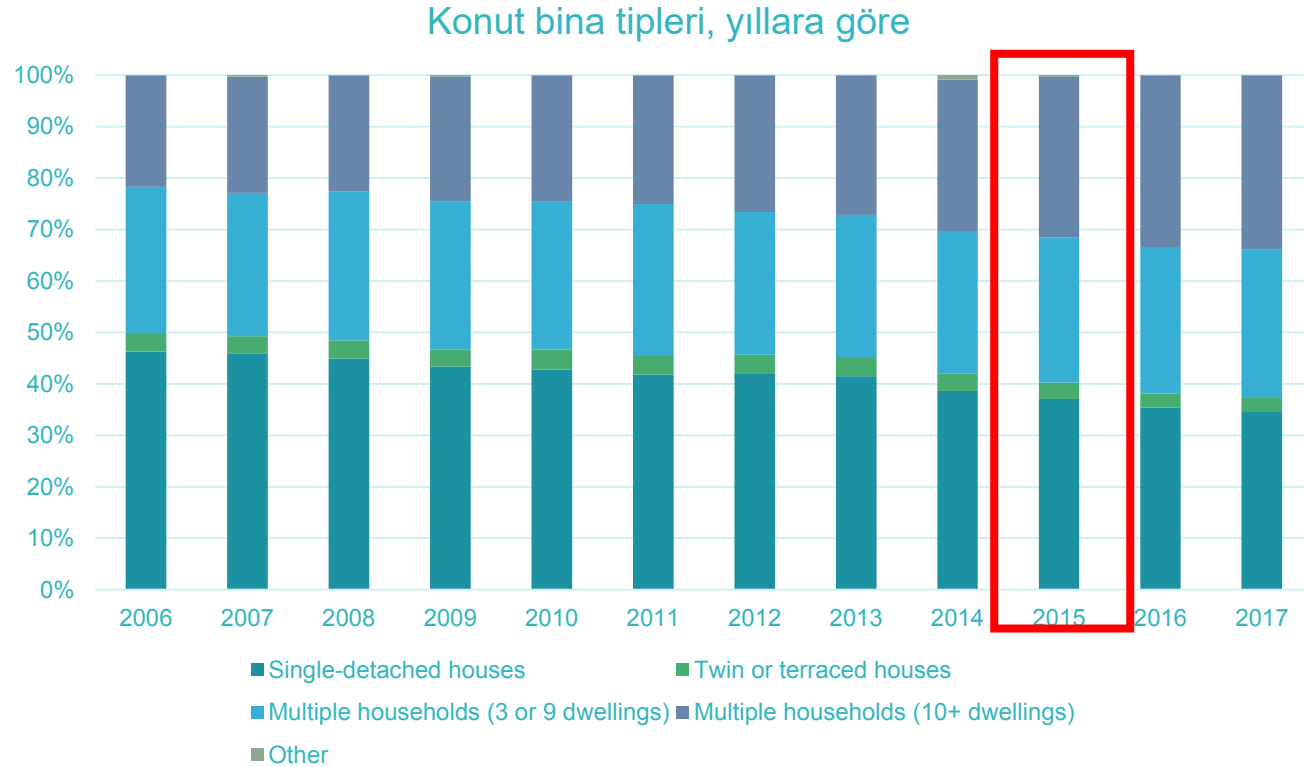
\*References

EIA,DOE,Energy Star,ASHRAE

# Sectoral TIMES model structure



# Base year building sector current status -2015



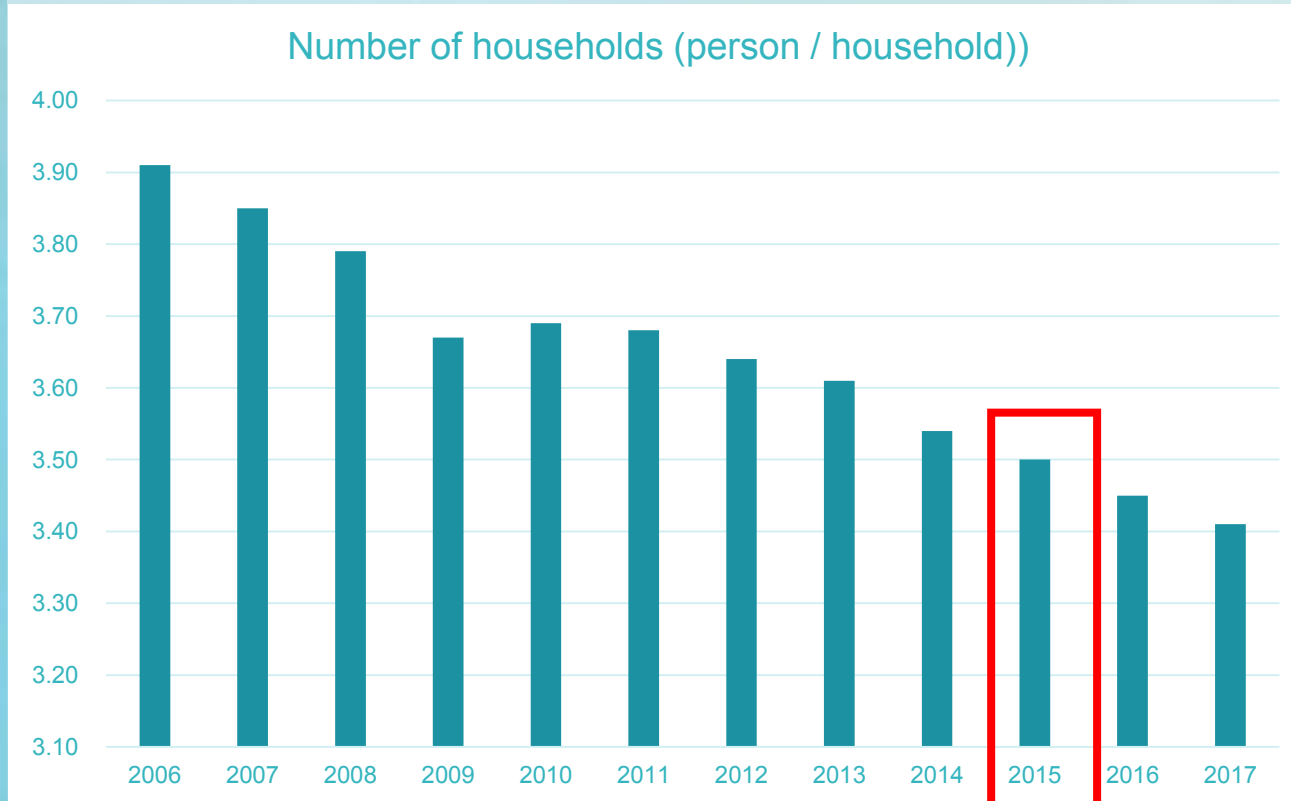
In 2015;

- %40.3 house (single family)
- %59.4 apartmant

# Base year building sector current status -2015

In 2015;

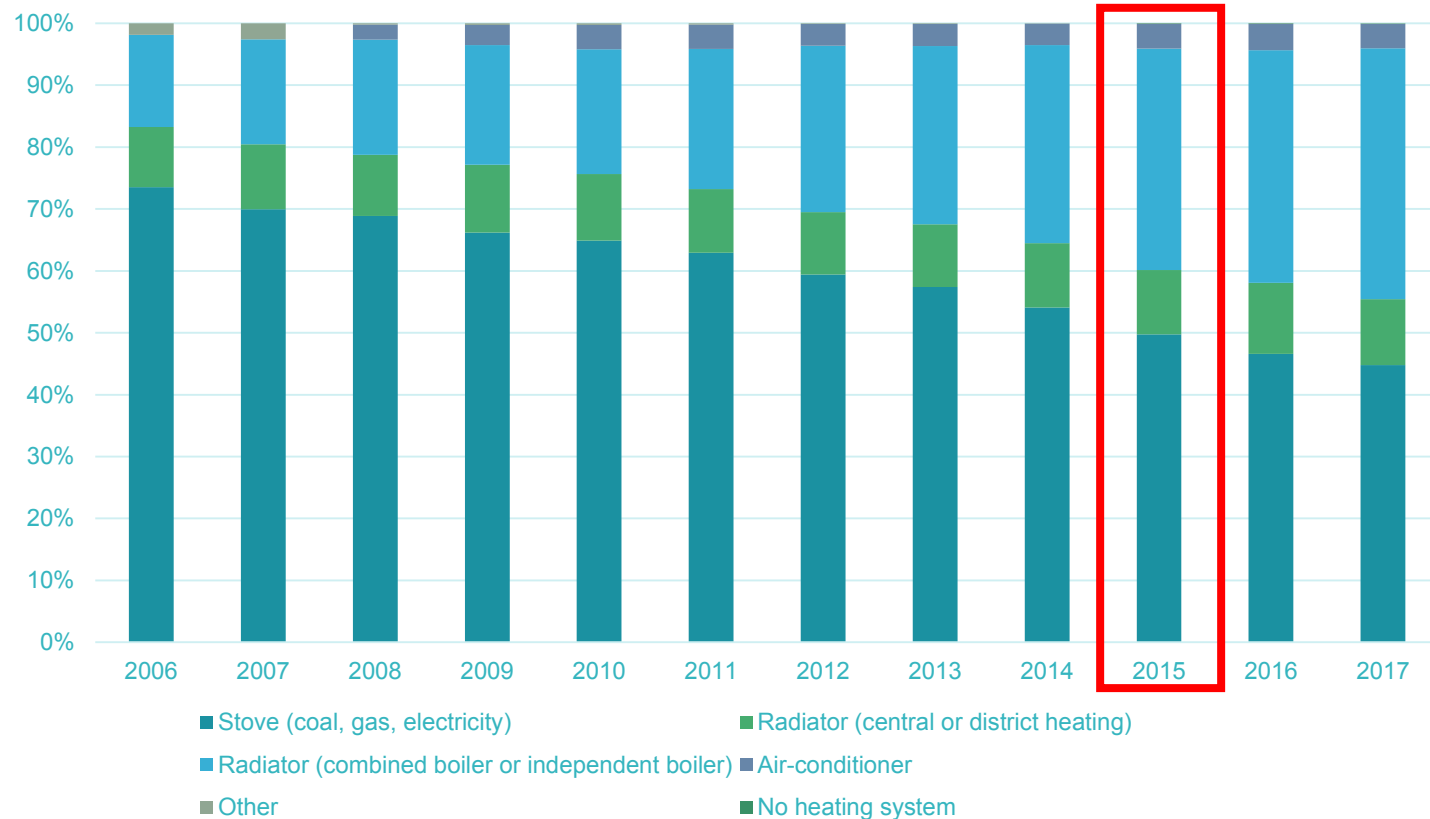
- 3.5 person/household



TURKSTAT, Income and Living Conditions Survey

# Base year building sector current status -2015

Heating systems in residential buildings, according to years



In 2015;

- %49.7 stove
- %35.8 room heater/central heating
- %10.4 common radiator
- %4 AC

