



Renewables & Waste Questionnaire

**UNECE/EUROSTAT/EEA Workshop on Waste Statistics
Geneva, 11-13 April**

**Yasmina Abdelilah
International Energy Agency**



**International
Energy Agency**

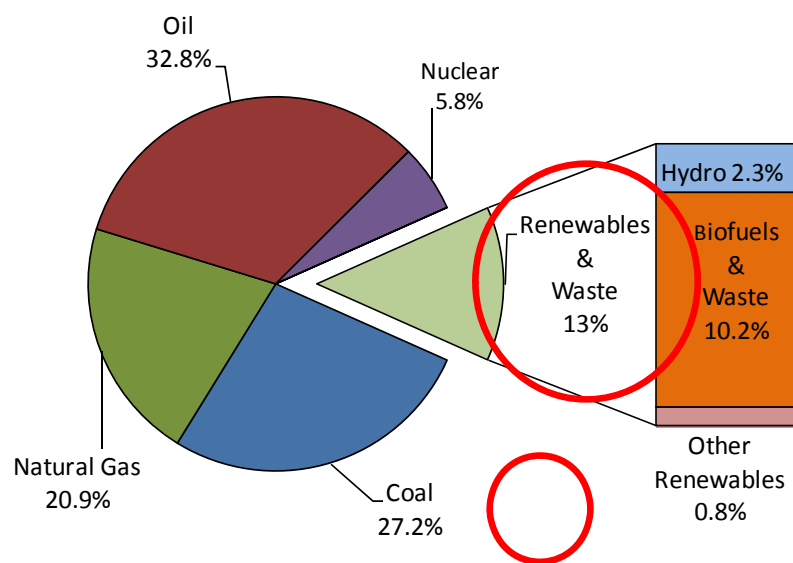
OVERVIEW

- **Renewable and waste energy in the world**
- **Classification and definitions renewable and waste energy sources in energy statistics**
- **How the data is collected: Renewables & Waste questionnaire**
- **On-going challenges –**
 - **General Issues**
 - **Waste Issues**
 - **Regional Issues**

TOTAL PRIMARY ENERGY SUPPLY 2009

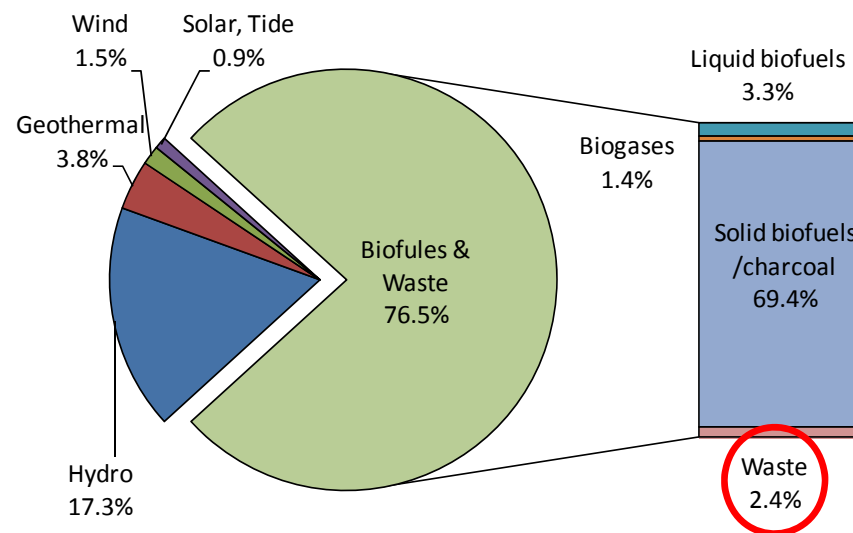
Renewable and waste energy account for 13% of global TPES in 2009

World



12,150 Mtoe

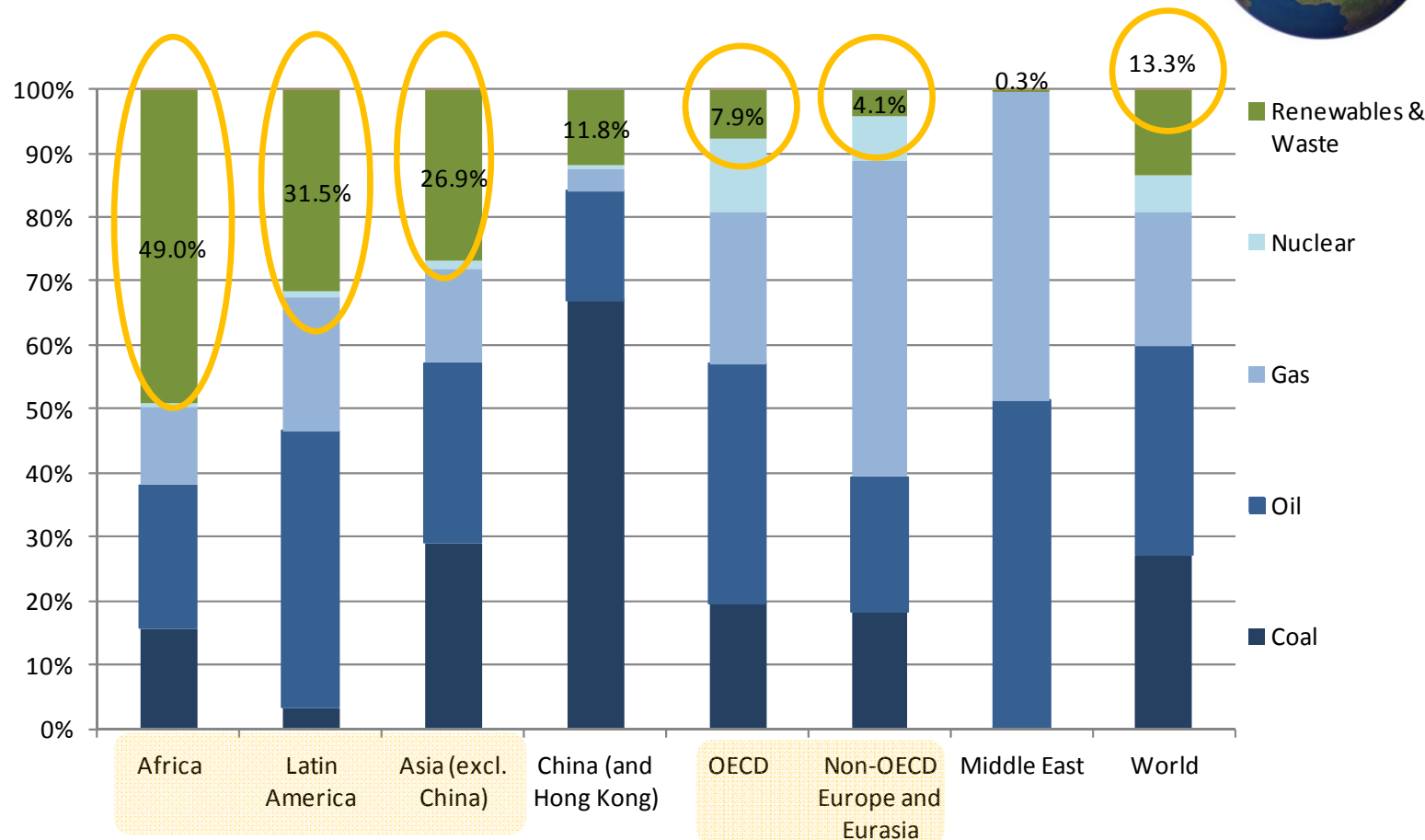
Renewables & Waste



1617 Mtoe

Waste energy accounts for less than 1% of global TPES in 2009

Share of Renewable and Waste energy by Region, 2009



Share of renewables and waste energy varies by region



International
Energy Agency

TPES RENEWABLES AND WASTE 1990 - 2009

Steady growth in renewable and waste energy global supply since 1990

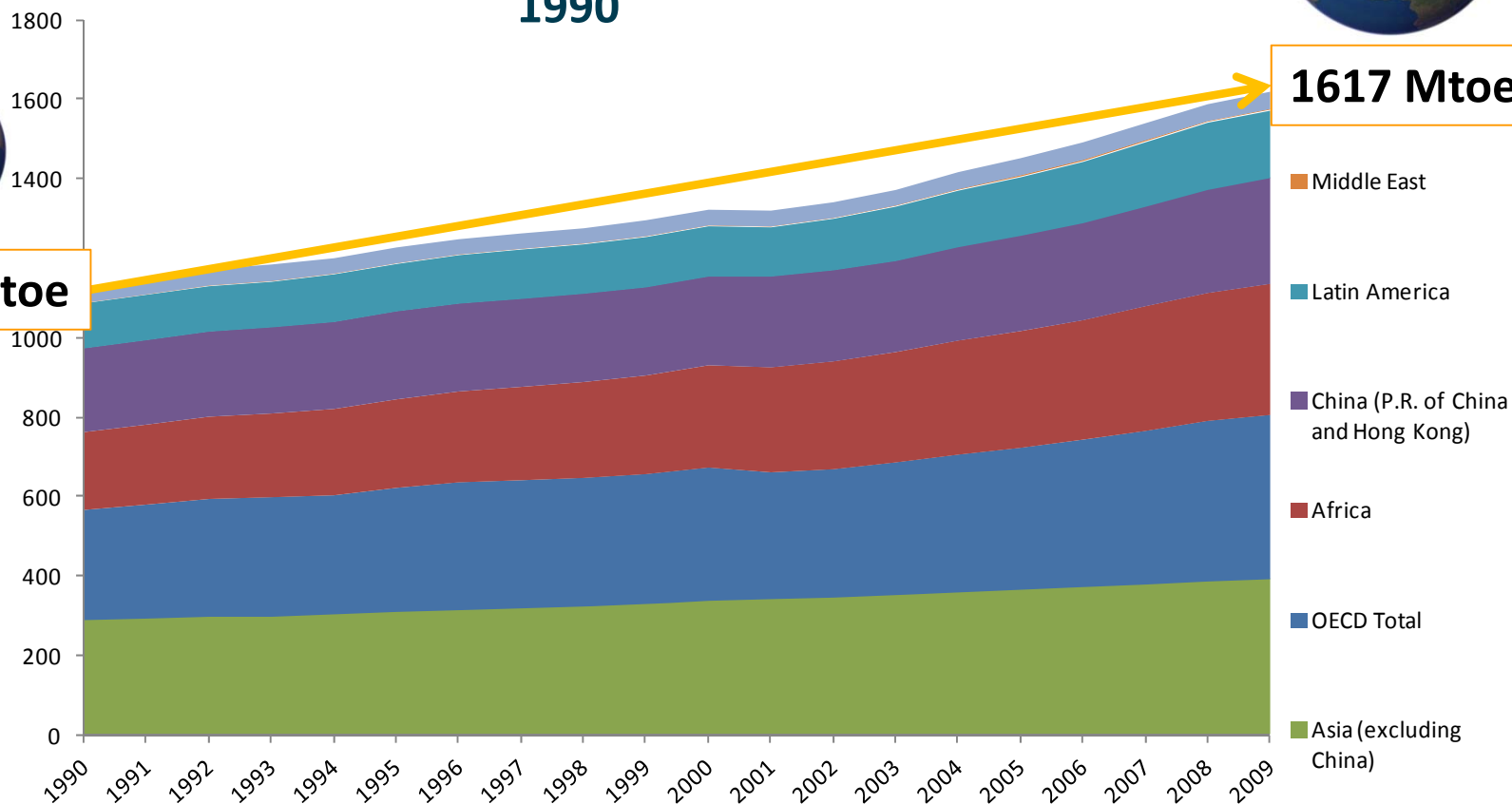


1617 Mtoe



1129 Mtoe

Total Primary
Energy Supply
(Mtoe)



