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# Energy Balances to Accounts

## 10-12 December 2024, Ankara, Türkiye

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# Outline

- Overall links, similarities and differences
- Going from energy balances to energy accounts
- Terminology



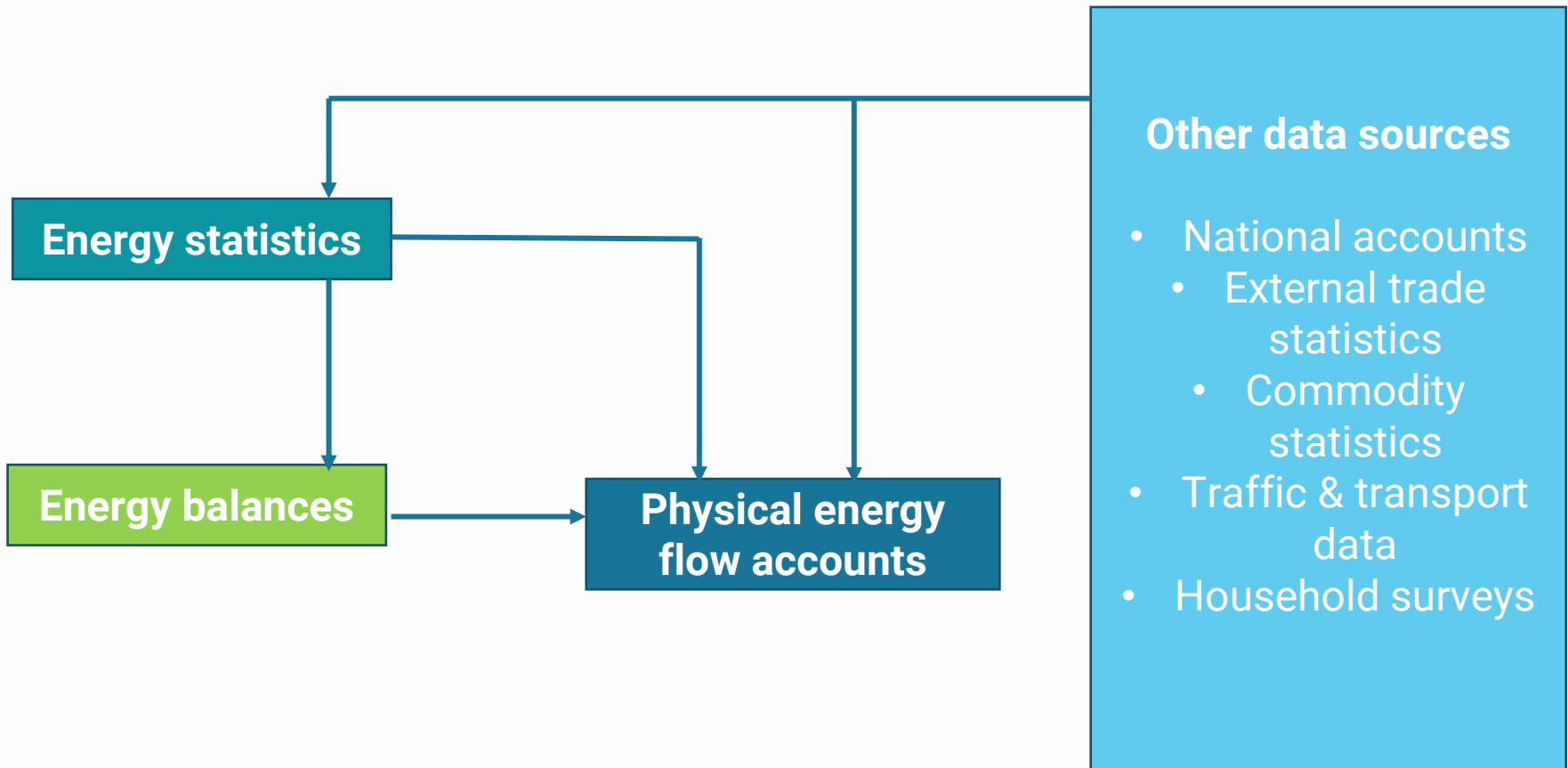
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# LINKS, SIMILARITIES, DIFFERENCES