# Base year building sector current status -2015

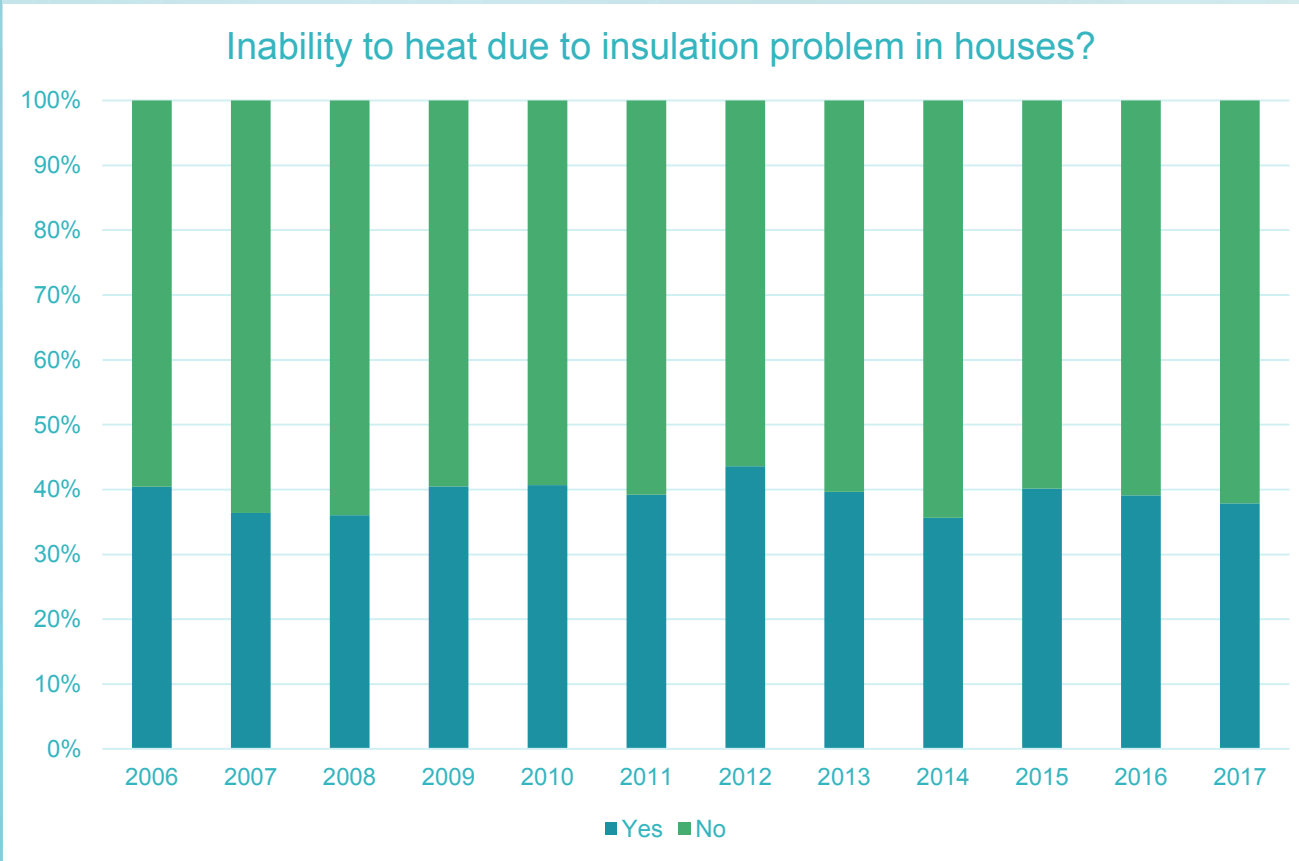
Type of fuel used for heating purposes in homes, according to years



In 2015;

- %42.4 natural gas
- %31.8 coal
- %16.1 wood
- %6.7 electric
- %2 animal waste

# Base year building sector current status -2015



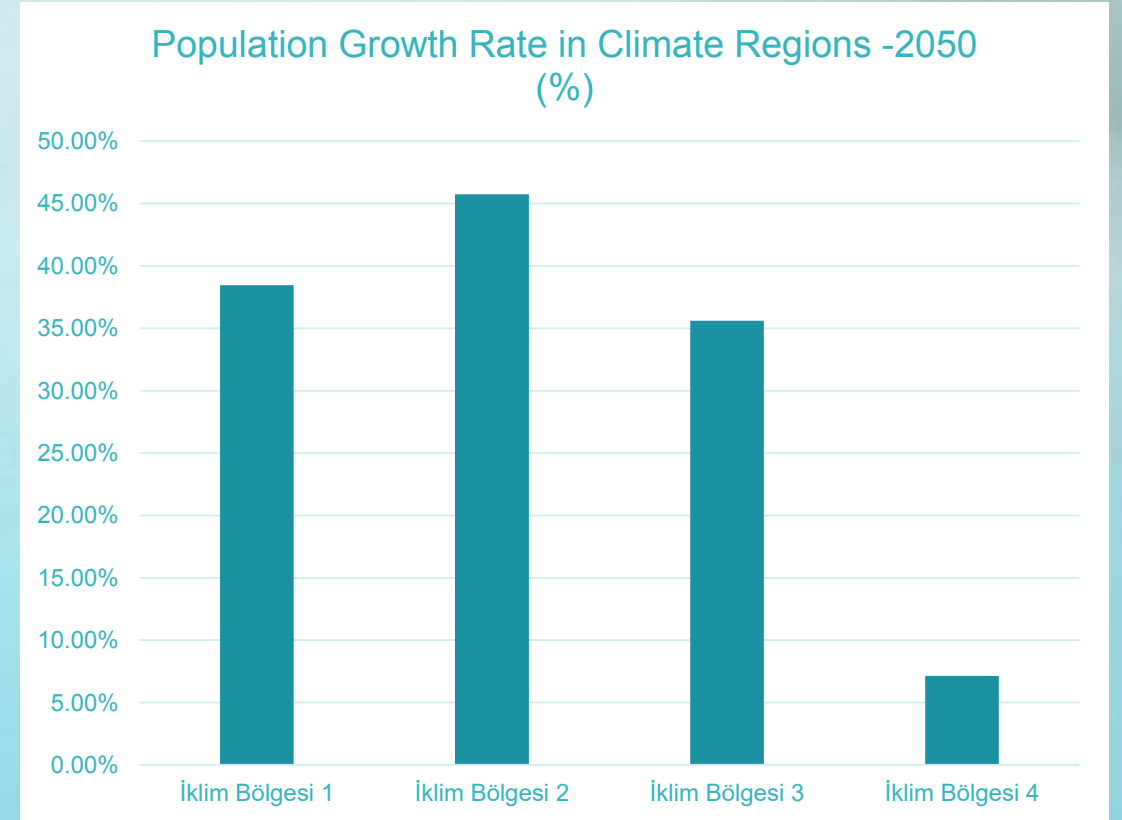
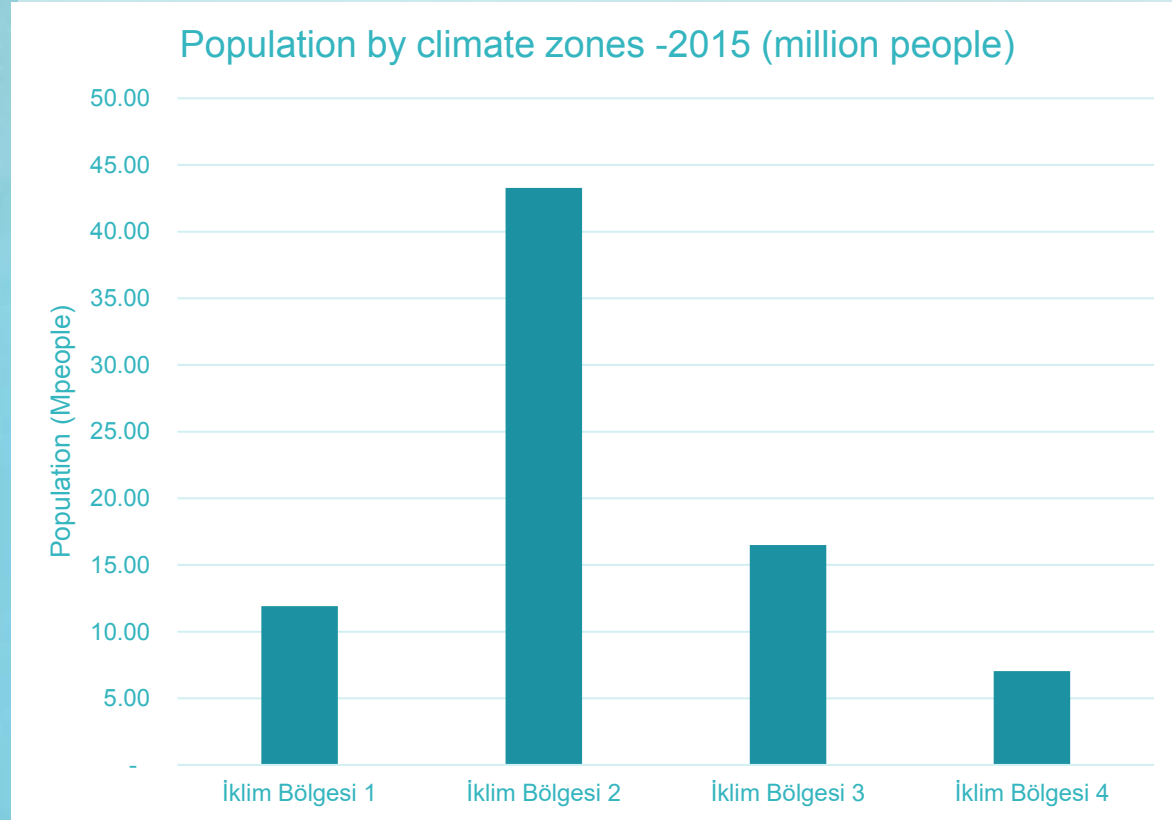
No significant change over the years.

A survey of the participant.

39% of the average lack of insulation because of the lack of heat.

