Methodologies, data sources and challenges related to indicators on wastewater treatment (6.3.1), water use efficiency (6.4.1) and water stress (6.4.2)

Tier I and tier II indicators

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Indicators discussed in this presentation:

- 6.3.1: Proportion of wastewater safely treated (tier II)
- 6.4.1: Change in water-use efficiency over time (tier II)
- 6.4.2: Level of water stress: freshwater withdrawal as a proportion of available freshwater resources (tier I)
Proportion of wastewater safely treated
SDG Indicator 6.3.1
6.3.1: Proportion of wastewater safely treated

**Policy context**

**SDG Target 6.3:** By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.

**Custodian agencies:**

- World Health Organization (WHO)
- United Nations Human Settlements Programme (UN-HABITAT)
6.3.1: Proportion of wastewater safely treated

Indicator definition

Definition:
Proportion of wastewater generated by households and by economic activities which is safely treated compared to total wastewater generated by households and economic activities.

What means safely treated?
• International norms and standards exist, but countries can set their own standards
• Examples for safely treated wastewater:
  • Treatment performance meets national targets
  • Secondary treatment or higher, or primary treatment with a long ocean outfall

Disaggregation: households/non-households and by ISIC
Only 59% of domestic wastewater flow is collected and safely treated. The untreated 41% poses risks to the environment and public health (WHO and UN-Habitat, 2018).

Source: UN Water, World Health Organization (WHO) and UN-Habitat 2010
Tier II; Custodian agency: World Health Organization (WHO) and UN-Habitat
6.3.1: Proportion of wastewater safely treated


In 22 of the 79 countries with data, percentage of safely treated wastewater flows from households is 50% or less

Map 1: Preliminary estimate for domestic wastewater treatment (6.3.1a)
6.3.1: Proportion of wastewater safely treated

Data availability on domestic wastewater treatment

Map 2: Countries for which preliminary estimates for 6.3.1a are derived from performance data

More than a third of the wastewater treatment data collected is performance-based

Source: United Nations, 2018
6.3.1: Proportion of wastewater safely treated

Safely treated industrial wastewater flows

Estimating industrial wastewater treatment is more challenging than estimating domestic wastewater treatment. Global data on industrial discharges are poorly monitored and seldom aggregated at the national level.
6.3.1: Proportion of wastewater safely treated

Treatment types (technology based)


Figure 6: Description of treatment types

Combination of several tertiary treatments

- Advanced oxidation
- Membrane filtration
- Carbon adsorption
- Ion exchange
- Chemical oxidation
- Advanced N/P removal
- Disinfection (e.g. chlorination, UV)

Sludges
- As per treatment of excreta from on-site systems

Aerobic suspended or attached growth (e.g. AS or trickling filters)
- Anaerobic suspended or attached growth (e.g. UASB)
- Waste stabilization ponds
- Wetlands

Sludges
- As per treatment of excreta from on-site systems

Screening and grit removal with:
- Sedimentation
- Chemical precipitation
- Filtration
- High-rate clarification
- Flootation

Sewage treatment

- Advanced treatment
- Tertiary treatment
- Secondary treatment
- Primary treatment
- No treatment

Excreta from on-site facilities

- Treatment of solid and liquid fraction
- Dewatering and/or stabilization of solid fraction and treatment of liquid fraction
- Solid-liquid fraction separation
- No treatment

On-site sanitation technologies

1. Of wastewater and treatment of sludge

Solid fraction
- Co-composting
- Incineration
- Lime stabilization
- Ammonia treatment
- Liquid fraction
- As per treatment for excreta from piped sewers

Solid fraction only
- Anaerobic reactors
- Chemical conditioning
- Mechanical dewatering
- Safe burial or storage (e.g. deep-throw entrenchment)
- Liquid fraction
- As per treatment for excreta from piped sewers