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# Energy statistics, balances and accounts



# Physical energy flow accounts in context

- Energy statistics and balances provide a wealth of information
  - > SEEA uses the IRES definition of an energy product
  - > SEEA accounts can be compiled using the SIEC classification
- Both measure energy production, consumption, transformation
- But accounts differ from balances in important ways
  - > Energy balances have a focus on the transformation sector; accounts provide an economic perspective of energy supply/use
  - > Different concepts and classifications due to coherence of the accounts with the System of National Accounts (e.g. ISIC—International Standard Industrial Classification of All Economic Activities)

# Main differences between energy balances and accounts

Energy balances	Energy accounts
Physical	Physical and monetary
Based on energy statistics	Based on energy statistics and balances
Territory principle	Residence principle
Various formats (IEA, Eurostat, UN)	Uses national accounts supply and use table format
Re-arrangement of industries' energy use according to purpose (transport, auto-producers, heat for sale)	No re-arrangement of industries' energy use
Focus on energy sector, including description of technologies	Energy "sector" described by ISIC, no special focus on technologies
All transport in one sector	Own account transport included in industries' activities
International bunkers excluded from supply	International bunkers included in supply

# Residence vs. territory principle

	Residents	Non-residents	
National territory	Sold on territory to resident units	Sold on territory to non-residents (foreign tourists, transport companies, embassies)	Energy statistics and balances
Rest of the world	Sold to residents operating abroad (tourists, transport companies, etc.)		
	SEEA-Energy		

- In accordance with the System of National Accounts and SEEA-Central Framework, the scope of SEEA-Energy covers the economic activity of resident units
- Resident of a country = institutional unit with centre of economic interest in the economic territory of a country
- Resident units can operate inside or outside of the national territory
- Use of residence principle is in contrast to energy statistics and balances

# Residence vs. territory principle: an example

	Residents	Non-residents	
National territory	Sold on territory to resident units	Sold on territory to non-residents (foreign tourists, transport companies, embassies)	Energy statistics and balances
Rest of the world	Sold to residents operating abroad (tourists, transport companies, etc.)		
	SEEA-Energy		

- A resident of Türkiye drives to Iraq to visit a friend and re-fuels before they drive home.
  - SEEA: Fuel purchased is accounted for as an import in Türkiye's accounts
  - Energy statistics/balances: Fuel purchased is counted as energy consumption in Iraq's statistics and balances
- A resident of Iraq visits Türkiye on holiday
  - SEEA: Energy used by the resident of Iraq is counted as an export in Türkiye's accounts, and would be considered an import in Iraq's accounts
  - Energy statistics/balances: Energy used by the resident of Iraq is accounted for as energy consumption in Türkiye's statistics and balances



# Energy use by industries

- Generally recorded by ISIC
- Exceptions for energy industries and transport
- In accounts, energy use is always recorded by the industry using the energy
- Especially with regards to road transport, this usually means some adjustments

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**Final consumption****Final energy consumption****Manufacturing, const., mining****Transport**

Road

Domestic aviation

Domestic navigation

Other transport

**Other**

Agriculture, forestry, fishing

Commerce and public services

Households

Other consumers

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**Non-energy use**

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# Focus on technologies

- Energy statistics and balances have a focus on technologies, which energy accounts do not have
- Transformation in the accounts is simply recorded under the relevant ISIC category—no information on technologies beyond this is supplied
  - E.g. Main activity electricity plant and main activity producer CHP plant both under ISIC D

<b>Transformation</b>
Electricity plants
Charcoal plants
Other transformation
Energy industries own use
Losses

# Differences for international bunkers

- Key differences concerning international bunkers
  - International bunkers = Quantities of fuel delivered to ships/aircraft of any nationality for consumption during international voyages transporting goods or passengers
- Supply and international (aviation and marine) bunkers
  - Balances subtract international aviation and marine bunkers from supply
  - Supply in accounts includes fuel made available through international marine and aviation bunkers
- Imports/exports from bunkering
  - For the balances, the bunkering of fuel abroad by national ships/aircraft engaged in international travel is excluded from imports
  - For the accounts, this fuel is considered an import
  - Similar case for exports