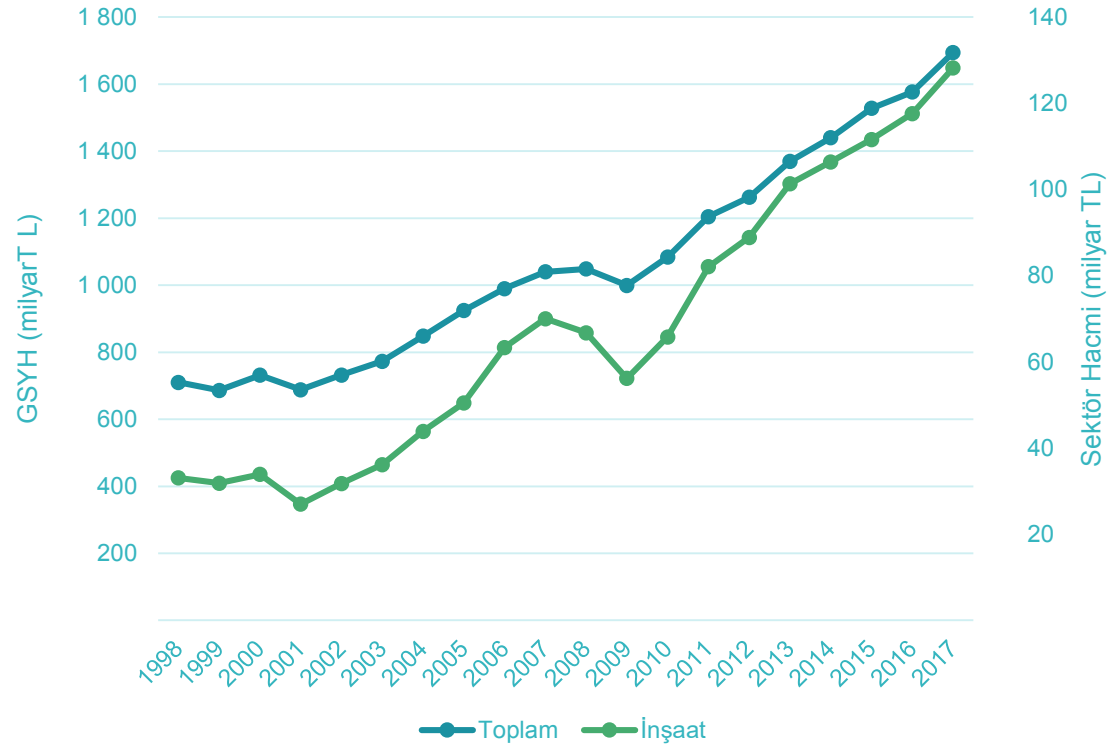


# Sector-based future projections - Population

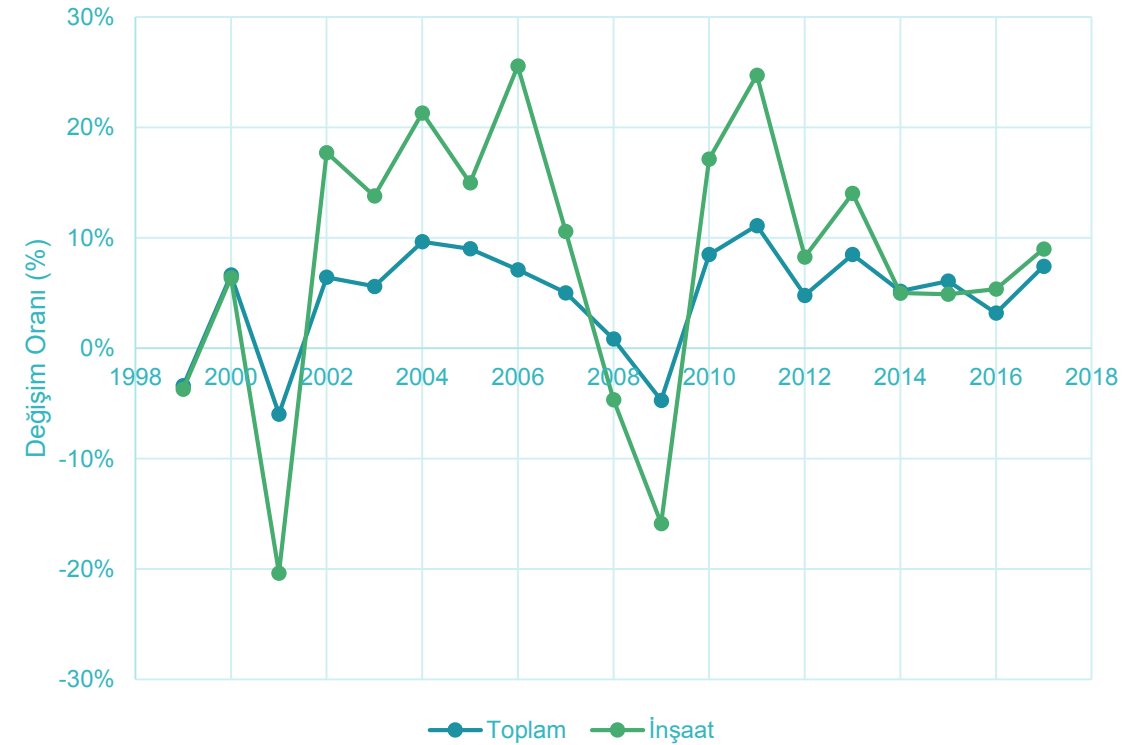


# Sector-based future projections– GDP (last 15 years)

## Total GDP - Construction Sector Volume



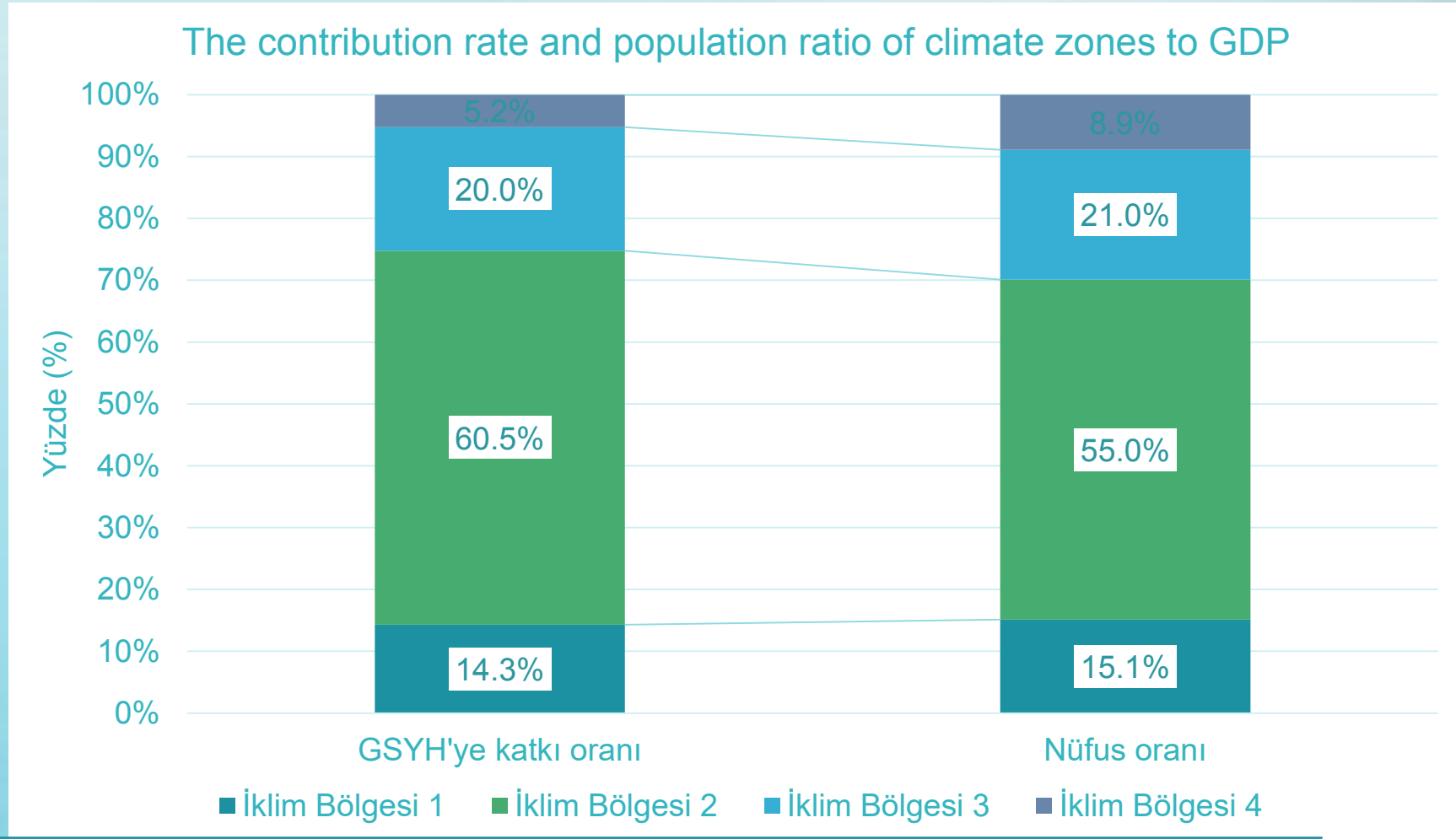
## GDP Change Rate (Total vs. Construction)



Gayrisafi yurtiçi hasıla, iktisadi faaliyet kollarına (A21) göre zincirlenmiş hacim, endeks ve değişim oranları, 1998-2017

Gross domestic product in chain linked volume, index and percentage change [2009=100], by kind of economic activity (A21), 1998-2017  
[2009=100]

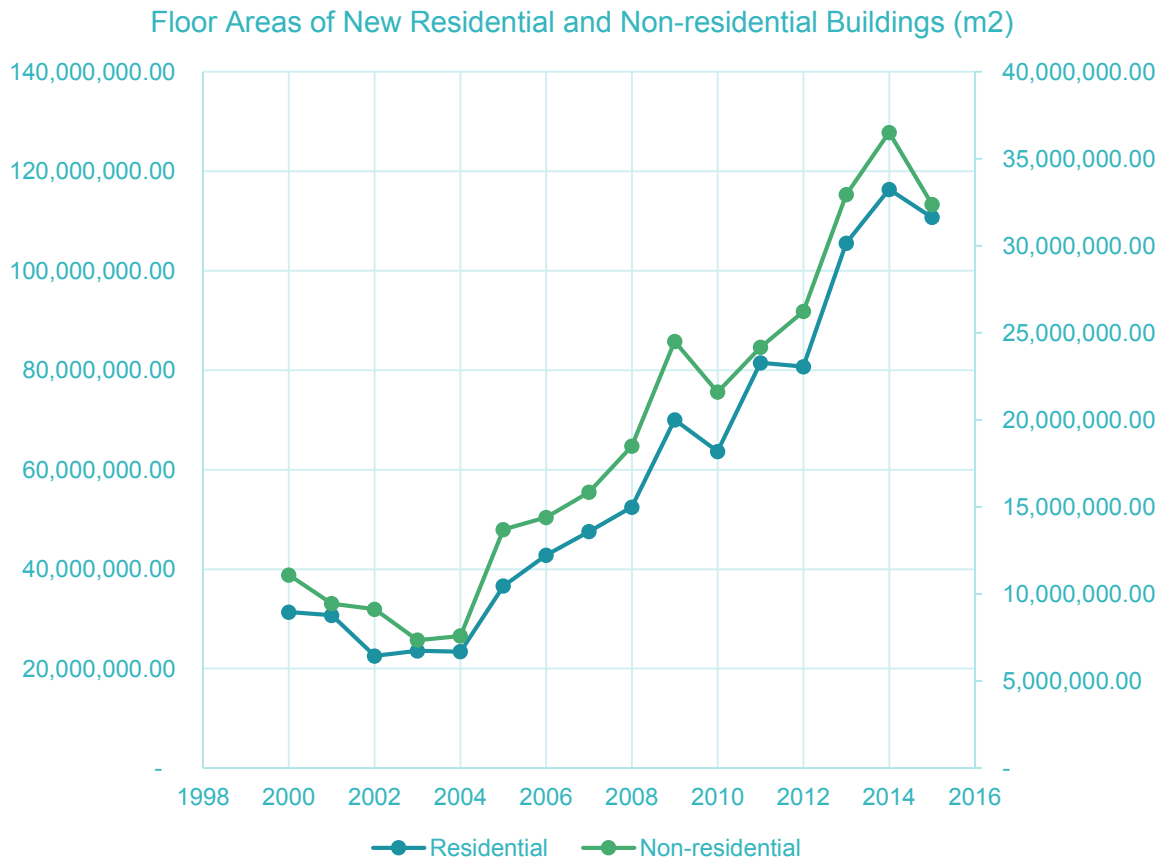
# Sector-based future projections– 2015 GDP and Population (by ClimateZones)



Gayrisafi yurtiçi hasıla, iktisadi faaliyet kollarına (A21) göre zincirlenmiş hacim, endeks ve değişim oranları, 1998-2017

Gross domestic product in chain linked volume, index and percentage change [2009=100], by kind of economic activity (A21), 1998-2017  
[2009=100]

# Sector based future projections - Building usage areas (last 15 years)



Comparison of the use of residential buildings and non-residential buildings:

Same amount of change.