Global Trends in Electricity Production

1973



6,115 TWh

2009

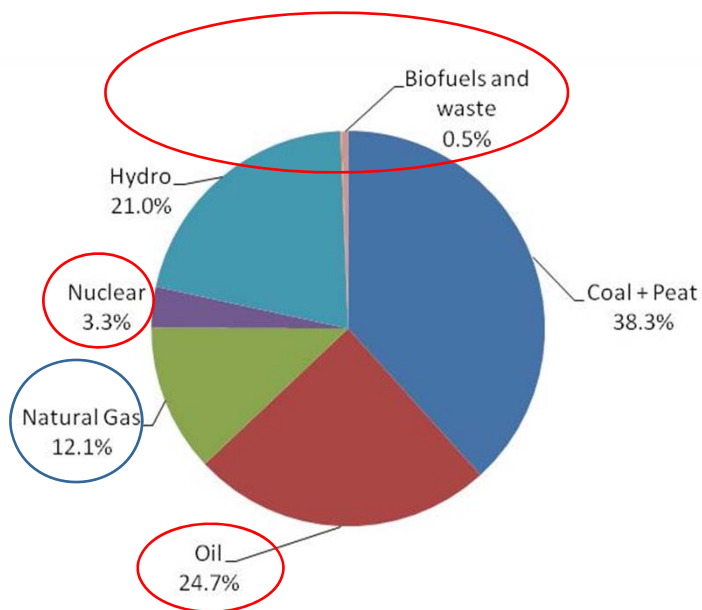


20,055 TWh

Global electricity generation more than triples in 36 years

WORLD FUEL SHARES OF ELECTRICITY

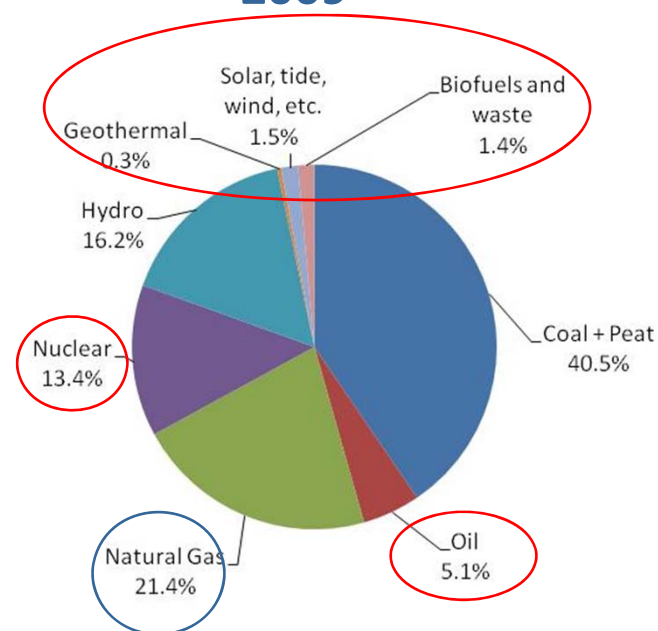
1973



6,115 TWh



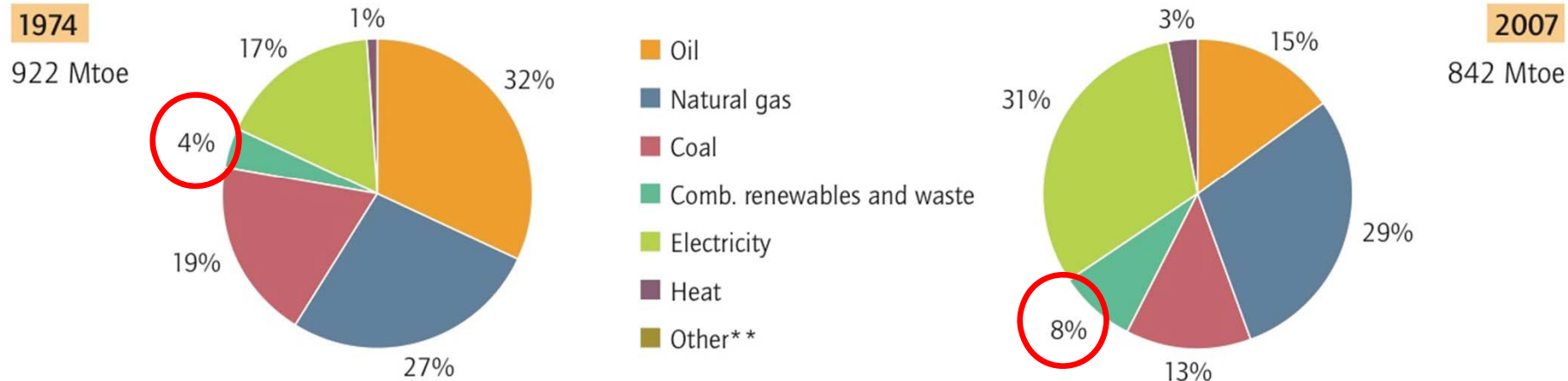
2009



20,181 TWh

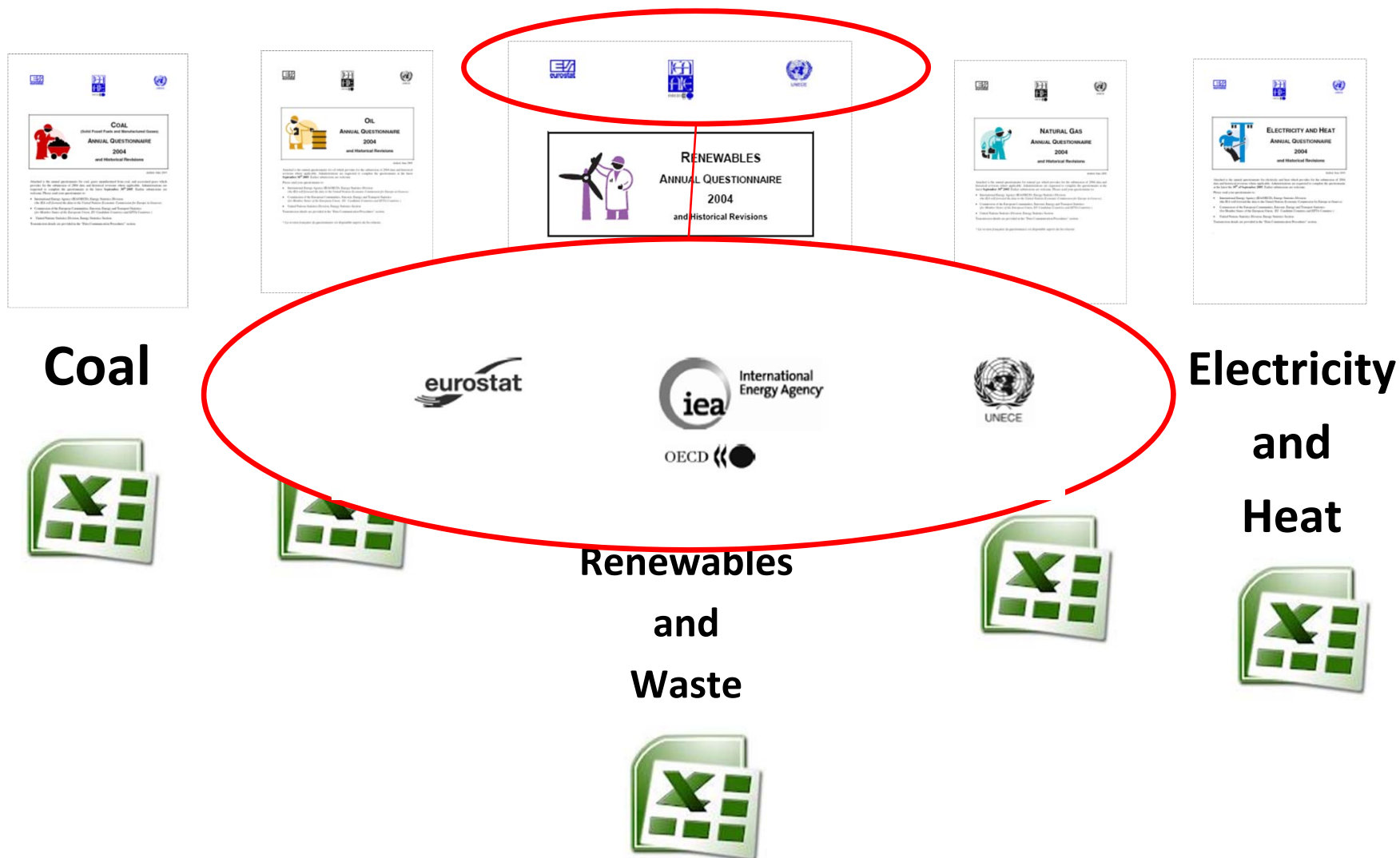
Renewables and Waste are being increasingly used for power generation