# Differences for international bunkers

- Example:
  - Turkish Airlines fuels up in Istanbul for a flight to Cairo with 5 TJ of fuel
  - Once in Cairo, they re-fuel at the airport for the flight back to Türkiye with 4 TJ of fuel
- Balances:
  - International bunkers in Türkiye are included in production but then removed from energy supply
  - Not counted as consumption in the balances
  - Use of fuel in Cairo is not considered an import for the balances
- Accounts:
  - The 5 TJ of fuel bunkered in Istanbul is included in energy supply and then used by the aviation industry
  - Fuel delivery to Turkish in Cairo is counted as 4 TJ of imports to supply in accounts, which are used by aviation industry

	Accounts	Balances
Fuel bunkered in Istanbul by Turkish	5 TJ is part of supply	Not part of supply
Use of fuel bunkered in Istanbul by Turkish	End use of 5 TJ by ISIC H	Not part of final consumption
Use of fuel bunkered in Cairo by Turkish	Import to Türkiye of 4 TJ	Not considered an import or part of use

# Differences for international bunkers

- Example:
  - Turkish Airlines fuels up in Istanbul for a flight to Cairo.
  - Once in Cairo, they re-fuel at the airport for the flight back to Türkiye.
- Conversely, if EgyptAir bunkers 6 TJ of fuel in Istanbul, it is considered...
  - International bunkers in the *energy balances* of Türkiye BUT is excluded from total energy supply
  - Exports in the *energy accounts* of Türkiye
- When EgyptAir bunkers in its hometown of Cairo, it is outside the scope of both Türkiye's energy balance and energy account

	Accounts	Balances
Fuel bunkered in Istanbul by Turkish	Part of supply	Not part of supply
Use of fuel bunkered in Istanbul by Turkish	End use by ISIC H	Not part of final consumption
Use of fuel bunkered in Cairo by Turkish	Import to Türkiye	Not considered an import



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# GOING FROM BALANCES TO ACCOUNTS



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# Approaches

- Existing data need to be manipulated and re-arranged according to accounting principles of the System of National Accounts
- Two general approaches used:
  - > “Statistics/energy statistics first”
  - > “Energy balances first”
- Often, second approach is preferred

# Steps to get to the accounts

- Three broad steps:
- 1. Use supply of primary energy products in balances to arrive at natural inputs and supply/use of certain products in accounts
  - > Need to use some assumptions to approximate natural energy inputs (and losses during extraction)
- 2. Use transformation block of balances to record transformation of energy products in the accounts
  - > Often straightforward adjustments, but one needs to record transformation losses as residuals
- 3. Compile end use of energy products (end use in accounts = final consumption in balances)
  - > Some straightforward adjustments, some more complex adjustments
  - > Record related residuals, usually the identical energy amounts that have been end used
- Illustration of this process using three blocks of the UNSD simplified balance



# Total energy supply

Energy flow in balances	Target column in supply/use tables
Primary production (e.g. primary coal and peat, primary oil, natural gas, biofuels + waste, nuclear, electricity and heat)	<b>Supply:</b> Natural energy inputs supplied by environment <b>Use:</b> Extracting industries (e.g. ISIC A (agriculture, forestry and fishing; ISIC B (mining) etc)
Imports	<b>Supply:</b> Rest of world <b>Use:</b> N/A
Exports	<b>Supply:</b> N/A <b>Use:</b> Rest of world
International marine bunkers	<b>Supply:</b> ISIC C (manufacturing) <b>Use:</b> ISIC H (transportation)
International aviation bunkers	<b>Supply:</b> ISIC C (manufacturing) <b>Use:</b> ISIC H (transportation)
Stock changes	<b>Supply:</b> N/A <b>Use:</b> Accumulation



# Things to remember

- Balances do not include quantities lost through flaring and venting in primary production, but this is included in SEEA-Energy as part of natural inputs
  - > These natural inputs then flow back to the environment as residuals
- Imports and exports need to be adjusted for residence principle