It was decided that future growth estimates need not be examined separately.

# Sector based future projections - Building usage areas (last 15 years)

Building use areas with building permission - GDP



Building usage areas with building permission - Population exchange



# Important assumptions for base scenario projection

- Existed data:

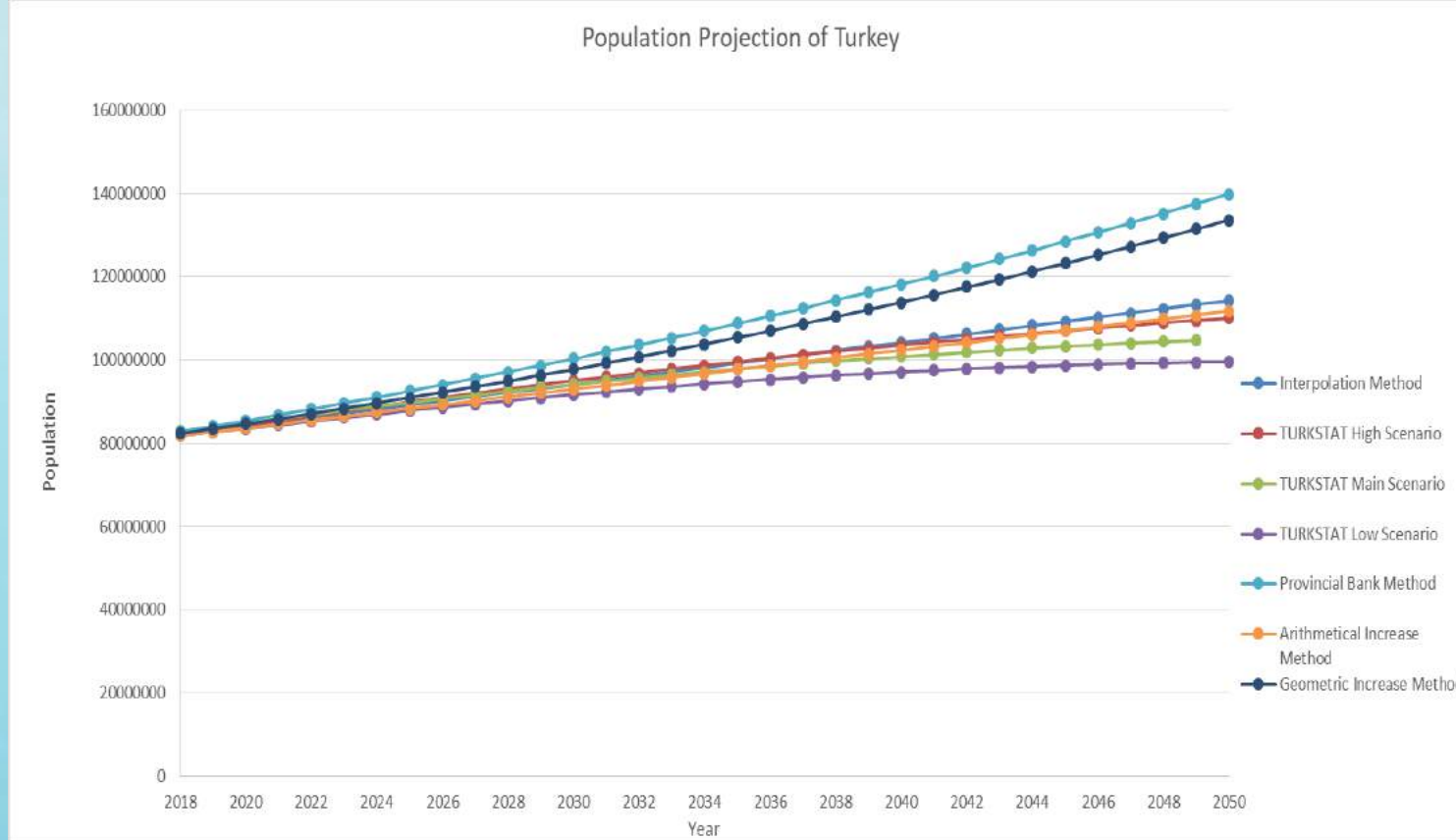
Data	Scale	Validity	Source	Notes
Residential heating system types	Country		TÜİK	Not on a climate zone scale
Residential building types	Country		TÜİK	Not on a climate zone scale
Number of households	Province		TÜİK	
Fuel types for residential building	Country		TÜİK	Not on a climate zone scale
Insolation status	Country	??	TÜİK	Survey result, partial
Population	Province		TÜİK	
Population growth forecast 2050	Country		TÜİK	Not on a climate zone scale
GDP	Province		TÜİK	
GDP growth forecast 2050	Country		BUMKO, UNFCC	Not on a climate zone scale

# Important assumptions for base scenario projection

- Existed data:

Data	Scale	Validity	Source	Notes
Number of buildings	Province, type		TurkStat	
Building areas (before 2000)	N/A	N/A	N/A	<b>Kabuller üzerinden hesaplandı</b>
Building areas (after 2000)	Province, type		TurkStat	
Building energy consumption according to BEP-tr types, climate areas	Detailed		MoEU	Tüketim ve sera gazı emisyon bilgileri var. Talep bilgisi yok.
Energy balance tables	2015, type		MoENR	

# Sector-based future projections - Population



Different methods were tried to be projected according to provinces and compared with TURKSTAT data.

Interpolation

Aritmatic increase

Geometric increase

Bank of Provinces



# Important assumptions for base scenario projection

There is no exact information on total building stock. Cooling area information available in the 2000 building count. It's about the following information.

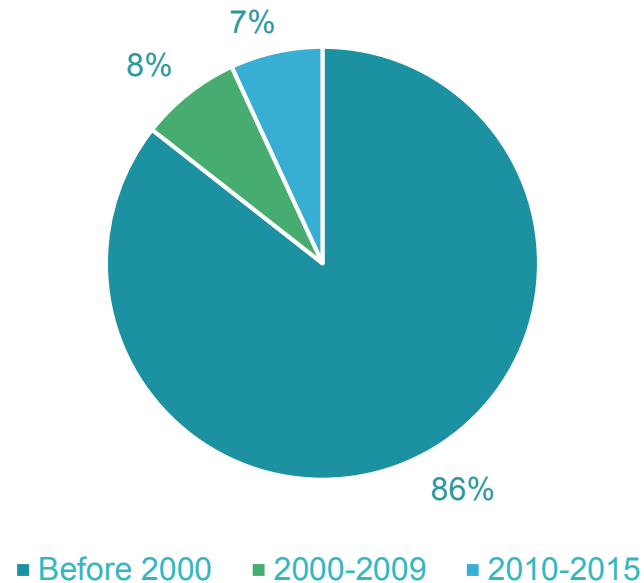
Floor Area(m2)	Residential	Non –residential
0000-0049	355003,00	307936,00
0050-0074	1052364,00	177396,00
0075-0099	1999692,00	117050,00
0100-0149	2461177,00	182205,00
0150-0199	383982,00	75957,00
0200-0299	313602,00	90765,00
0300-0399	85750,00	39851,00
0400-0499	45874,00	25646,00
0500-0749	24532,00	30908,00
0750-0999	4182,00	13073,00
1000-1999	2998,00	20236,00
2000-4999	894,00	12213,00
5000+	559,00	4960,00
Bilinmeyen	5204,00	4666,00
<b>Toplam</b>	<b>6735813,00</b>	<b>1102862,00</b>

Number of floor	Residential	Non residential
1	2897986,00	722583,00
2	2090754,00	198692,00
3	753483,00	74411,00
4	395400,00	39984,00
5	294266,00	27689,00
6	158415,00	12144,00
7-9	93177,00	10506,00
10+	15868,00	1539,00
Bilinmeyen	36464,00	15314,00
<b>Toplam</b>	<b>6735813,00</b>	<b>1102862,00</b>

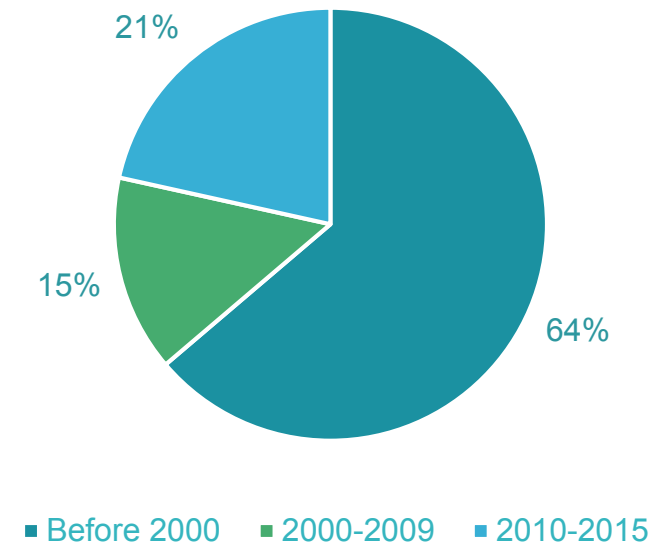
# Important assumptions for base scenario projection– Residential buildings

In order to calculate the total usage areas, the total number of floor areas and the average number of floors were used.