Industry consumption* by fuel

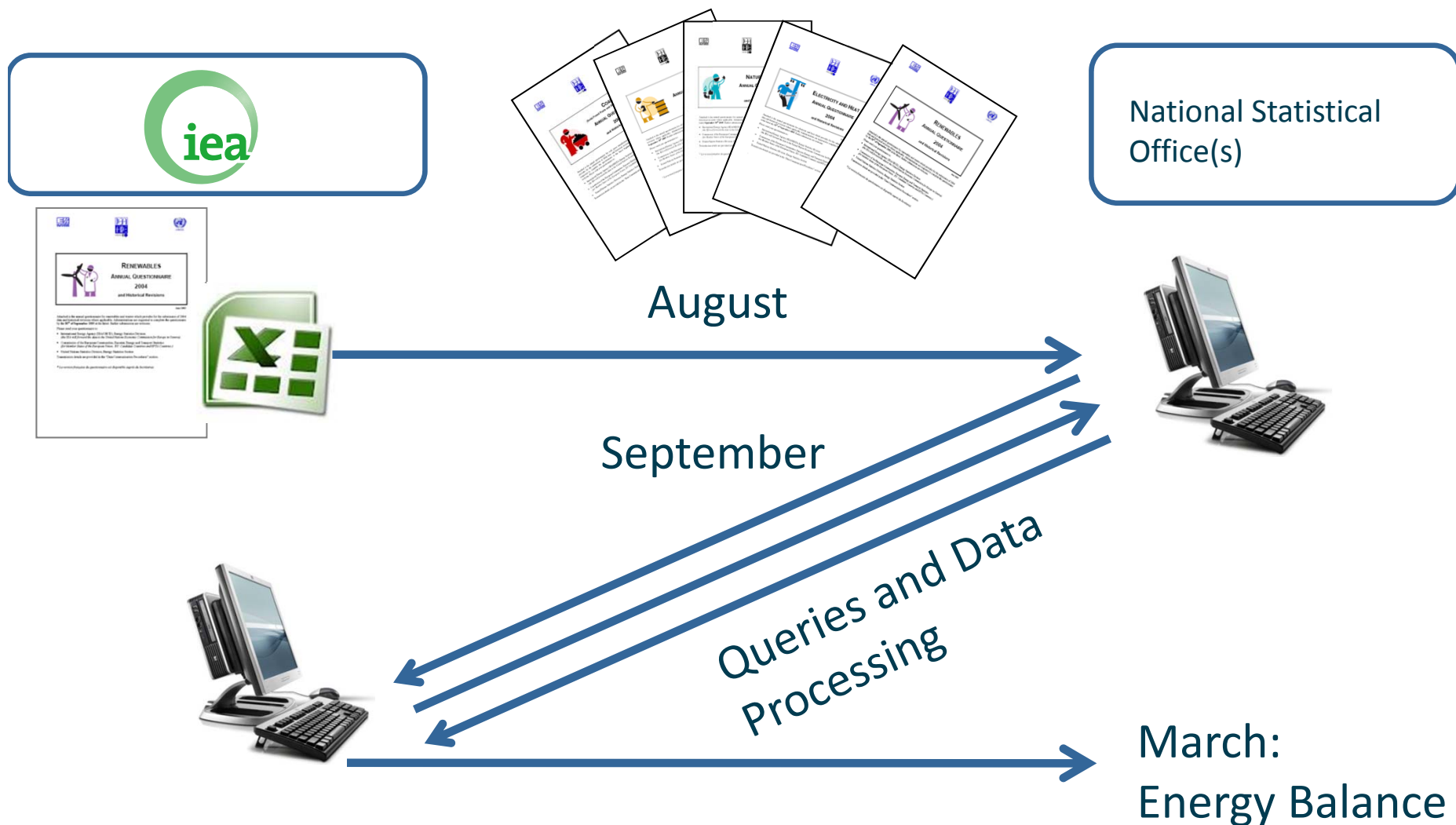


- Most IEA member countries increased the use of combustible renewables and waste in industry. Their combined share rose from 4% to 8%.
- Two examples include the extensive use of biomass (wood wastes and residues) in the pulp and paper industry and increased use of waste in other sectors (e.g. used tyres in the being the delocalisation of energy-intensive sectors such cement industry).

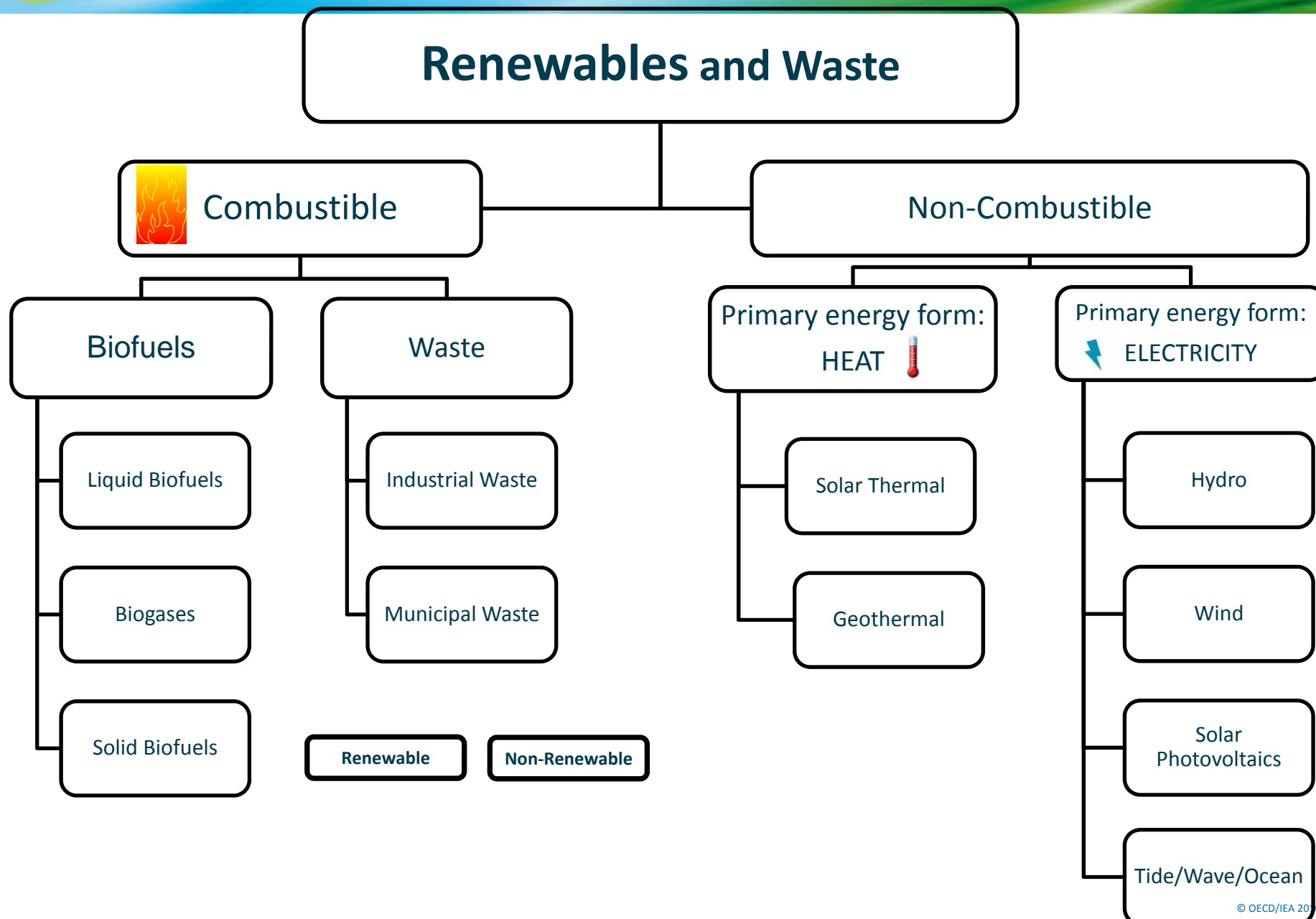
How does the IEA collect its Data?



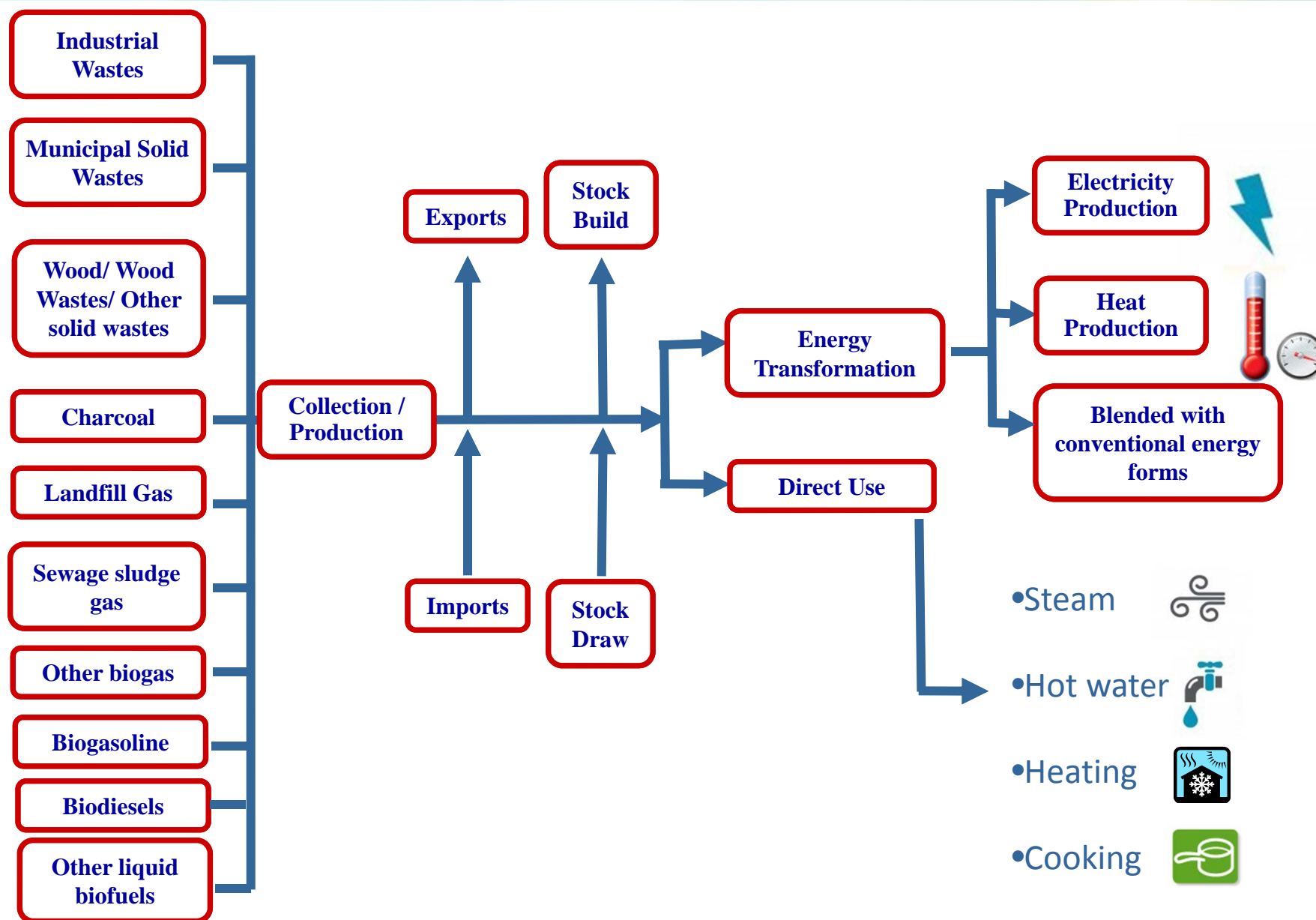
The data collection cycle



A focus on Renewables and Waste



COMBUSTIBLES: BIOFUELS AND WASTE



INDUSTRIAL WASTE

Industrial Wastes



Industrial Waste (e.g. tyres) consists of solid, liquid, or gaseous products **combusted directly** usually in specialised plants, to produce **heat** and/or **power** and that are not reported in the category solid biomass (i.e. not renewable)



Tires



Chemical Industry Wastes



Tail Gas

Industrial Wastes = Non Renewable

**Biofuels = Renewable Industrial Wastes
(i.e. solid biofuels, liquid biofuels, or biogases)**



MUNICIPAL SOLID WASTE

Municipal Solid Wastes

Consists of the municipal waste products that are **combusted directly** to produce **heat** and/or **power**. It comprises waste produced by the residential, commercial and public services sectors that is collected by local authorities for disposal in a central location, including hospital waste.



