

UNDA project, on “Up-scaling Energy Efficiency in the residential and services sectors in the Arab Region”



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National Seminar on: “Launching of the baseline mapping study of the energy use situation in the buildings sector in Jordan”,
5 March 2019 –Amman - Jordan



MINISTRY OF ENERGY AND MINERAL RESOURCES
THE HASHEMITE KINGDOM OF JORDAN

Economic And Social Commission For Western Asia



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Proposed UNDA baseline mapping methodology for the residential sector

Content

1. Main objectives of the study of the baseline situation for residential sector
2. Data collection and analysis methodology for the residential sector
3. Questions and topics to discuss

Mains objectives of the baseline mapping study of the energy use situation in the buildings sector

- **Estimation of the built stock in number and surface area**
 - ✓ by type of housing
 - ✓ by geographical and climatic zones
 - ✓ by thermal quality (if possible)
- **Estimation of final energy consumption**
 - ✓ by energy source
 - ✓ by use
 - ✓ By climate zone
- **Estimation of the equipment rate**
 - ✓ By use
 - ✓ by type of housing
 - ✓ by climate zone

Mains objectives of the baseline mapping study of the energy use situation in the buildings sector

- **Zoom on some specific uses**
 - ✓ Evolution of the equipment rate
 - ✓ Evolution of energy performance
 - ✓ Evolution of energy consumption linked to use
- **Development of EE Indicators**
 - ✓ By total final energy consumption
 - ✓ By energy source
 - ✓ By use
 - ✓ by type of housing
 - ✓ by climate zone
- **To allow the development of residential building stock evolution scenarios and the estimation of EE potential for this park**

Data collection and analysis methodology for the residential sector

- 4 types of possible sources of information
 - ✓ Sources of public institutions
 - ✓ surveys
 - ✓ Measurements campaigns
 - ✓ Modeling
- It is often necessary to combine certain sources to form complete sets of indicators

Statistical data of the park	Data for GIS	Energy consumption
<ul style="list-style-type: none">• Ministry of Energy• Department of Statistics• JNBC, MoPWH, MoMA	<ul style="list-style-type: none">• JNBC• DoS, MoMA,• Google Map.....	<ul style="list-style-type: none">• Ministry of Energy• NERC• RSS, JorGBC.....



Typology & Quantities of Equipment / Buildings



Breakdown by climate zone



Characterization physical / energetic

Data collection and analysis methodology for the residential sector

Available sources from public institutions

	National level	Regional level
Available data	<ul style="list-style-type: none"> Final energy consumption in residential energy Final energy consumption by use 	<ul style="list-style-type: none"> Final energy consumption in residential energy Final energy consumption by use
Sources	<ul style="list-style-type: none"> ✓ Surveys ✓ Statistic Department ✓ Energy Audits 	<ul style="list-style-type: none"> ✓ Surveys ✓ Data gathering from gas and electricity distributors
Strengths	Reliable sources	Surveys
weaknesses	<ul style="list-style-type: none"> ✓ Limited sources on building and equipment features 	<ul style="list-style-type: none"> ✓ Small number of indicators ✓ No aggregation possible at the levels above
Timeliness	Access to data processed by the Ministry of Energy, Electricity's utilities and statistic department but no access to the raw database	

Data collection and analysis methodology for the residential sector

- **Main energy services / uses**
 - ✓ Lighting
 - ✓ Heating
 - ✓ Air conditioner
 - ✓ Hot water
 - ✓ refrigerators
 - ✓ Washing machines (dresses / dishes)
 - ✓ Iron
 - ✓ Other

- **Other distribution keys according to**
 - ✓ Type and size of housing
 - ✓ Urban / rural
 - ✓ Owners / Tenants
 - ✓ Heating systems installed
 - ✓ Installed air conditioning systems
 - ✓ Thermal quality