# Transformation

Energy flow in balances	Target column in supply/use tables
Electricity plants	<b>Supply:</b> Various, depending on the input, but often ISIC B (mining) or ISIC C (manufacturing) <b>Use:</b> Transformation use by ISIC D (electricity/gas/steam/AC)
Charcoal plants	<b>Supply:</b> Often ISIC A (agriculture, forestry, fishing) <b>Use:</b> Transformation use likely by ISIC A or ISIC C (Manufacturing)
Other transformation	<b>Supply and use:</b> Various, depending on the product (e.g., ISIC B (mining) or ISIC C (manufacturing) etc) <b>Example:</b> Transformation in a coke oven = supply by mining industry (ISIC B) to be used by manufacturing industry (ISIC C)
Energy industries own use	<b>Supply and use:</b> ISIC B, C and ISIC D (electricity/gas/steam/AC)
Losses	<b>Supply:</b> Likely ISIC C (Manufacturing), ISIC D (electricity/gas/steam/AC) <b>Use:</b> Environment

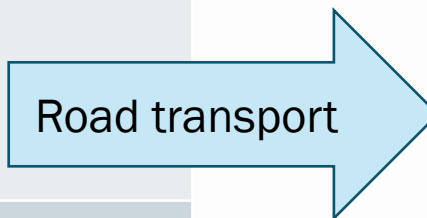


# Things to remember

- Auxiliary information is needed for autoproducers
  - > Autoproducers are not always represented in the transformation block of the balances—they may only part of final consumption
  - > Their transformation use needs to be allocated to the specific ISIC industry
- Example of recording transformation of 20 TJ crude into diesel:
  - > **Supply** of 20 TJ crude by mining industry (ISIC B)
  - > **Use** of 20 TJ crude by manufacturing (ISIC C) to produce diesel
  - > **Supply** of diesel by ISIC C
  - > **Supply** of any residuals (losses during transformation) by ISIC C
  - > **Use** of residuals by the environment

# Final consumption

Energy flow in balances	Target column in supply/use tables
<b>Manufacturing, construction, mining</b>	<b>Supply:</b> Depends on energy product <b>Use:</b> ISIC C, ISIC F, ISIC B, respectively
<b>Transport: Road</b>	<b>Supply:</b> Usually ISIC C (manufacturing) <b>Use:</b> Any ISIC!
<b>Transport: Domestic aviation</b>	<b>Supply:</b> ISIC C <b>Use:</b> ISIC H
<b>Transport: Domestic navigation</b>	<b>Supply:</b> ISIC C <b>Use:</b> ISIC H



# Final consumption, continued

Energy flow in balances	Target column in supply/use tables
<b>Agriculture, forestry, fishing</b>	<b>Supply:</b> Usually ISIC A (agriculture, forestry and fishing) or ISIC C <b>Use:</b> ISIC A
<b>Commerce and public services</b>	<b>Supply:</b> Usually ISIC C or ISIC D (electricity supply) <b>Use:</b> Several ISIC categories (e.g. ISIC I, J, K, L, ... to U)
<b>Households</b>	<b>Supply:</b> Usually ISIC A, ISIC C (manufacturing) or ISIC D <b>Use:</b> Households
<b>Other consumers, other transport</b>	<b>Supply:</b> Depends on energy product <b>Use:</b> Any ISIC!

# Things to remember

- In balances, those undertaking final consumption generally identified by ISIC, e.g. “Agriculture, forestry and fishing” → ISIC A
- Exceptions are for energy industries and transport, with allocation of road transport being the trickiest
- You can calculate a distribution key for road transport by industry using various data sources:
  - > Transport statistics
  - > National vehicle registers
  - > Detailed monetary use tables providing information on use of fuels per industry, etc.
- If available, a distribution key for a neighboring or similar country could be used

# Other differences

	Balances	Accounts
Imports/exports	Imports have a positive sign; exports a negative sign	Both imports (supply table) and exports (use table) have positive signs
Stocks/inventories	Stock build is negative; stock draw is positive	Stock (use table) build is positive; stock draw is negative
Statistical difference	Row for statistical difference	Having a column (or row) for statistical difference is not always the practice