Household Wastes



Commercial/Public Services
Wastes



Hospital Wastes

Renewable

Non-Renewable



Biodegradable



Non-Biodegradable

SOLID BIOMASS

Solid Biomass

Solid Biomass– covers organic, non-fossil material of biological origin which may be used as fuel for heat production and electricity generation or transformation into other products.

Wood/ Wood Wastes/ Other solid wastes

Wood/Wood Wastes/Other Solid Wastes– covers wood, vegetal waste, wood waste, animal materials/waste, and sulphite lyes (black liquor).

Wood



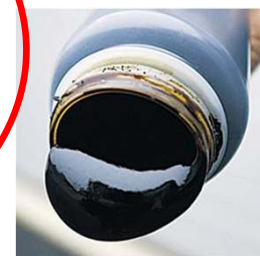
Wood Wastes



Vegetal Waste



Black Liquor



Other Solid Wastes



Charcoal

Charcoal– covers the solid residue of the destructive distillation and pyrolysis of wood/other material. It is considered a secondary energy product and is treated differently than wood in the AQ.



LIQUID BIOFUELS

Liquid Biofuels

Liquid Biomass (Bioliqids) includes fuels and bioadditives such as biogasoline, biodiesel, and other liquid biofuels.

Biogasoline



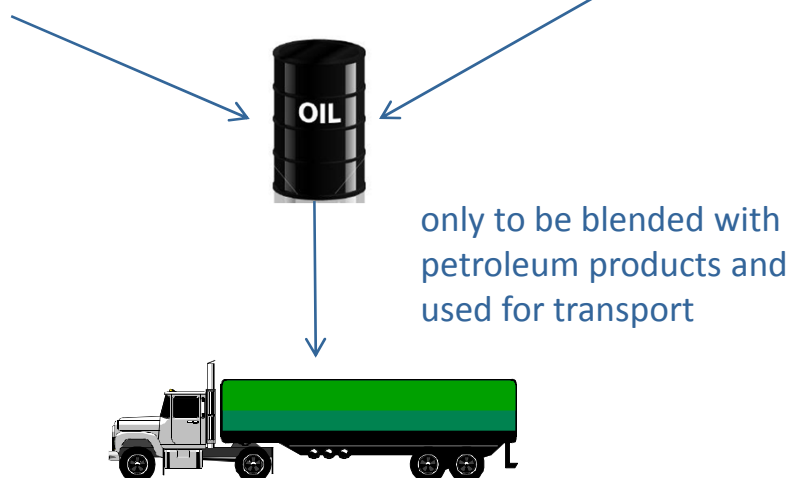
Bioethanol
Biomethanol

Biodiesels



Vegetable/animal oil

Other Liquid Biofuels



Biogases

Biogas is derived principally from the anaerobic fermentation of biomass and solid waste and is **combusted** to produce **heat** and/or **power**.



Landfill Gas

Landfill Gas covers gas formed by the digestion of landfilled waste.



Sewage sludge gas

Sewage Sludge Gas covers gas produced from the anaerobic fermentation of sewage sludge.

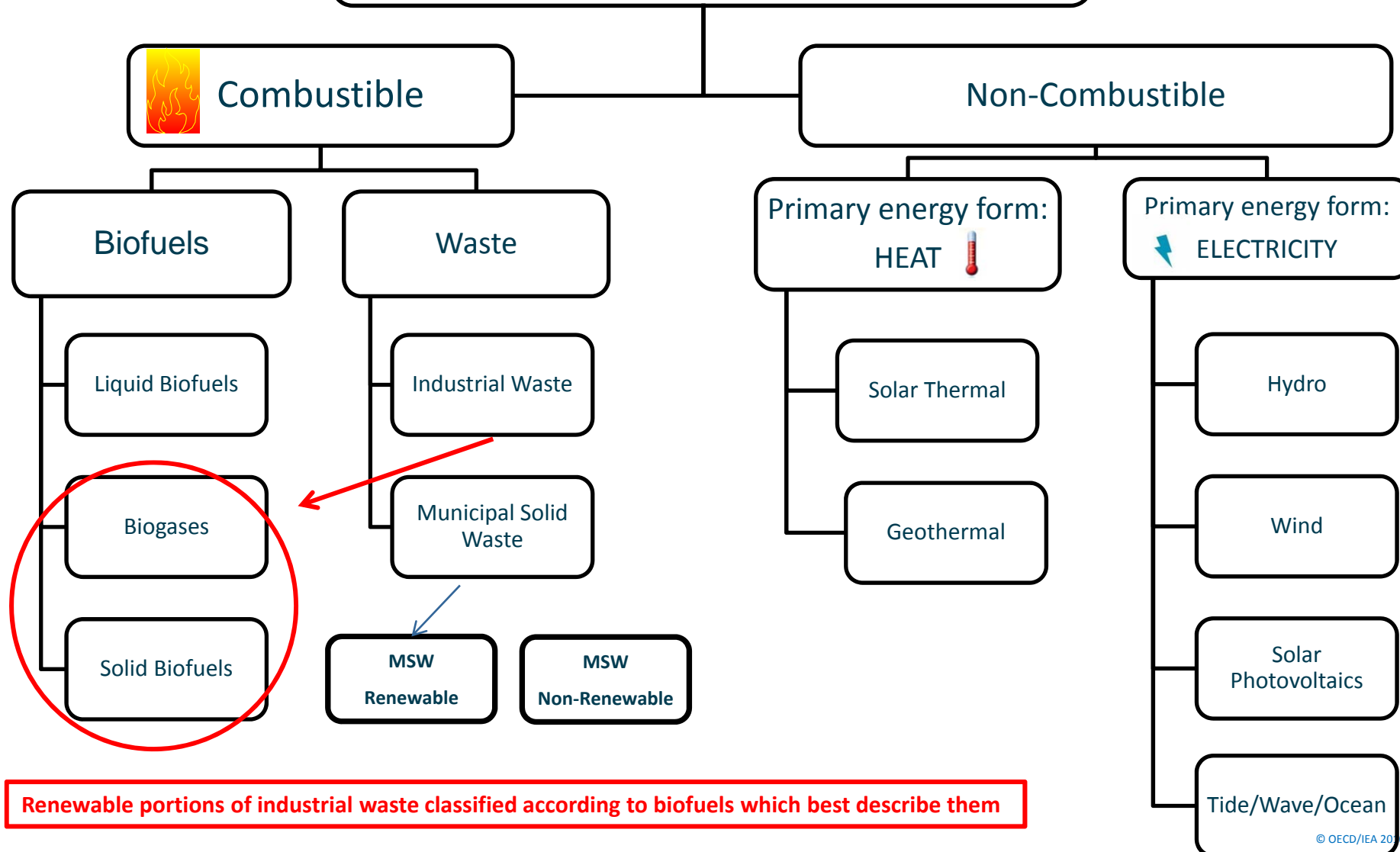


Other biogas

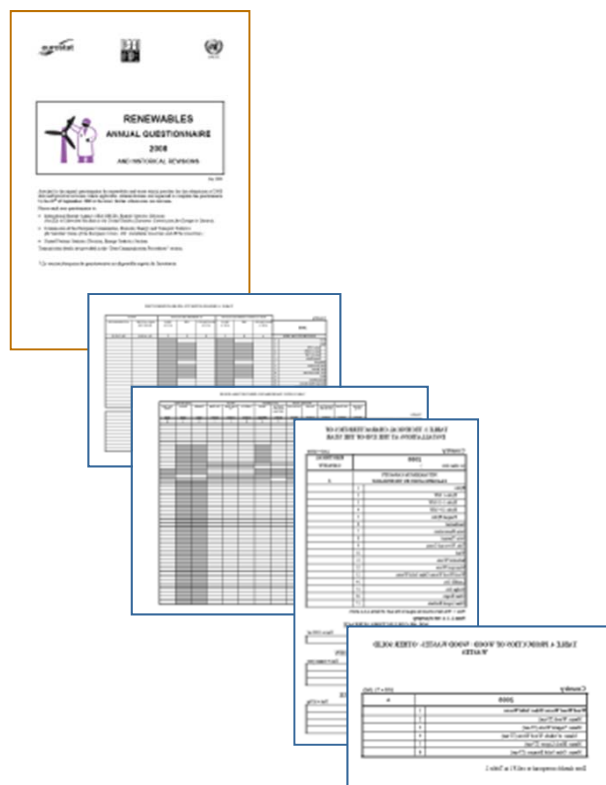
Other Biogas covers gas such as biogas produced from the anaerobic fermentation of animal slurries and of agro-food breweries.