Data collection and analysis methodology for the residential sector

- **Evolution of the park and equipment rate**
 - ✓ Evolution of the size of the park / thermal quality
 - ✓ Evolution of equipment rate and energy performance
 - ✓ Evolution of housing types and sizes
 - ✓ Focus on specific energy services / uses

Data collection and analysis methodology for the residential sector

عدد المساكن المأهولة في المملكة حسب تعداد عام 2004 موزعة حسب المحافظة والحضر والريف ونوع المسكن												
المملكة			ريف				حضر				المحافظة	
المجموع	فيلا	شقة	دار	مجموع	فيلا	شقة	دار	مجموع	فيلا	شقة		دار
378165	5482	333030	39653	26615	288	11245	15082	351550	5194	321785	24571	عمان
141849	149	115700	26000	6572	7	2498	4067	135277	142	113202	21933	الزرقاء
60697	337	36973	23387	20320	85	10041	10194	40377	252	26932	13193	السلط
22353	55	13239	9059	8772	12	2791	5969	13581	43	10448	3090	مأدبا
164849	570	106614	57665	38301	63	18111	20127	126548	507	88503	37538	اربد
38286	84	11635	26567	25310	32	4328	20950	12976	52	7307	5617	المفرق
25722	54	13784	11884	12203	12	5872	6319	13519	42	7912	5565	جرش
20431	6	12350	8075	6491	1	3085	3405	13940	5	9265	4670	عجلون
35051	85	16308	18658	22587	32	8905	13650	12464	53	7403	5008	الكرك
13016	15	6744	6257	4439	6	2100	2333	8577	9	4644	3924	الطفيلة
15061	36	6468	8557	7856	5	1737	6114	7205	31	4731	2443	معان
17617	61	11096	6460	1961	0	120	1841	15656	61	10976	4619	العقبة
933097	6934	683941	242222	181427	543	70833	110051	751670	6391	613108	132171	المجموع

Data collection and analysis methodology for the residential sector

جدول رقم (1)

حجم الاستهلاك الكلي لكافة انواع الطاقة المستخدمة في القطاع المنزلي لعام 2012

النسبة المئوية %	حجم الاستهلاك السنوي		نوع المادة
	طن مكافئ نغظ	طن	
13	149253	146471	مولار
6	69577	67289	كاز
30	356573	320659	غاز المسال
10	115000	-	طاقة شمسية
41	487323	-	طاقة كهربائية
100	1177726	-	مجموع

جدول رقم (4)

معدل استهلاك المسكن من الغاز المسال

حجم الاستهلاك الكلي		عدد المساكن	نسبة المساكن المستخدمة	معدل الاستهلاك السنوي		معدل الاستهلاك اسطوانة/الشهر		نوع الاستخدام
طن مكافئ نغظ	طن			كغم/السنة	اسطوانة/السنة	صيفاً	شتاءً	
26148	23514	111972	12	210	16.8	1.6	1.2	تسخين المياه
130116	117010	709154	76	165	13.2	3.3	0	التدفئة
200309	180134	923766	99	195	15.6	1.4	1.2	الطهي
356573	320659	-	-	-	-	-	-	المجموع

جدول رقم (3)

معدل استهلاك المسكن من الكاز

حجم الاستهلاك الكلي		عدد المساكن	نسبة المساكن المستخدمة	معدل الاستهلاك السنوي		معدل الاستهلاك ليتر/الشهر		نوع الاستخدام
طن مكافئ نغظ	طن			ليتر/السنة	صيفاً	شتاءً		
2872	2777	10264	1.1	342	44	13	تسخين المياه	
65721	63560	382570	41	210	105	0	التدفئة	
330	319	3732	0.4	108	12	6	الطهي	
655	633	12130	1.3	66	8	3	الانارة	
69577	67289	-	-	-	-	-	المجموع	