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# Differences in terminology

- Supply
  - > In energy balances, supply is defined as
    - + *Primary energy production*
    - + *Imports of primary and secondary energy*
    - *Exports of primary and secondary energy*
    - *International (aviation and marine) bunkers - Stock changes*

i.e. energy entering into the national territory for the first time, less energy exiting the national territory and stock changes
  - > In the energy accounts the supply is defined as *production (output) + imports*
    - Slightly broader conception of supply – includes all energy available for use, **including fuel made available through international bunkers**

Bridge table for domestic supply and total supply (terajoules)

	Supply (energy balances)	+Losses during generation of secondary production	+International marine bunkers	Exports	Accumulation	Purchased by residents abroad	Supply (SEEA-Energy)
Coal	244.1			1.9	- 21.0		225
Peat and peat products							
Oil shale/oil sands							
Natural gas (extracted)	395						395
Natural gas (distributed)	166.1			201.0	2.0		369.1
Oil (e.g., conventional crude oil)	360			361.0			721
Oil (oil products)	996		44	80.0	- 3.0	160	1277
Biofuels	7						7
Waste	109.1			1.0	0.3		110.4
Electricity	134			100.0			234
Heat	78.5						78.5
Nuclear fuels and other fuels not elsewhere classified							

Note: Exports are removed before the calculation of net supply or availability in the energy balances and therefore need to be added back in.

# Differences in terminology

- Use
  - > Energy balances: *energy industries own use and final consumption*
  - > Energy accounts: *consumption by industries, households' final consumption, exports, international bunkers and inventory (stock) changes*

Bridge table for final consumption and end use of energy (terajoules)

	Final consumption (energy balances)	+International marine bunkers	Exports	Accumulation	Energy sectors use of energy for supporting activities	Purchased by residents abroad	End use (SEEA- Energy)
Coal	21.1		1.9	- 21.0			2
Peat and peat products							
Oil shale/oil sands							
Natural gas (extracted)							
Natural gas (distributed)	77.1		201.0	2.0	2.0		282.1
Oil (e.g., conventional crude oil)	930		361.0				1291
Oil (oil products)	44	44	80.0	- 3.0	6.0	160	331
Biofuels	7						7
Waste	78.1		1.0	0.3			79.4
Electricity	131		100.0		3.0		234
Heat	76.5				2.0		78.5
Nuclear fuels and other fuels not elsewhere classified							

# Differences in terminology



- **Final consumption**

- > Energy balances:   

- > Energy accounts:   

- Final consumption in balances is equivalent to **end use** in the accounts

- **Stocks and stock changes**

- > Energy balances:  

- > Energy accounts:   

- Inventories and changes in inventories is termed “**accumulation**” and is part of the use table.

# Conclusions

- Balances are a good starting point for compiling energy accounts
  - > Many 1:1 transformations
- But this indicates the importance of high-quality basic energy statistics!
- Important to understand terminology of different stakeholders and users
- Start small, make improvements over time
  - > Many countries may start with energy balances, to arrive at accounts which do not have the desired industry disaggregation
  - > Make improvements over time, in collaboration with data providers



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# EXERCISE



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# Instructions

- Statisland would like to take the balances to accounts approach to create a physical energy flow account
- They have used the balance and gotten fairly far along, but they are missing some numbers in their tables.
- Can you help them fill in the yellow cells?
- Please note there are some assumptions to be made

# Assumptions

- Oil products in the country are a mix of gas oil, which goes into electricity production, and transport diesel
- Biofuels are produced by the sugar manufacturing industry
- End use (i.e. final consumption) by non-specified industries in the balance is assumed to be by manufacturing companies, as manufacturing is one of Statisland's largest industries
- According to Statisland's national accounts supply and use tables:
  - > 10% of transport diesel is purchased by the agricultural industry
  - > 10% is purchased by the mining industry
  - > The remainder is purchased by the transportation industry





**THANK YOU**

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