Renewables and Waste



STRUCTURE OF ANNUAL QUESTIONNAIRE



- **Table 1: Gross Electricity and Heat Production**
- **Table 2: Supply, Transformation, Energy Sectors, End-Use**
- **Table 3: Technical Characteristics of Installations**
 - **Net Maximum Capacity (electricity)**
 - **Solar Collectors Surface**
 - **Liquid Biofuels Plants Capacity**
 - **Average Net Calorific Values**
- **Table 4: Production of Wood, Wood Wastes, and Other Solid Wastes**

TABLE 1. GROSS ELECTRICITY AND HEAT PRODUCTION

| | | MAIN ACTIVITY PRODUCER PLANTS | | | AUTOPRODUCER PLANTS | | | TOTAL | |
|-------------------------------------|----|-------------------------------|-----------|----------------|-----------------------|-----------|----------------|---------------------------|--------------|
| | | ELECTRICITY (ONLY) | CHP | HEAT (ONLY) | ELECTRICITY (ONLY) | CHP | HEAT (ONLY) | MAIN ACTIVITY PRODUCER | AUTOPRODUCER |
| 2009 | | | | | | | | | |
| ELECTRICITY Unit: MWh | | A | B | C | D | E | F | G (= A+B+C) | H (= D+E+F) |
| Total | 1 | 72,081,281 | 1,072,214 | | 1,258,164 | 2,320,905 | | 73,153,505 | 3,579,129 |
| Hydro | 2 | 24,344,600 | | | 365,400 | | | 24,344,600 | 365,400 |
| Hydro-1 MW | 3 | 1,866,000 | | | 0 | | | 1,866,000 | 0 |
| Hydro 1-10 MW | 4 | 4,113,000 | | | 365,400 | | | 4,113,000 | 365,400 |
| Hydro 10+ MW | 5 | 12,315,600 | | | 0 | | | 12,315,600 | 0 |
| Pumped Hydro | 6 | 6,050,000 | | | 0 | | | 6,050,000 | 0 |
| Geothermal | 7 | 18,800 | | | 0 | | | 18,800 | 0 |
| Solar Photovoltaic | 8 | 0 | | | 0 | | | 0 | 0 |
| Solar Thermal | 9 | 0 | | | 0 | | | 0 | 0 |
| Tide, Wave and Ocean | 10 | 0 | | | 0 | | | 0 | 0 |
| Wind | 11 | 38,570,869 | | | 68,131 | | | 38,570,869 | 68,131 |
| Industrial Waste | 12 | 0 | 0 | | 0 | 0 | | 0 | 0 |
| Municipal Waste (Renewable) | 13 | 0 | 0 | | 0 | 0 | | 0 | 0 |
| Municipal Waste (Non-Renewable) | 14 | 0 | 0 | | 0 | 0 | | 0 | 0 |
| Wood/Wood Wastes/Other Solid Wastes | 15 | 7,132,915 | 1,016,573 | | 749,207 | 1,982,133 | | 8,149,488 | 2,731,340 |
| Landfill Gas | 16 | 0 | 0 | | 0 | 0 | | 0 | 0 |
| Sludge Gas | 17 | 0 | 0 | | 0 | 0 | | 0 | 0 |
| Other Biogas | 18 | 0 | 0 | | 0 | 0 | | 0 | 0 |
| Other Liquid Biofuels | 19 | 2,014,097 | 55,651 | | 75,426 | 338,832 | | 2,069,748 | 414,258 |
| HEAT Unit: TJ | | | | | | | | | |
| Total | 20 | | 8,401 | 7,145 | | 0 | 0 | 15,546 | 0 |
| Geothermal | 21 | | 0 | 1,048 | | 0 | 0 | 1,048 | 0 |
| Solar Thermal | 22 | | | | | 0 | 0 | 0 | 0 |
| Industrial Waste | 23 | | | | | 0 | 0 | 0 | 0 |
| Municipal Waste (Renewable) | 24 | | | | | 0 | 0 | 0 | 0 |
| Municipal Waste (Non-Renewable) | 25 | | | | | 0 | 0 | 0 | 0 |
| Wood/Wood Wastes/Other Solid Wastes | 26 | | | | | 0 | 0 | 14,063 | 0 |
| Landfill Gas | 27 | | | | | 0 | 0 | 0 | 0 |
| Sludge Gas | 28 | | | | | 0 | 0 | 0 | 0 |
| Other Biogas | 29 | | 0 | 0 | | 0 | 0 | 0 | 0 |
| Other Liquid Biofuels | 30 | | 219 | 216 | | 0 | 0 | 435 | 0 |

Type of
Plant

Type of
Producer

Sources of
electricity and
heat

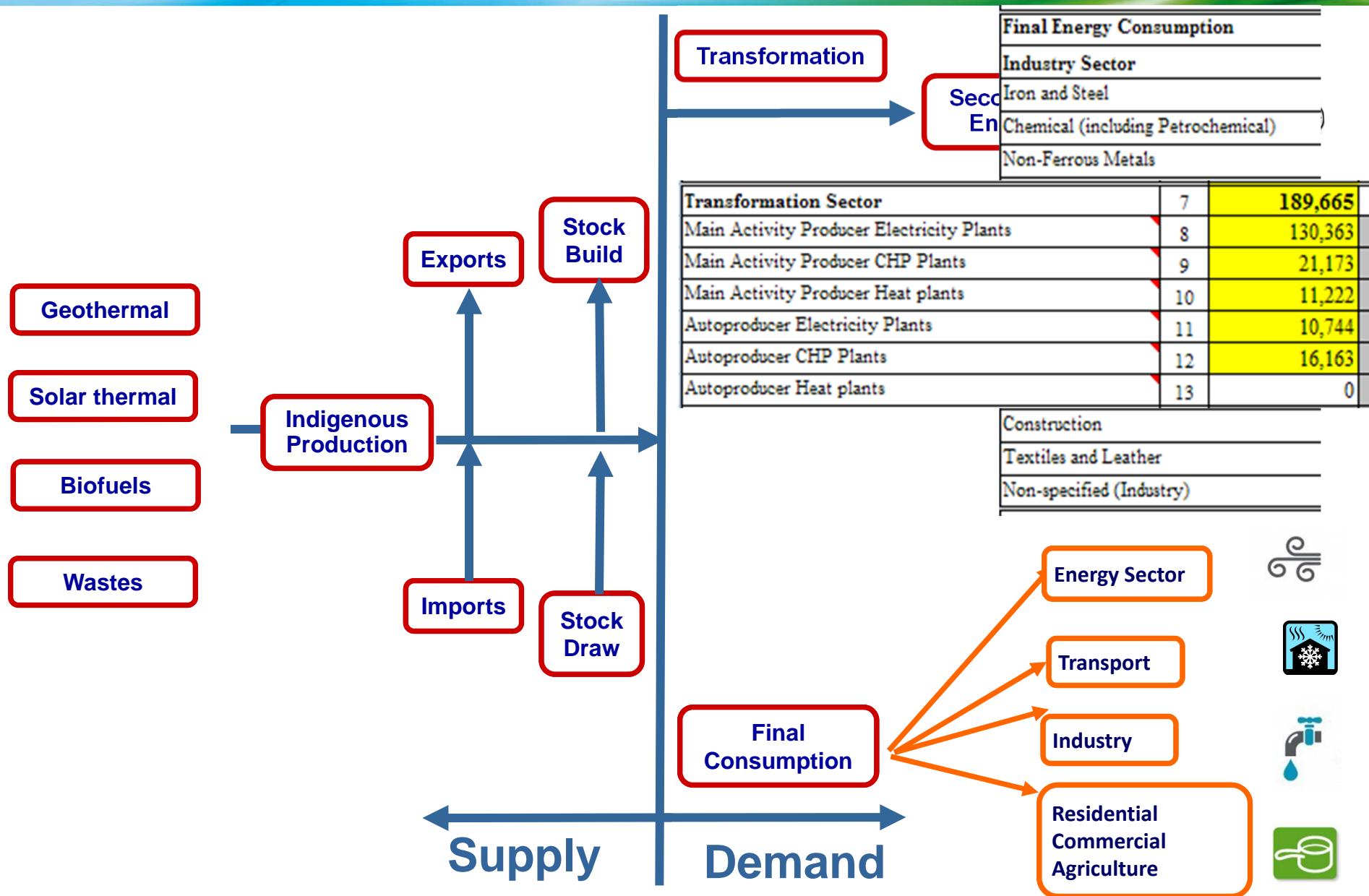
TABLE 2. SUPPLY, TRANSFORMATION, ENERGY SECTORS AND END USE

| Country | | | | | | | | | | | | | |
|---|----|-------------------|---------------|----------------------------------|-----------------|-----------|---------------|---------------|-------------------------------------|----------|--------------|----------|-----------------|
| | | Geothermal Energy | Solar Thermal | Industrial Waste (non-renewable) | MUNICIPAL WASTE | Renewable | Non-Renewable | SOLID BIOMASS | Wood/Wood Wastes/Other Solid Wastes | Charcoal | Landfill Gas | Biogas | LIQUID BIOFUELS |
| | | TJ (NCV) | TJ (NCV) | TJ (NCV) | TJ (NCV) | TJ (NCV) | TJ (NCV) | TJ (NCV) | TJ (NCV) | TJ (NCV) | TJ (NCV) | TJ (NCV) | TJ (NCV) |
| | | A | B | C | D | E | F | G | H | I | J | K | L |
| 2000 | | | | | | | | | | | | | |
| Indigenous Production | 1 | | | | | | | | | | | | |
| Total Imports (Balance) | 2 | | | | | | | | | | | | |
| Total Exports (Balance) | 3 | | | | | | | | | | | | |
| Stock Changes (National Territory) | 4 | | | | | | | | | | | | |
| Inland Consumption (Calculated) | 5 | | | | | | | | | | | | |
| Statistical Differences | 6 | | | | | | | | | | | | |
| Transformation Sector | 7 | | | | | | | | | | | | |
| Main Activity Producer Electricity Plants | 8 | | | | | | | | | | | | |
| Main Activity Producer CHP Plants | 9 | | | | | | | | | | | | |
| Main Activity Producer Heat plants | 10 | | | | | | | | | | | | |
| Autoproducer Electricity Plants | 11 | | | | | | | | | | | | |
| Autoproducer CHP Plants | 12 | | | | | | | | | | | | |
| Autoproducer Heat plants | 13 | | | | | | | | | | | | |
| Patent Fuel Plants (Transformation) | 14 | | | | | | | | | | | | |
| BKB Plants (Transformation) | 15 | | | | | | | | | | | | |
| Gas Works (Transformation) | 16 | | | | | | | | | | | | |
| For Blended Natural Gas | 17 | | | | | | | | | | | | |
| For Blending to Motor Gasoline/Diesel | 18 | | | | | | | | | | | | |
| Charcoal Production Plants (Transformation) | 19 | | | | | | | | | | | | |
| Non-specified (Transformation) | 20 | | | | | | | | | | | | |
| Energy Sector | 21 | | | | | | | | | | | | |
| Gasification Plants for Biogas | 22 | | | | | | | | | | | | |
| Own Use in Electricity, CHP and Heat Plants | 23 | | | | | | | | | | | | |
| Coal Mines | 24 | | | | | | | | | | | | |
| Patent Fuel Plants (Energy) | 25 | | | | | | | | | | | | |
| Coke Ovens (Energy) | 26 | | | | | | | | | | | | |
| Petroleum Refineries | 27 | | | | | | | | | | | | |
| BKB Plants (Energy) | 28 | | | | | | | | | | | | |
| Gas Works (Energy) | 29 | | | | | | | | | | | | |
| Blast Furnaces (Energy) | 30 | | | | | | | | | | | | |
| Charcoal Production Plants (Energy) | 31 | | | | | | | | | | | | |
| Non-specified (Energy) | 32 | | | | | | | | | | | | |
| Distribution losses | 33 | | | | | | | | | | | | |
| Total Final Consumption | 34 | | | | | | | | | | | | |
| Final Energy Consumption | 35 | | | | | | | | | | | | |
| Industry sector | 36 | | | | | | | | | | | | |
| Iron and Steel | 37 | | | | | | | | | | | | |
| Chemical (including Petrochemical) | 38 | | | | | | | | | | | | |
| Non-Ferrous Metals | 39 | | | | | | | | | | | | |
| Non-Metallic Minerals | 40 | | | | | | | | | | | | |
| Transport Equipment | 41 | | | | | | | | | | | | |
| Machinery | 42 | | | | | | | | | | | | |
| Mining and Quarrying | 43 | | | | | | | | | | | | |
| Food, Beverages and Tobacco | 44 | | | | | | | | | | | | |
| Paper, Pulp and Printing | 45 | | | | | | | | | | | | |
| Wood and Wood Products | 46 | | | | | | | | | | | | |
| Construction | 47 | | | | | | | | | | | | |
| Textiles and Leather | 48 | | | | | | | | | | | | |
| Non-specified (Industry) | 49 | | | | | | | | | | | | |
| Transport Sector | 50 | | | | | | | | | | | | |
| Rail | 51 | | | | | | | | | | | | |
| Road | 52 | | | | | | | | | | | | |
| Domestic Navigation | 53 | | | | | | | | | | | | |
| Non-specified (Transport) | 54 | | | | | | | | | | | | |
| Other sectors | 55 | | | | | | | | | | | | |
| Commercial and Public Services | 56 | | | | | | | | | | | | |
| Residential | 57 | | | | | | | | | | | | |
| Agriculture/Forestry | 58 | | | | | | | | | | | | |
| Fishing | 59 | | | | | | | | | | | | |
| Non-specified (Other) | 60 | | | | | | | | | | | | |