Number of Buildings, Residence  
(TurkStat, Building Census 2000)



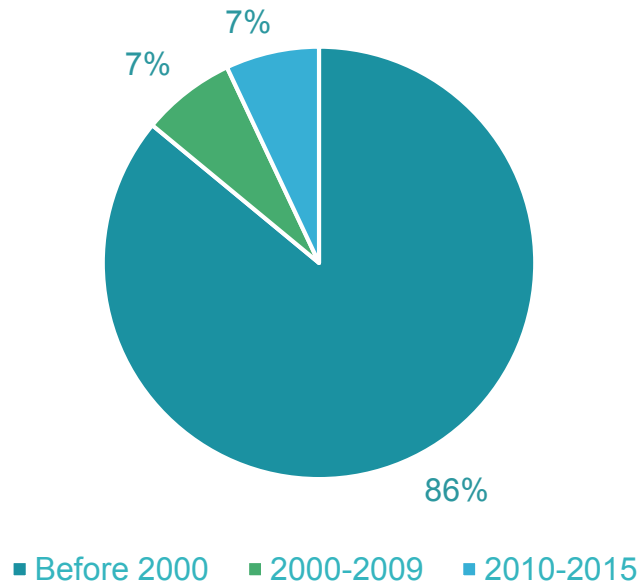
Usage Areas, Housing  
Approximate value before 2000)



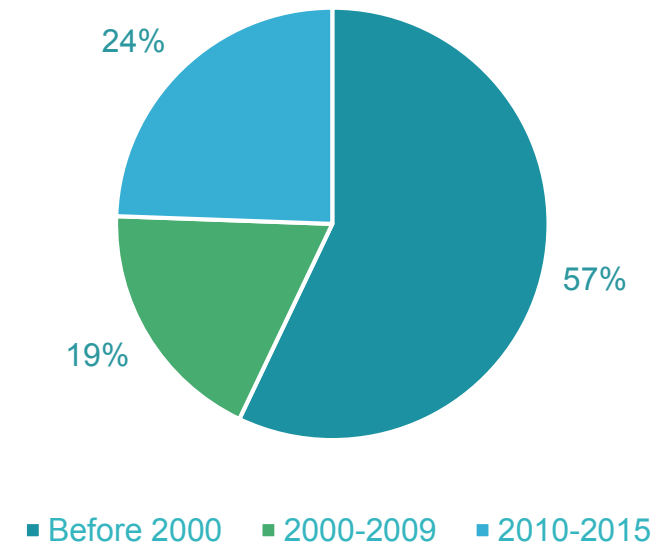
# Important assumptions for base scenario projection– non-residential buildings

In order to calculate the total usage areas, the total number of floor areas and the average number of floors were used.

Number of Buildings, Non-residential  
(TurkStat, Building Census 2000)

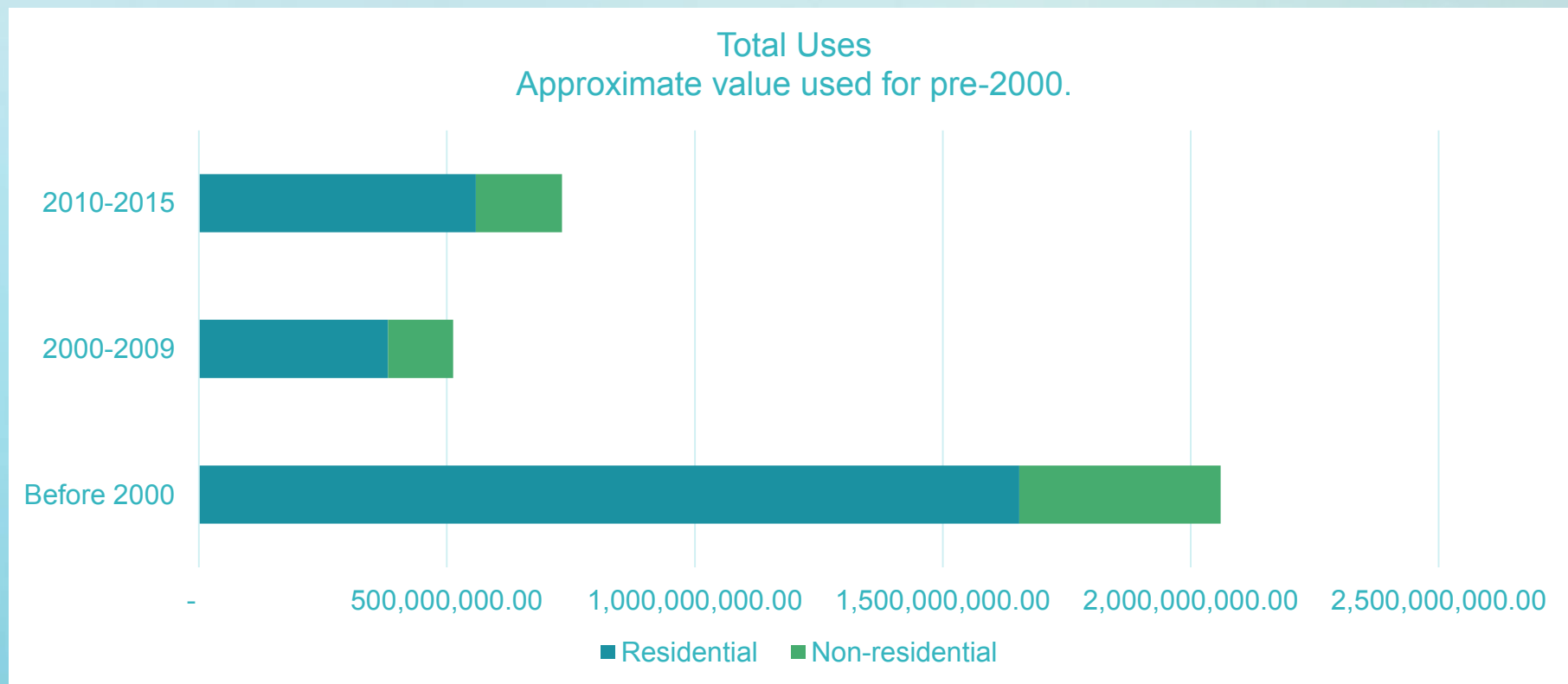


Areas of use, Non-residential  
(Approximate value before 2000)



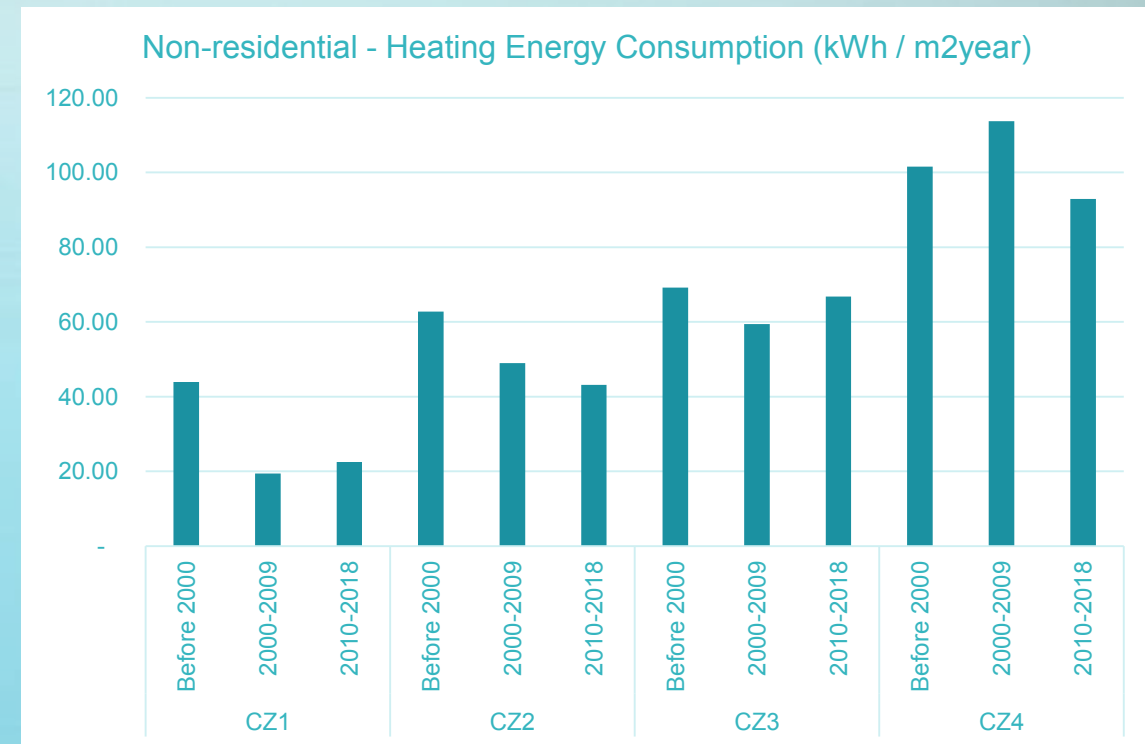
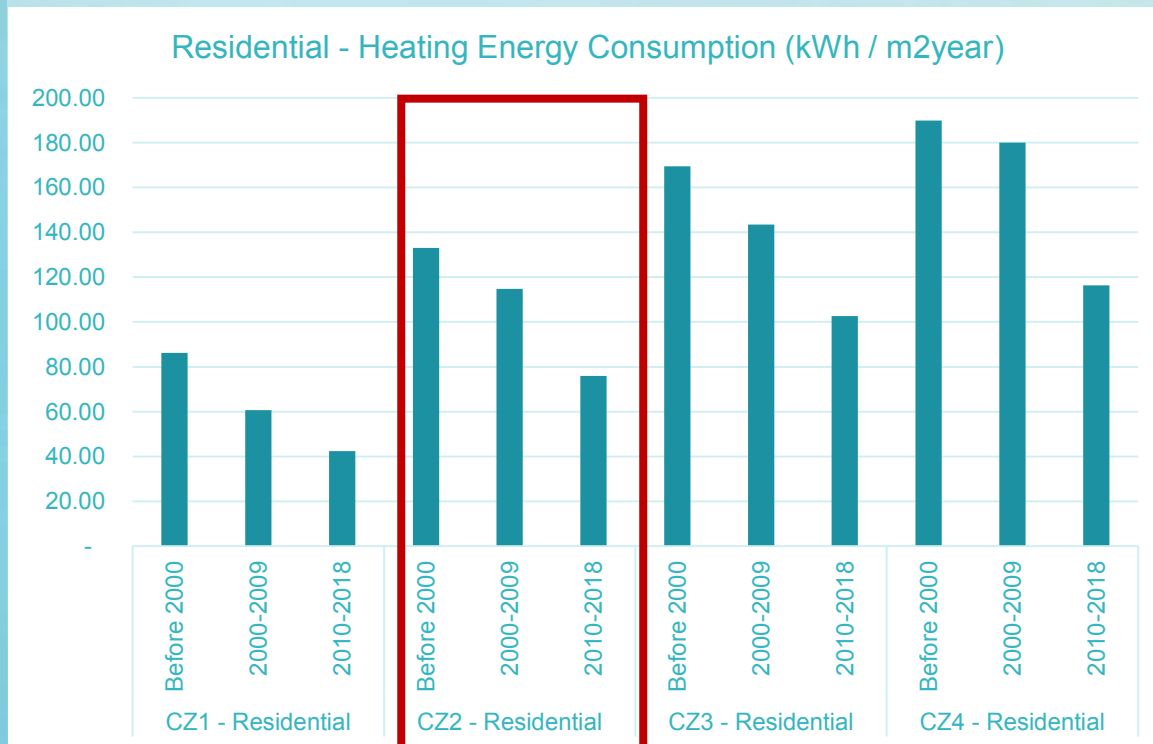
# Important assumptions for base scenario projection

In order to calculate the total usage areas, the total number of floor areas and the average number of floors were used.