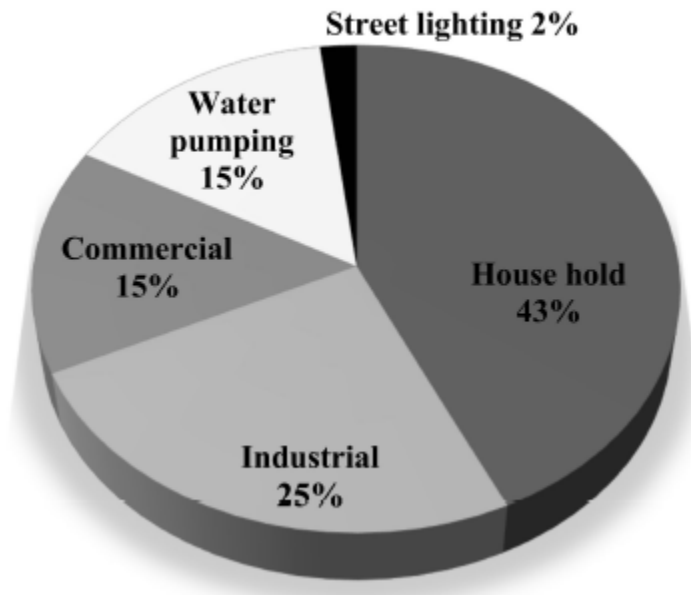
جدول رقم (21)

معدل عدد ساعات التشغيل اليومية للأجهزة الكهربائية المستخدمة في التكييف في المسكن حسب الارتفاع والانخفاض عن سطح البحر

الارتفاع والانخفاض عن سطح البحر	مروحة متحركة / ساعة	مروحة سقف / ساعة	مكيف غازي / ساعة	مكيف مائي / ساعة	أخرى / ساعة
مرتفع	6.21	7.88	5.80	4.54	4.33
متوسط	6.49	7.16	4.65	5.12	2.33
منخفض	8.14	14.47	8.76	9.76	8.00
المملكة	6.48	8.26	5.75	7.63	4.00

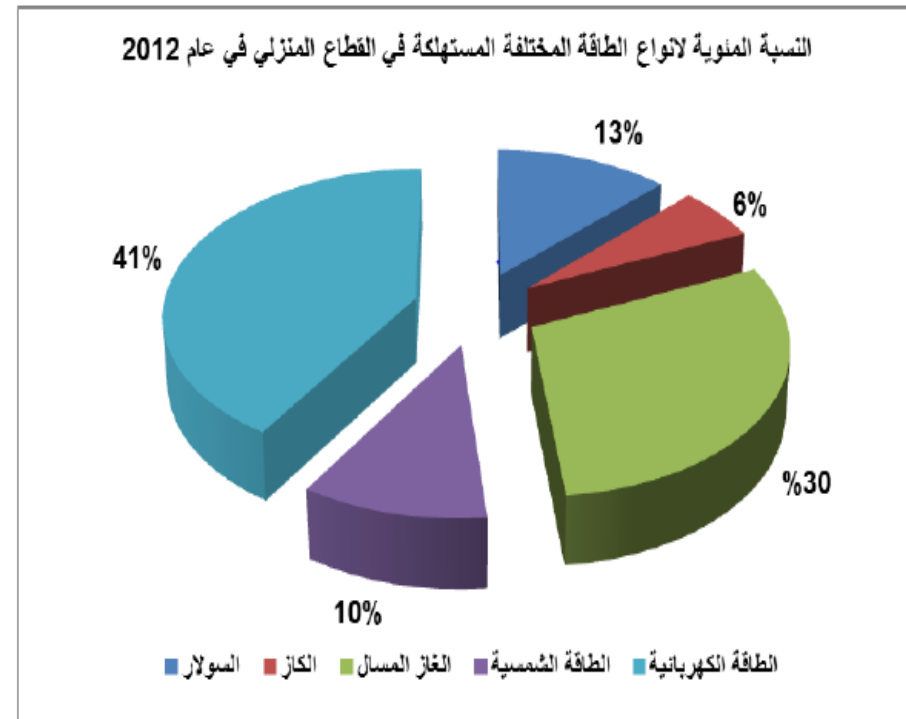
Data collection and analysis methodology for the residential sector