- 13 energy products
- 60 flows divided into 6 sections
 - Supply
 - Transformation Sector
 - Energy Sector
 - Industry Sector
 - Transport Sector
 - Other Sectors

Data is collected in TJ - on a
Net Calorific Basis (NCV)

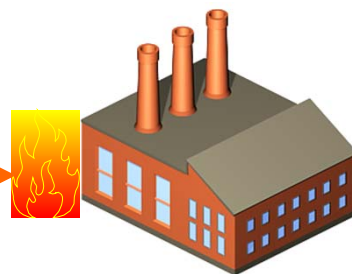
TABLE 2: COMMODITY BALANCE FORMAT



Transformation Sector

Inputs – Table 2

Industrial Waste
(TJ)



Outputs -Table 1



Heat
(TJ)



Electricity
(MWh)

$$\epsilon = \frac{\text{Outputs}}{\text{Inputs}}$$

- Inputs of primary energy that get transformed to secondary energy
- Outputs of Electricity (MWh) and Heat (TJ) are collected in Table 1
- Efficiencies of each type of plant (electricity, CHP, and heat) at the sectoral level can be calculated with the data

TABLE 2. SUPPLY, TRANSFORMATION, ENERGY SECTORS AND END USE

| Country | MUNICIPAL WASTE | | | | | SOLID BIOMASS | | BIOGAS | | | LIQUID BIOFUELS | | |
|---|-------------------|---------------|----------------------------------|------------|---------------|-------------------------------------|-------------|--------------|-------------------|--------------|-----------------|------------|-----------------------|
| | Geothermal Energy | Solar Thermal | Industrial Waste (non-renewable) | Renewable | Non-Renewable | Wood/Wood Wastes/Other Solid Wastes | Charcoal | Landfill Gas | Sewage Sludge Gas | Other Biogas | Biogasoline | Biodiesels | Other Liquid Biofuels |
| | 12 (UNC V) | 13 (UNC V) | 14 (UNC V) | 15 (UNC V) | 16 (UNC V) | 17 (UNC V) | 1000 tonnes | 12 (UNC V) | 13 (UNC V) | 14 (UNC V) | tonnes | tonnes | tonnes |
| | A | B | C | D | E | F | G | H | I | J | K | L | M |
| 2000 | | | | | | | | | | | | | |
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- 13 energy products
- Geothermal
- Solar thermal
- Industrial Waste
- MSW – Renewable
- MSW – Non-Renewable
- Wood/wood Wastes/Other Solid Wastes
- Charcoal
- Landfill Gas

Wood



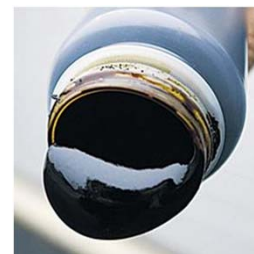
Vegetal Waste



Wood Wastes



Black Liquor



Other Solid Wastes



TABLE 2: COMMODITY BALANCE FORMAT

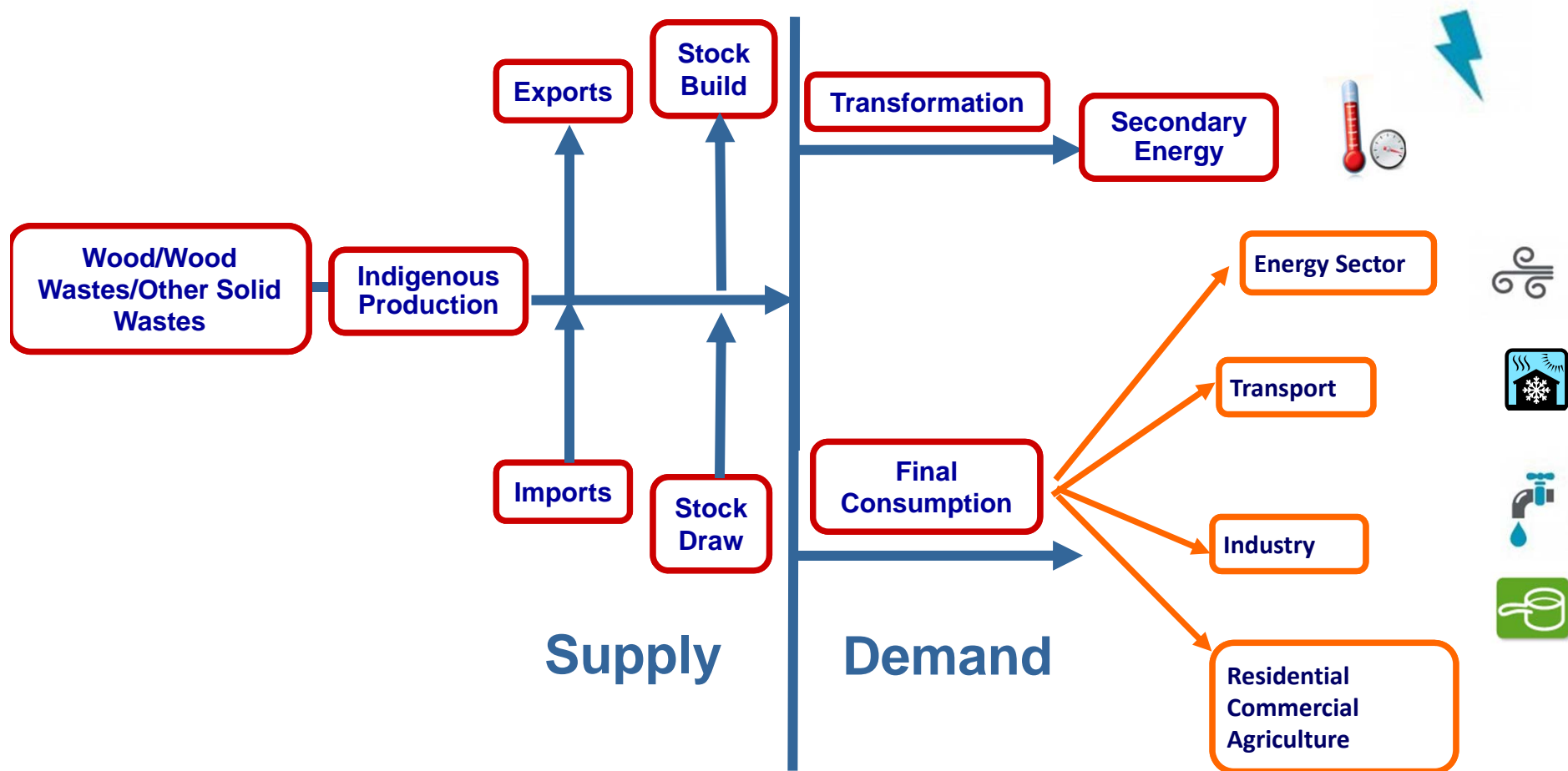


TABLE 4 : PRODUCTION OF WOOD/WOOD WASTES/OTHER SOLID WASTES

Only production is collected for individual agricultural residues and wood

Unit = TJ (net)

| 2009 | | A |
|-------------------------------------|---|---------|
| Wood/Wood Wastes/Other Solid Wastes | 1 | 469,636 |
| Memo: Wood (TJ-net) | 2 | 469,636 |
| Memo: Vegetal Waste (TJ-net) | 3 | 0 |
| Memo: of which: Wood Waste (TJ-net) | 4 | 0 |
| Memo: Black Liquor (TJ-net) | 5 | 0 |
| Memo: Other Solid Biomass (TJ-net) | 6 | 0 |