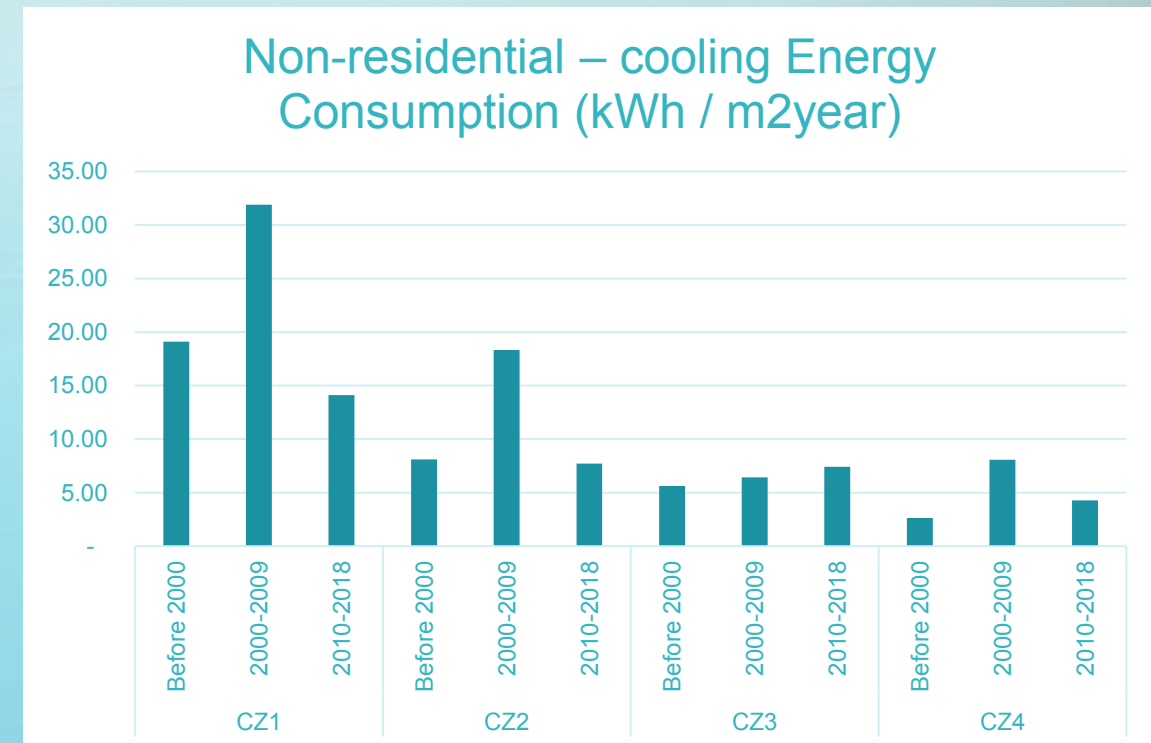
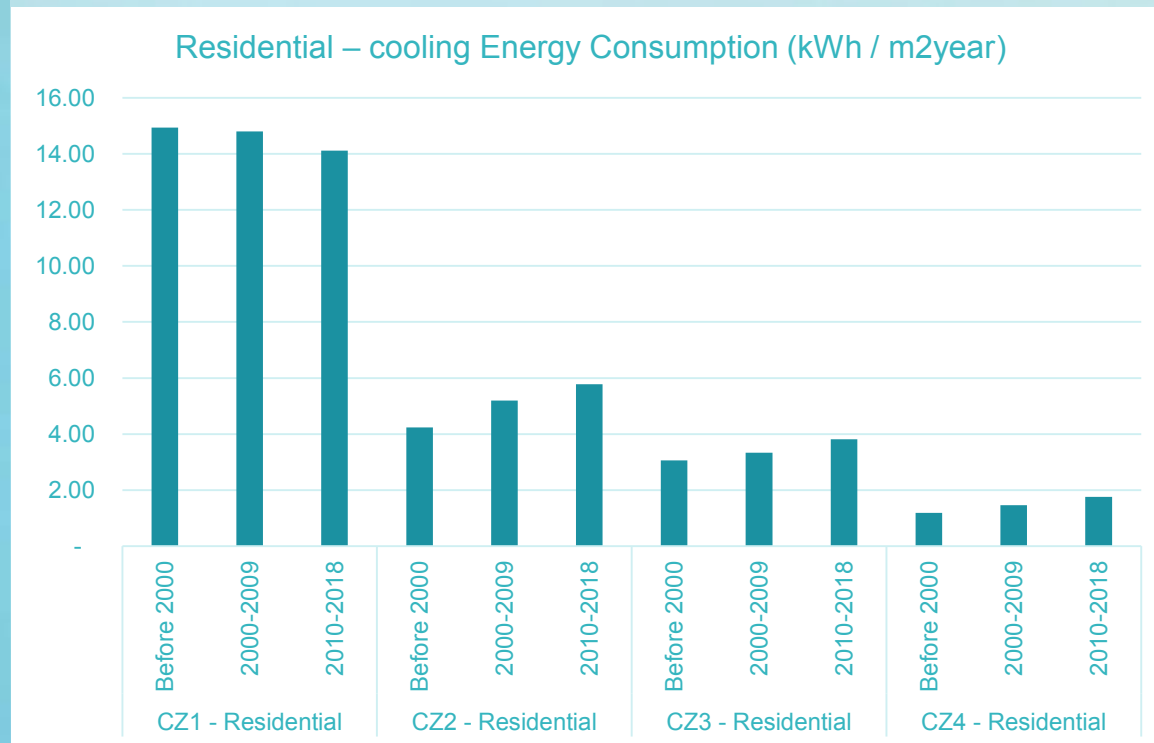
# Important assumptions for base scenario projection

HEATING Energy Consumption - BEP-tr data are compiled according to climate zones and license years.



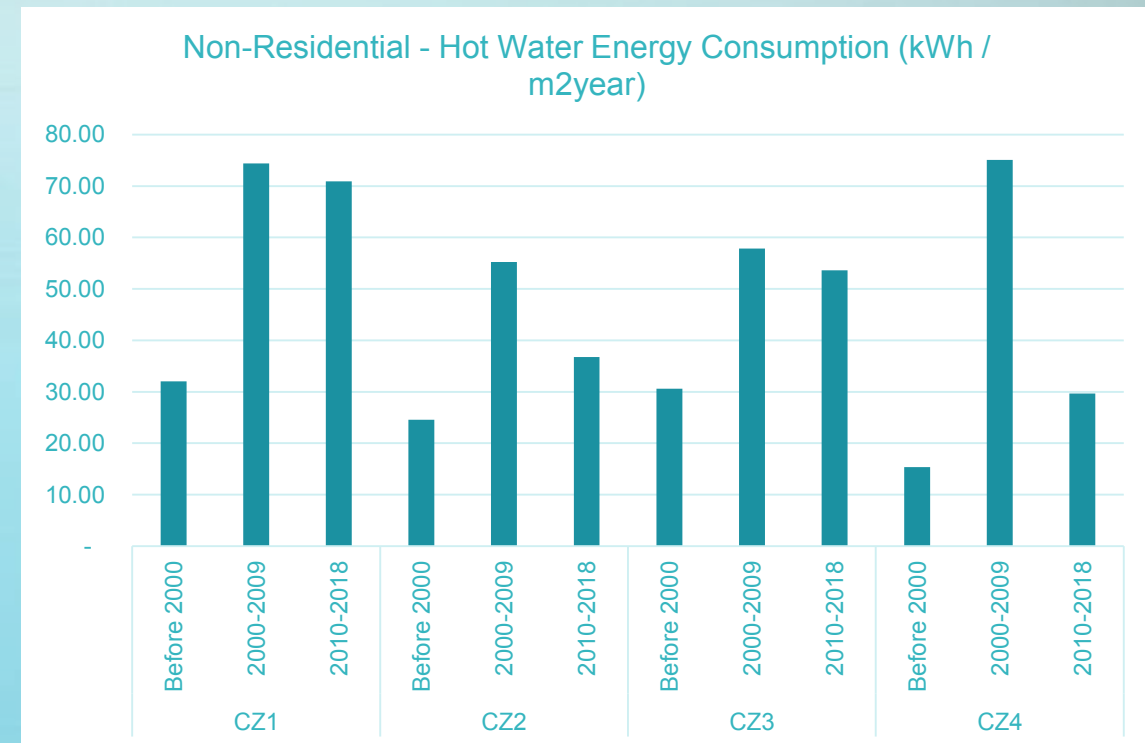
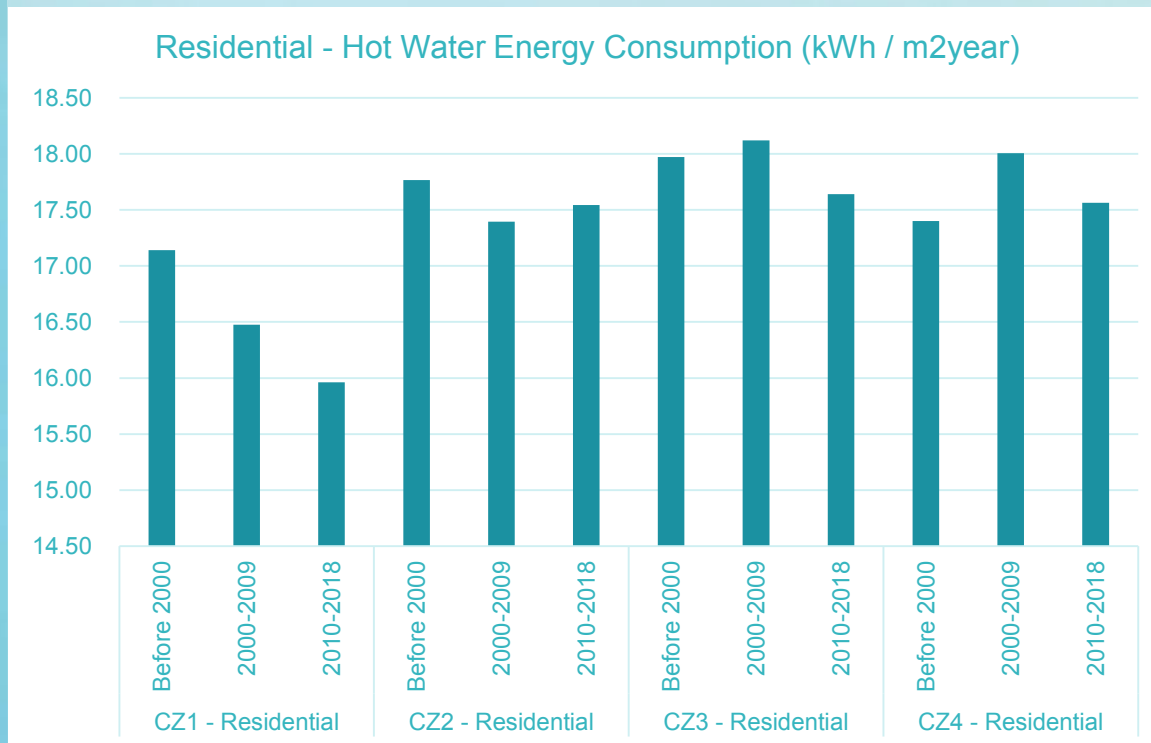
# Important assumptions for base scenario projection

COOLING Energy Consumption - BEP-tr data are compiled according to climate zones and license years.