Electrical Energy Distribution (2016)



Source: Ministry of Energy and Mineral Resources

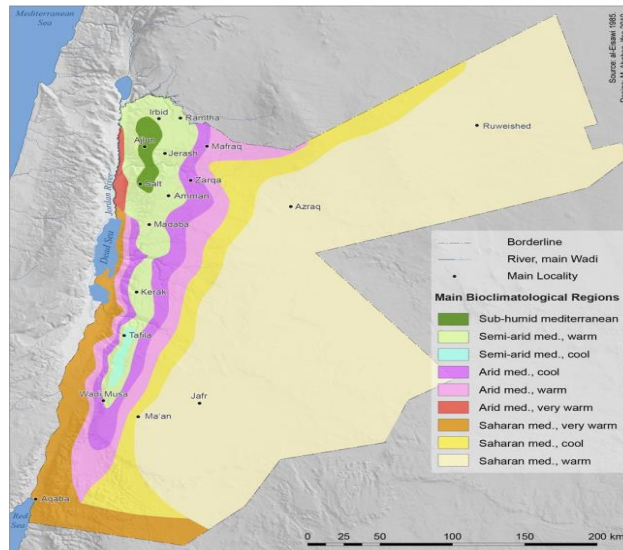
Distribution of energy consumption by source



Distributions to be examined according to other distribution keys

Data collection and analysis methodology for the residential sector

■ Park distribution by climate zone



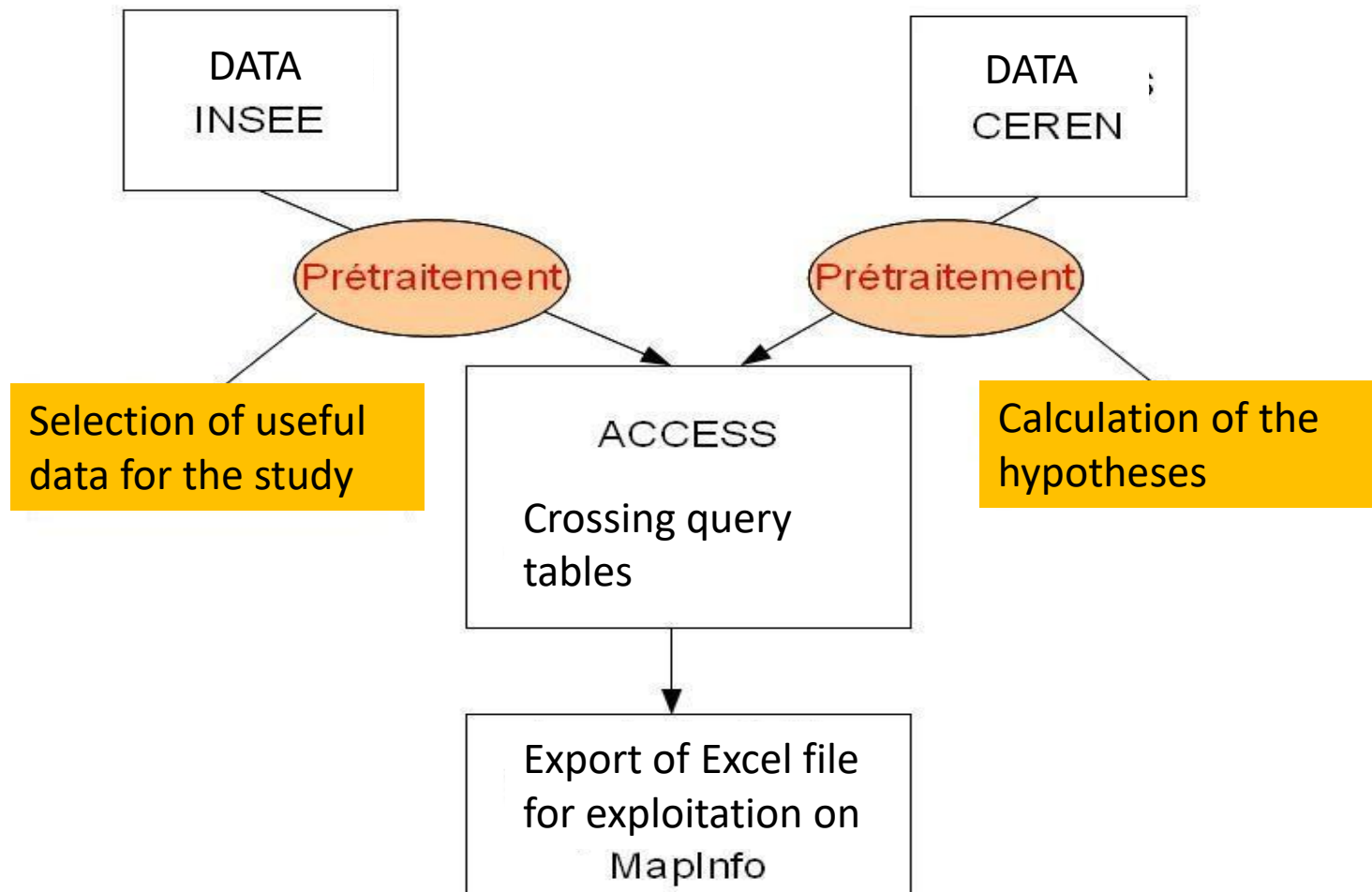
Climate characteristics of Jordan. Atlas of Jordan 2014.