Wood/Wood
Wastes/Other Solid
Wastes

Indigenous
Production

Wood



Vegetal Waste



Wood Wastes



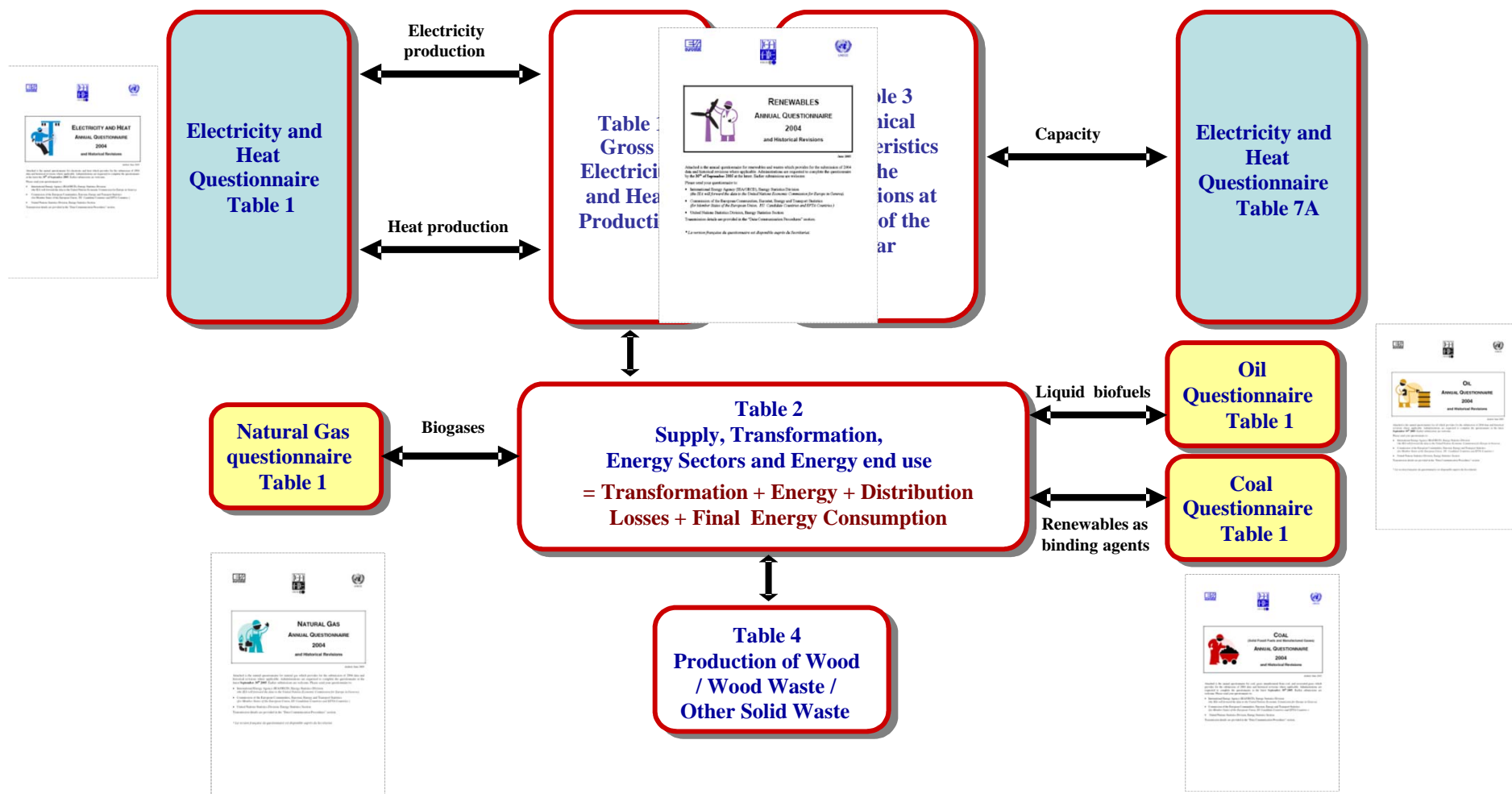
Black Liquor



Other Solid
Wastes



INTERRELATIONSHIP OF QUESTIONNAIRES

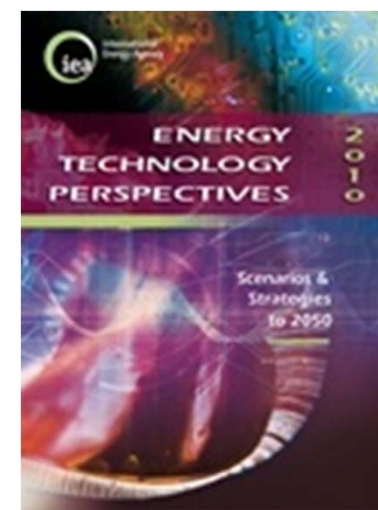
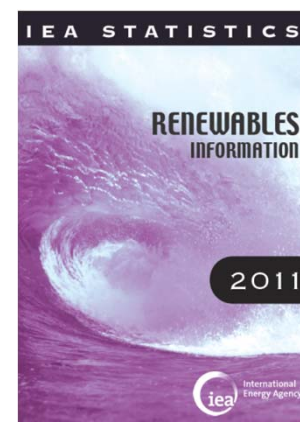


DATA QUALITY CHECKS

- Integers, negative numbers, sums
- Percentage differences with prior year
- Comparisons to other questionnaires
- Calorific values
- Statistical difference
- Transformation efficiency rates
- Shifts in product classification
- Breaks in series

USE OF THE DATA

- Renewable Information book
- Electronic online files
- Energy balances
- CO₂ emissions
- Data support for other IEA divisions/other organizations
- Country reviews
- Analysis
 - Assessing security of supply
 - Evolution of efficiencies
 - Environmental impacts
- Making policy and business decisions



ON-GOING CHALLENGES

■ General Challenges:

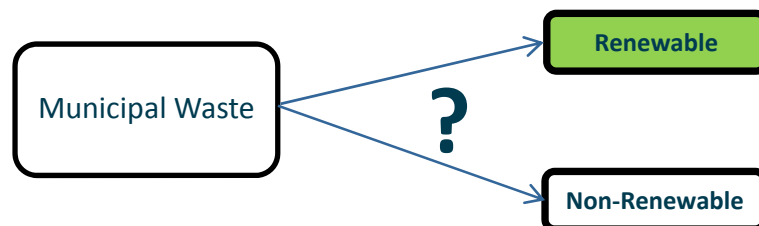
- Lack of resources allocated to statistics
- Lack of expertise

■ Challenges Specific to Renewables and Waste

- Not all renewable and waste energies flow through conventional systems
- Scattered production/consumption data
- Multitude of individual small installations
- Lack of standardized estimation methodology

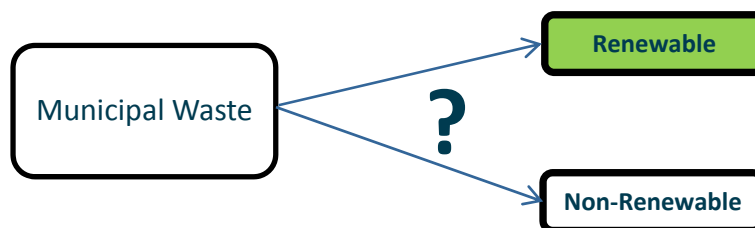
Challenges with “Waste”

- **Distinction between Industrial Waste and Municipal Solid Waste data may not be available until later years**
 - Data collection systems were not in place until early 1990's
- **IEA methodology considers Industrial Waste and MSW Renewable -> Non-Renewable**
 - Distinction is important because the non-renewable component is counted when calculating CO2 emissions
 - Some countries may include it for their national targets
- **Split MSW into Renewable & Non-Renewable Parts:**



Challenges with “Waste”

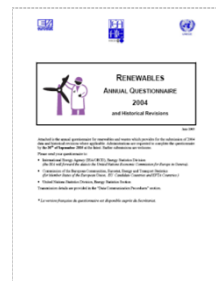
■ Split MSW into Renewable & Non-Renewable Parts:



- IEA estimate assumes 50/50 split when the split is unknown
- Most countries follow this assumption if unknown
- Some countries have other methods to determine the split:
 - An assumption of: 70/30
 - Surveys done at one point in time to assess the share that were carried through in later years (Canada)

Scope of “Waste” crosses several Questionnaires

Definition of “Waste” is only a portion of the residues from all economic activity



Waste

Industrial Waste

Municipal Waste

Biogases



Wood Wastes



Vegetal Waste



Other Solid Wastes



Black Liquor



Residues from the forestry, paper, and agricultural industries



Coal
Manufactured
Gases



Other Oil
Products
i.e. Syngas



Chemical Heat

Other: “waste”
heat?



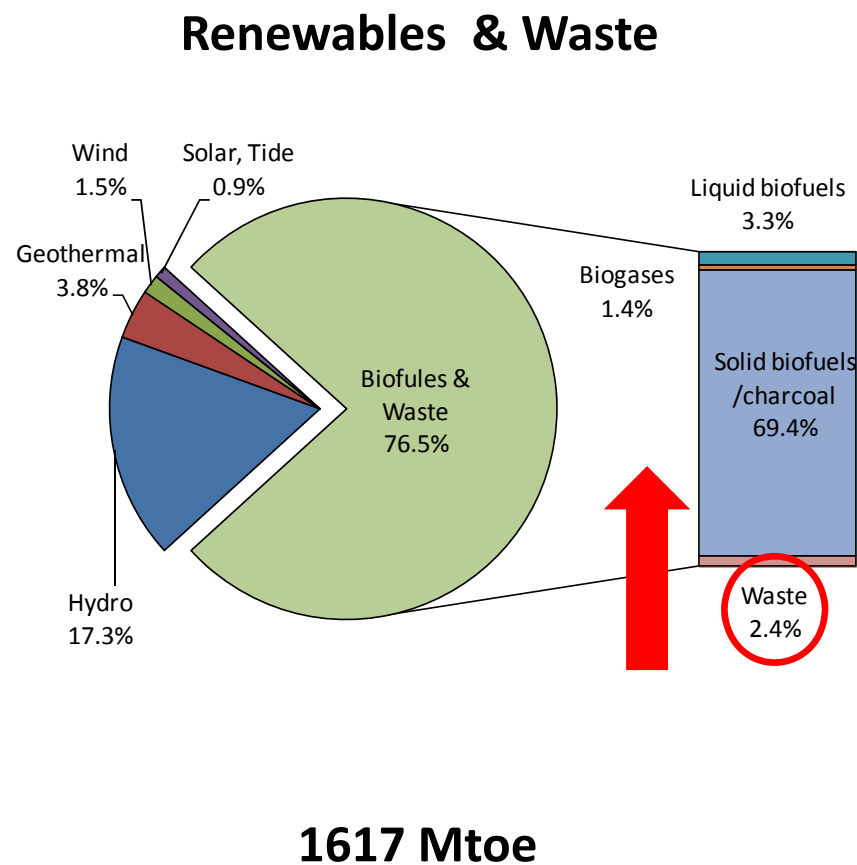
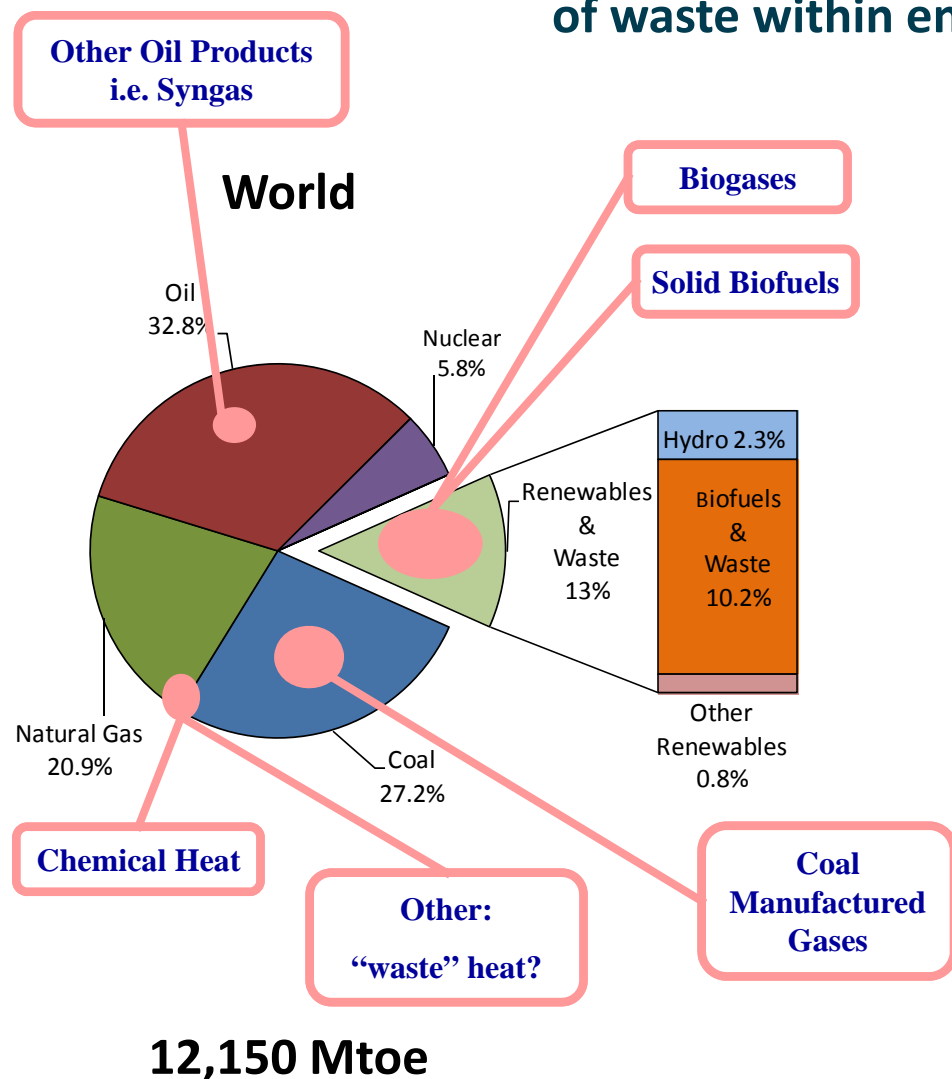
Residues from other
manufacturing industries