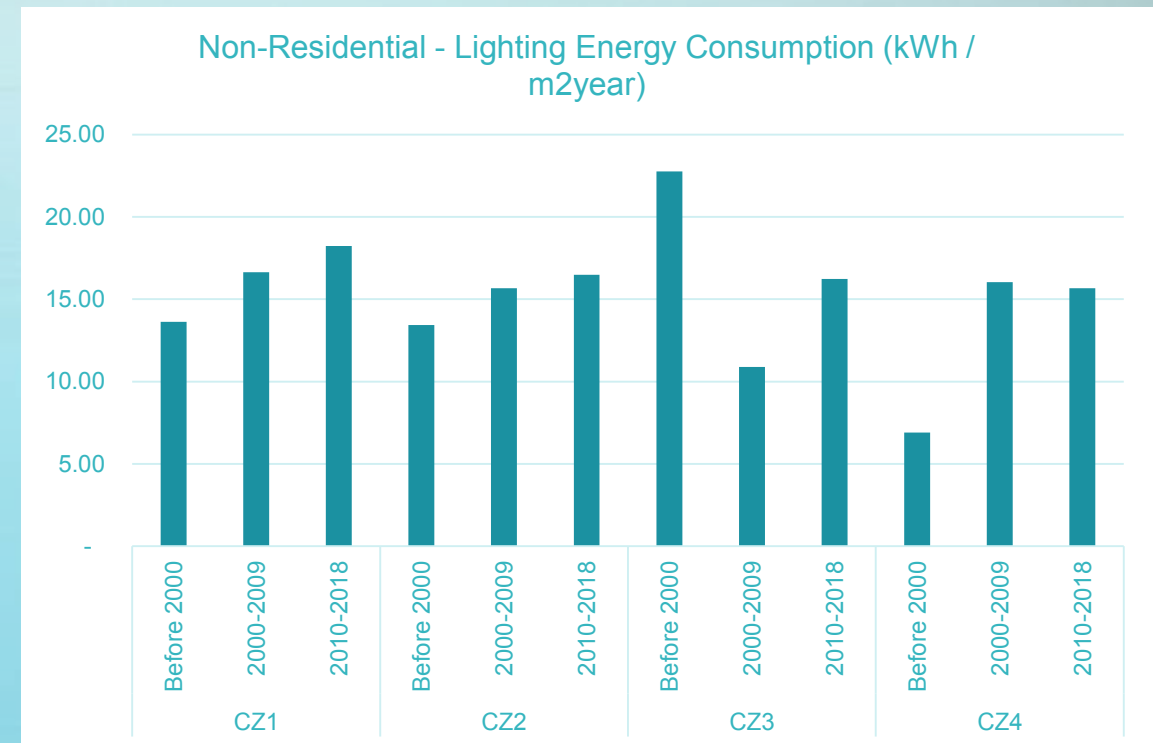
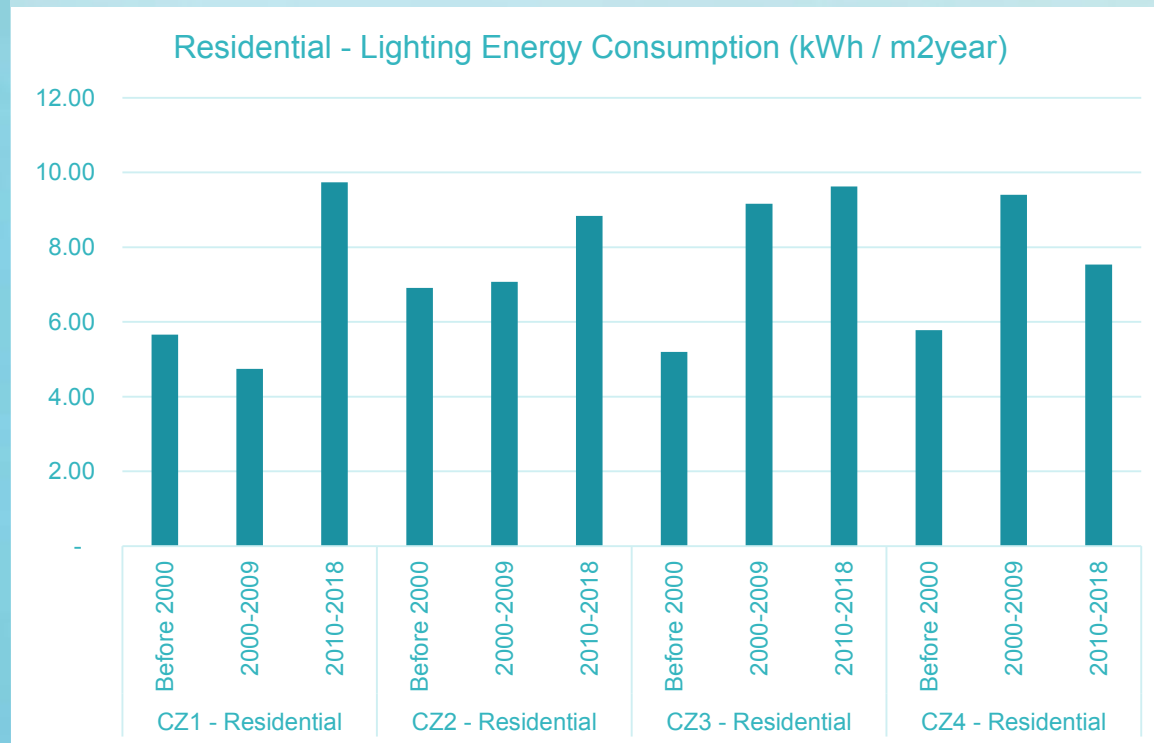
# Important assumptions for base scenario projection

Domestic Hot Water Energy Consumption - BEP-tr data were compiled according to climate zones and license years.



# Important assumptions for base scenario projection

Lighting Energy Consumption - BEP-tr data was compiled according to climate zones and license years.





# Important assumptions for base scenario projection– Energy balance tables

## Residential Buildings - 2015

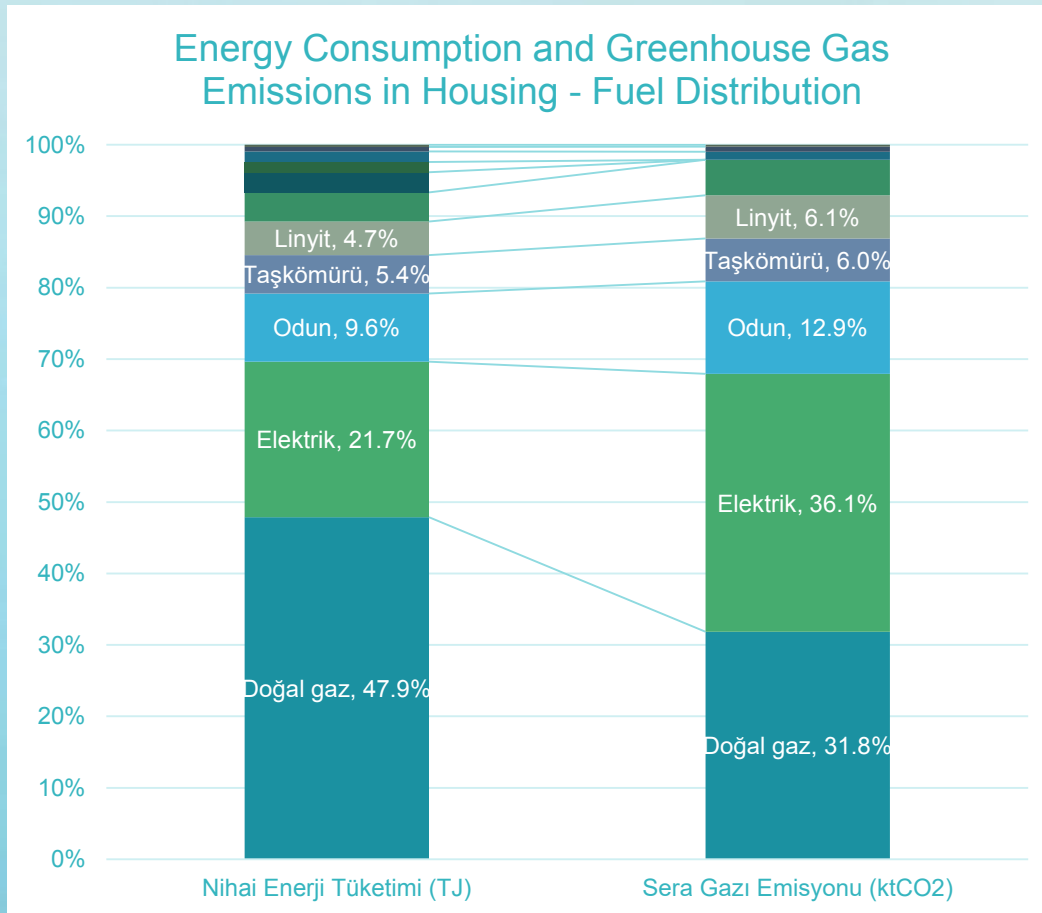
Energy Carrier	End use energy consumption (TJ)	GHG emission (ktCO2)
Natural Gas	379.952,10	20.931,77
Electric	172.474,64	23.722,50
Wood	75.839,70	8.494,05
Coal	42.747,23	3.948,99
Lignite	37.082,49	3.991,19
Crop and animal waste	32.569,95	3.257,00
Solar	22.106,30	-
Geothermal	11.707,01	-
LPG	11.581,69	730,80
Asphaltite	4.893,78	470,29
Gas Oil	2.537,62	182,45