■ Other distribution keys by climate zone according to:

- ✓ Type and size of housing
- ✓ Urban / rural
- ✓ Owners / Tenants
- ✓ Heating systems installed
- ✓ Installed air conditioning systems
- ✓ Thermal quality

Data collection and analysis methodology for the residential sector

- Example of approach used in France



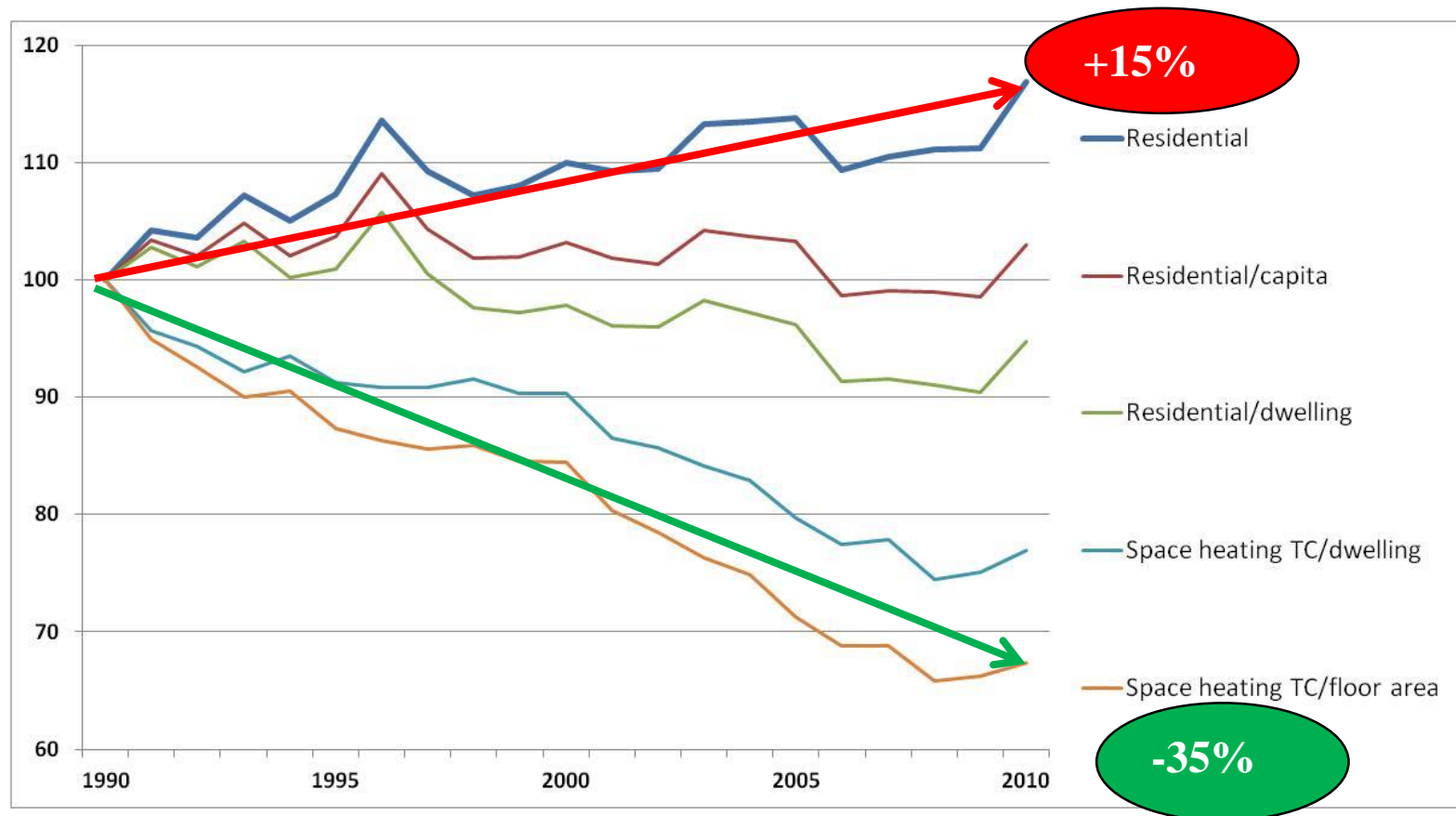
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- **Key EE indicators in the Residential**
 - ✓ Per capita energy consumption
 - ✓ Energy consumption per household
 - ✓ Energy consumption by income / consumption
 - ✓ Energy consumption per floor area (heated)
 - ✓ Equipment by housing
 - ✓ Energy consumption by use and household
 - ✓ Energy consumption for heating by heated surfaces
 - ✓ Energy consumption for conditioning by conditioned surfaces

- **Aspects to consider:**
 - ✓ The effect of weather conditions
 - ✓ The effect of tariffs and prices of different energy sources