Products
outside
the
scope of
energy
statistics

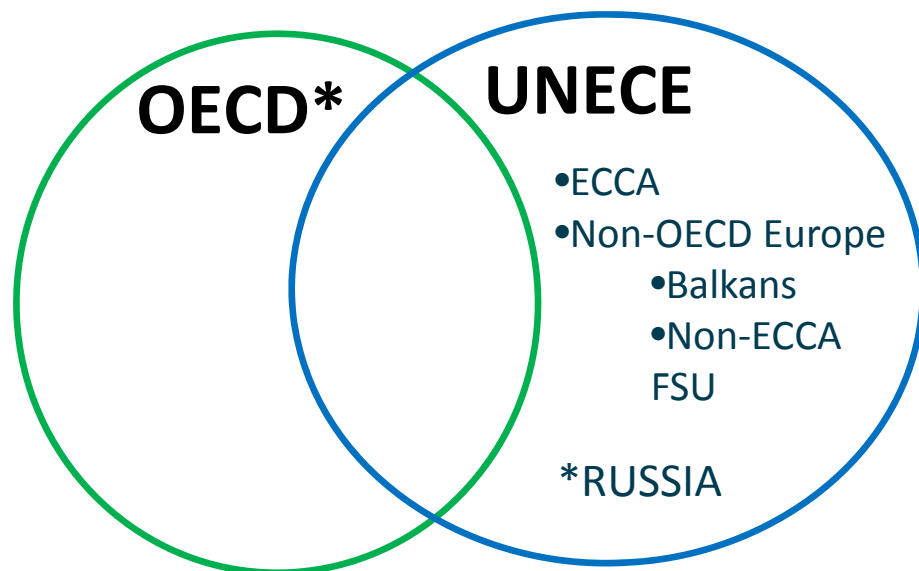


TOTAL PRIMARY ENERGY SUPPLY 2009

Energy from “Waste”s is likely higher than the definition of waste within energy statistics



Geographical Coverage of Questionnaire Use



| COUNTRY | QUESTIONNAIRE |
|----------------------|---------------|
| ALBANIA | |
| LATVIA | X |
| BELARUS | X |
| BOSNIA & HERZEGOVINA | |
| BULGARIA | X |
| ROMANIA | X |
| ARMENIA | X |
| AZERBAIJAN | X |
| MOLDOVA | X |
| CROATIA | X |
| MALTA | X |
| LITHUANIA | X |
| MONTENEGRO | X |
| FYROM | X |
| CYPRUS | X |
| SERBIA | X |
| GEORGIA | X |
| KAZAKHSTAN | |
| KYRGYZSTAN | X* |
| TAJIKISTAN | |
| TURKMENISTAN | |
| UKRAINE | X |
| UZBEKISTAN | X* |

Regional On-Going Challenges (#1)

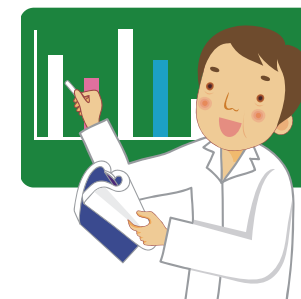
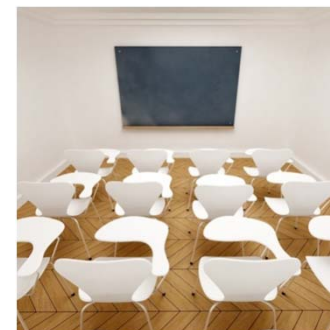
- **Communication – maintaining contacts is difficult**
 - No contact for Tajikistan, Turkmenistan, Uzbekistan
 - Language barriers (Energy balances provided in Russian)
 - FSU statistical system used, difficulties to disaggregate and match to international (IEA, EU, etc.) systems
 - Some consumption is not for energy use
 - Russia & Ukraine – difficulties to determine the breakdown of electricity and heat from combustible fuels
 - Energy balances provided in Russian (units in mtce)
- **Uncovered Regions**
 - Autonomous regions leads to fragmentation in coverage

Regional On-Going Challenges (#2)

- **Need for expertise**
- **Need for resources**
 - Lack of staff, funds, computer resources
- **Problems obtaining data**
 - Lack of legislation, claims of data confidentiality,
- **Problems collecting non-commercial data (e.g. solid biomass)**
 - Too many individuals to survey, lack of credible extrapolation methods from survey data, market is too volatile

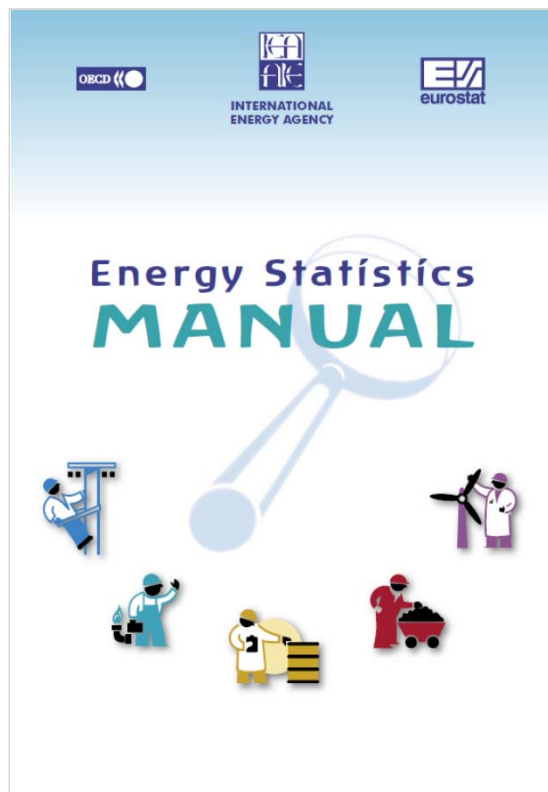
Training and capacity-building

1. Two Annual trainings per year at the IEA (March and October)
2. Centralised Training – Balkans countries
3. Consulting Training – INOGATE – ECCA countries
4. One – to – one
 - Ukraine statisticians came to Paris, 2011
 - IEA held a training session for Russia, 2012



Manuals

The Joint IEA/Eurostat Energy Statistics Manual



The Manual is now available in 10 languages and widely used all around the world



Efforts to Build Capacity and Expertise

Harmonisation among international organisations:



Agreement on harmonised definitions (including Renewables and Waste) reached at the end of 2010 after 5 years of collaboration

International Recommendations for Energy Statistics (IRES)

The IRES Manual (UNSD and Oslo City Group)
(in cooperation with the IEA and many organisations and countries)

UN Statistics
Commission decided
to use InterEnerStat
definitions as the basis
for IRES

| International Recommendations for Energy Statistics | |
|---|----|
| List of Abbreviations and Acronyms | v |
| Chapter 1. Introduction | 1 |
| A. Background | 1 |
| B. Purpose of the international recommendations for energy statistics | 3 |
| C. Users and uses of energy statistics | 7 |
| D. Revision process and IRES content | 8 |
| E. Implementations and revision policy | 12 |
| Chapter 2. Scope of energy statistics | 14 |
| A. Energy and energy statistics | 14 |
| B. Basic concepts and boundary issues | 17 |
| Chapter 3. Standard International Energy Classification | 19 |
| A. Introduction | 19 |
| B. Purpose and scope of the SIEC | 20 |
| C. Classification criteria and coding system | 23 |
| D. Definitions of energy products | 27 |
| 1. Solid fossil fuels and derived products | 27 |
| 2. Natural gas, oil and derived products | 30 |
| 3. Nuclear fuels | 35 |
| 4. Biofuels and waste | 35 |
| 5. Electricity | 37 |
| 6. Heat | 38 |
| Chapter 4. Measurement units and conversion factors | 39 |
| A. Introduction | 39 |
| B. Measurement units | 40 |
| 1. Original units | 40 |
| 2. Common units | 44 |
| C. Calorific values | 44 |
| 1. Gross and net calorific heating values | 45 |
| 2. Default to specific calorific values | 45 |
| 3. How to calculate average calorific values | 46 |
| 4. Default calorific values | 47 |
| D. Recommendations | 55 |
| Chapter 5. Energy Flows | 58 |
| A. Introduction | 58 |
| B. Concept of energy flows | 58 |
| C. Definitions of main energy flows | 60 |
| D. Energy subtotals | 62 |
| 1. Electricity and heat | 65 |
| 2. Transformation processes | 67 |

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THANK YOU

RenewAQ@iea.org

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