## Commercial Buildings- 2015

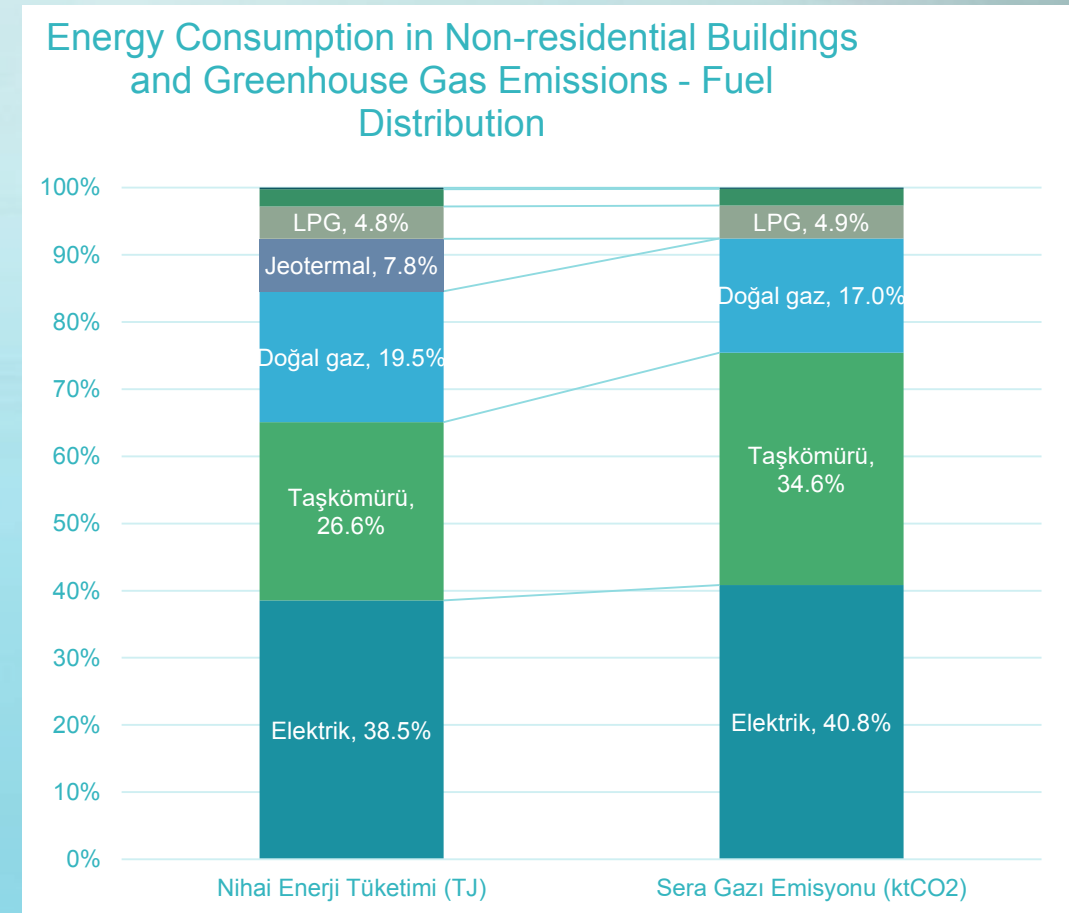
Energy Carrier	End use energy consumption (TJ)	GHG emission (ktCO2)
Electric	215.801,24	24.169,74
Coal	148.715,14	20.454,57
Natural Gas	109.171,98	10.085,31
Geothermal	43.640,76	-
LPG	27.023,95	2.908,59
Lignite	14.413,06	1.441,31
Coking coal	1.306,28	120,67

# Important assumptions for base scenario projection– Energy balance tables– 2015 Base year

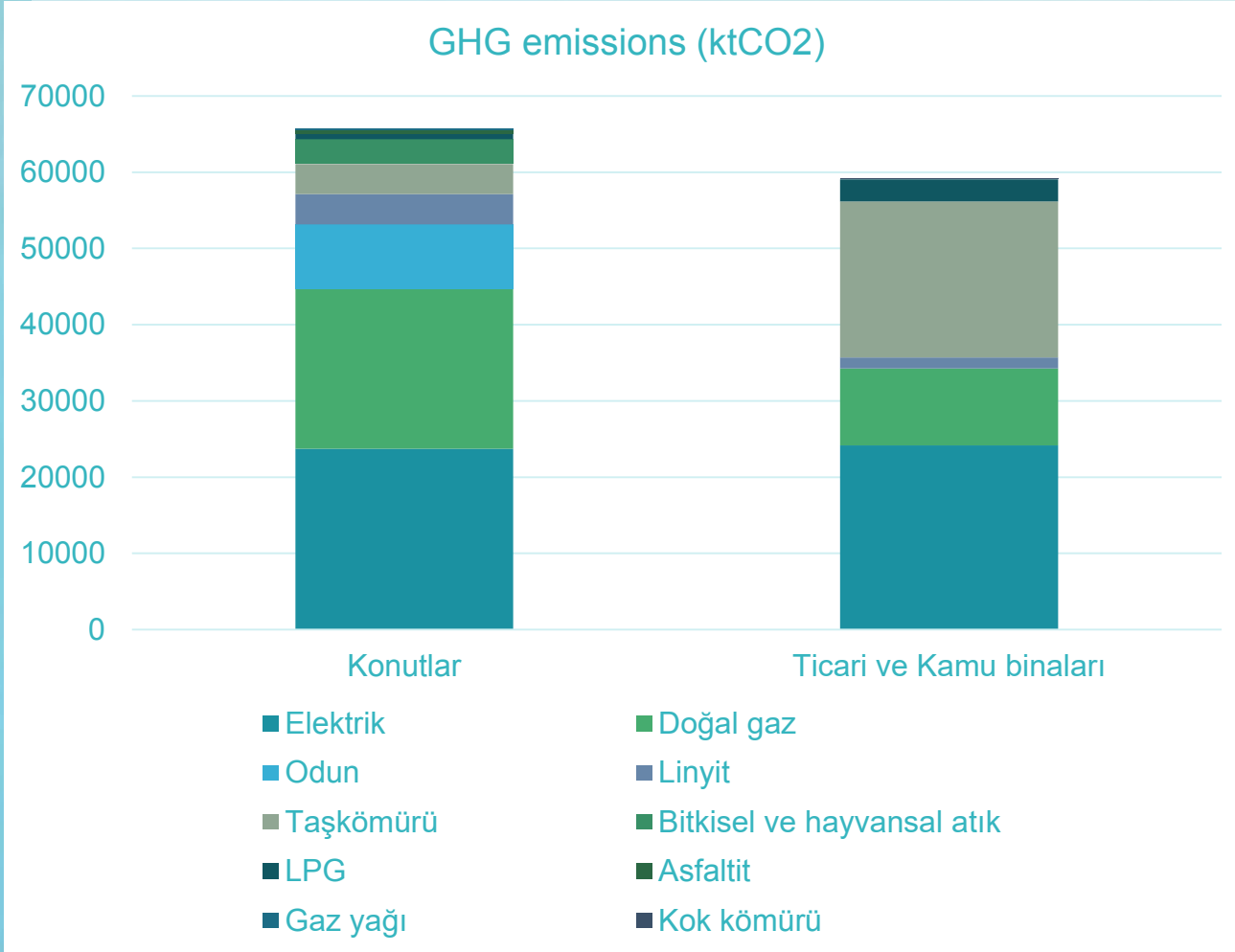
## Residential



## Commercial

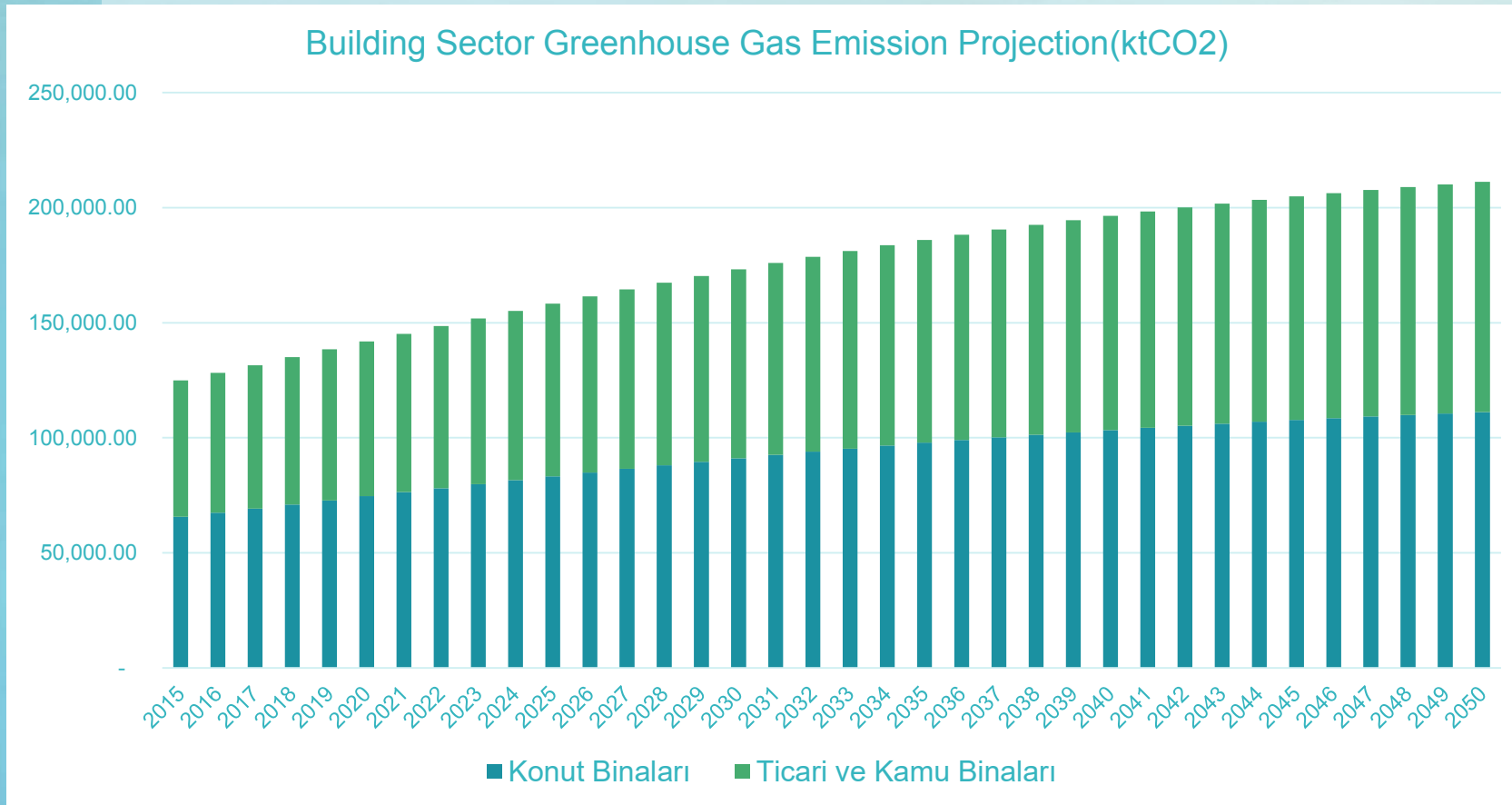


# Important assumptions for base scenario projection– 2015 – GHG emission caused by Building sector



Breakdown	GHG emmission(ktCO <sub>2</sub> )
Residential	65.729,05
Commercial	59.180,19
<b>Total</b>	<b>124.909,23</b>

# 2015-2050 Estimation of Greenhouse Gas Emissions caused by Buildings



Between 2000 and 2015, the usage areas of buildings that have been granted permission to use building and GDP were compared.

The relationship between regression analysis and population projections and GDP projections was investigated.

Projected in 2050.

# 2015-2050 Estimation of Greenhouse Gas Emissions caused by Buildings

Between 2000 and 2015, the usage areas of buildings that have been granted permission to use building and GDP were compared.

The relationship between regression analysis and population projections and GDP projections was investigated.

Projected in 2050.

	Total building floor area (m <sup>2</sup> )	Population (people)	GHG Emissions (ktCO <sub>2</sub> )
Turkey 2015	~3.262.901.098,11	78.741.053,00	<b>124.909,23</b>
Turkey 2050	5.515.744.954,17	104.749.423,00	<b>~211.151,81</b>



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## Thank you for your attention!

<http://www.lowcarbonturkey.org/>