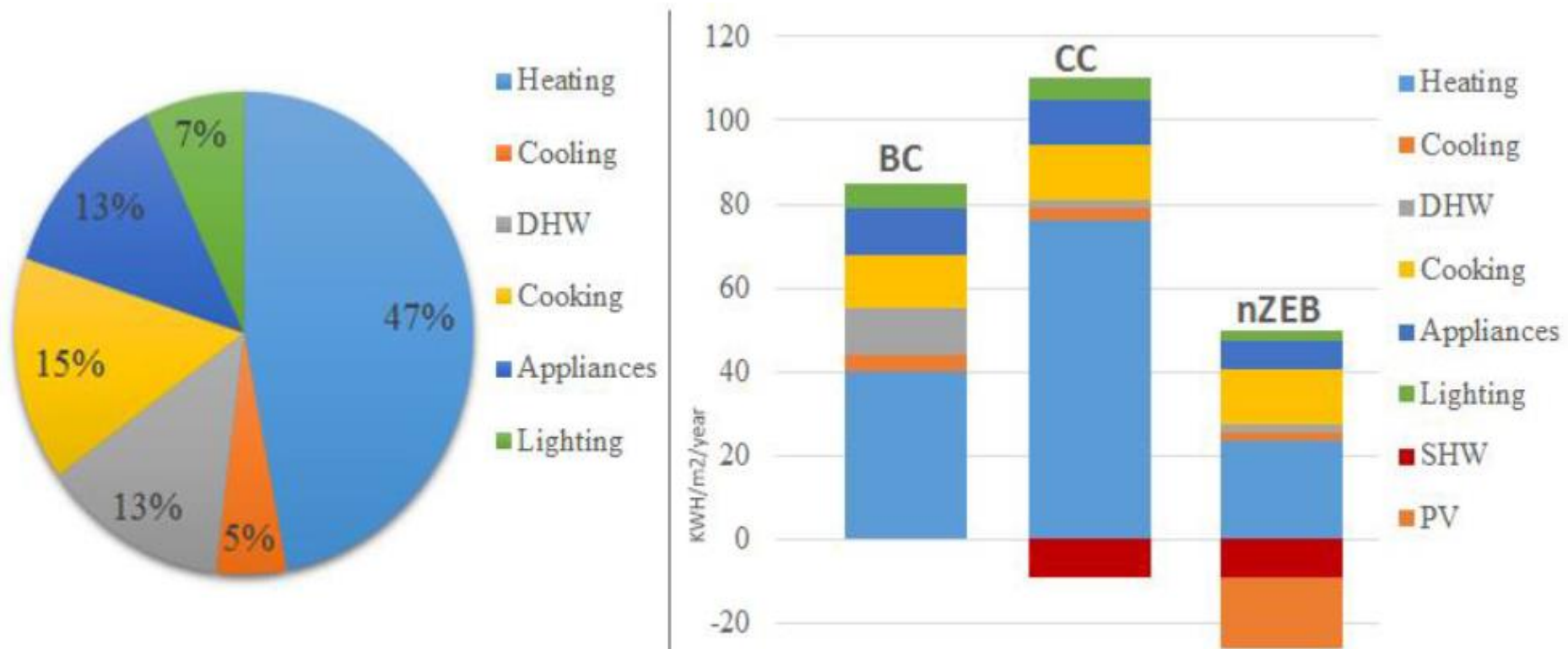
Data collection and analysis methodology for the residential sector

- Example of disaggregation and monitoring of the evolution of the indicators



Index: 1990=1. Data for IEA18 (Australia, Austria, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, Norway, Slovakia, Spain, Sweden, Switzerland, UK, USA). Source: IEA energy efficiency indicators database.
TC: Temperature Corrected.

Data collection and analysis methodology for the residential sector



(left) Total energy consumption for residential apartments in Amman and Zarqa (Al-Sallami 2015)
 (right) Energy consumption comparison of the base case and the two design scenarios in Amman

Source : S. Attia - 2016 - Life Cycle Costing for a Near Zero energy Building in Jordan

Data collection and analysis methodology for the residential sector

- **Methodological aspects to take into account**
 - ✓ Approach taken by all stakeholders to adherence to results
 - ✓ Assessment of information contained in available sources (Ministry of Energy, DoS, Research papers, etc.) and determination of additional information requirements
 - ✓ Methods for estimating additional data (combination of bottom-up and top-down approaches)
 - Ascending: use of micro data (Energy consumption of a representative sample of dwellings by type and climatic zone) to reduce uncertainty
 - Descendant: Macro Data (Country or region) according to distribution of : dwellings, population, etc..
 - ✓ Confrontation of results from modeling with metered data (Consumption of electricity / gas by a representative housing stock)
 - ✓ Seeking coherence with national and regional level statistics

Questions and topics to discuss

- **What are the energy uses on which to zoom?**
- **How can we estimate the penetration rate of high-performance equipment and its evolution?**
- **How can one estimate the rate of buildings with a good level of thermal quality and the evolution of this rate?**
- **What sources are available for additional information other than those provided by usual sources (Ministry of Energy surveys, Department of statistics, energy audits by NERC, Research papers...)?**
- **How to strengthen the efforts of existing data producers: Ministry of Energy, Statistic services, etc.?**
- **How to set up a residential energy monitoring tool to measure the impact of energy efficiency policies in the country?**
- **Other points to discuss**

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THANK YOU FOR YOUR ATTENTION

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