- Thickening/settling tanks or ponds

- Storage/partial treatment
6.3.1: Proportion of wastewater safely treated
Treatment types (performance based)
(Joint OECD/UNECE Questionnaire on Inland Waters)

### TREATMENT PLANTS CLASSIFICATION

<table>
<thead>
<tr>
<th>Category</th>
<th>Treatment efficiencies</th>
<th>Count Faecal Coliforms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TSS</td>
<td>BOD</td>
</tr>
<tr>
<td>Primary treatment</td>
<td>&gt;50%</td>
<td>&gt;20%</td>
</tr>
<tr>
<td>Secondary treatment</td>
<td></td>
<td>&gt;70%</td>
</tr>
<tr>
<td>Tertiary treatment:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Of which for Organic Pollution</td>
<td>&gt;95%</td>
<td>&gt;85%</td>
</tr>
<tr>
<td>Of which for Nitrogen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Of which for Phosphorous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Of which for Microbiological pollution</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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**Primary treatment:** Septic tank

**At least secondary treatment (\(^*\)):**
- Systems using filtration:
  - Filtration bed
  - Biological sand filter
  - Infiltration field (vertical flow)
  - Rootzone system (horizontal flow)

**Mini biological treatment plants:**
- Biorotor
- Submerged bed
- Trickling filter
- Activated sludge system
- Anaerobic treatment systems

**Remarks:**
- \(^*\) In many cases the listed treatment methods require pre-settling in a septic tank.
6.3.1: Proportion of wastewater safely treated

Data sources

Water statistics, such as used for:

• UNSD/UNEP questionnaire on Environment Statistics:
• OECD/Eurostat Joint Questionnaire on Inland Waters
• Shared Environmental Information System (SEIS) and UNECE Guidelines for the Application of Environmental Indicators
6.3.1: Proportion of wastewater safely treated
Calculation of the indicator

\[
domestic \text{ wastewater treated} + industrial \text{ wastewater treated} = \frac{\text{wastewater generated}}{}
\]

Remarks:
• Wastewater treated Includes on-site and off-site treatment
• SDG metadata use the term “domestic wastewater”, international questionnaires use the term “urban wastewater”

Step by step calculation guide:
6.3.1: Proportion of wastewater safely treated

Wastewater data in the Eurostat/OECD Joint Questionnaire on Inland waters
Change in water use efficiency over time

SDG Indicator 6.4.1
6.4.1: Change in water-use efficiency over time

Policy context

- **SDG Target 6.4:** By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity

**Custodian agency:**
- Food and Agriculture Organization of the United Nations (FAO)
6.4.1: Change in water-use efficiency over time

Rationale

- Providing information on the **efficiency** of the economic and social usage of water resources.

- Addresses specifically the target component “**substantially increase water-use efficiency across all sectors**”, by measuring the output per unit of water from productive uses of water as well as losses in municipal water use.

- Provides a measure of **overall water efficiency**.

- Provides **incentives to improve water use efficiency** through all sectors, highlighting those sectors where water use efficiency is lagging behind.
6.4.1: Change in water-use efficiency over time

Rationale

Agricultural sector is responsible for ca. 69% of all water used globally. (Wallace, 2000)

Proportion of total water withdrawn for agriculture (%)

Water use efficiency by region ((USD/m²), base year 2015)

- Central Asia and Southern Asia
- Asia and the Pacific
- Africa
- Sub-Saharan Africa
- Western Asia and Northern Africa
- Latin America and the Caribbean
- Eastern Asia and South-eastern Asia
- World
- Western Asia
- Oceania excluding Australia and New Zealand
- Northern America
- Australia and New Zealand
- Northern America and Europe
- Europe

Source: FAO and UN-Water 2018
Tier II; Custodian agency
6.4.1: Change in water-use efficiency over time

Calculation of the indicator

- Measures the relative change of Water Use Efficiency (WUE)
- WUE is defined as the value added of a given major sector divided by the volume of water used:
  - Agriculture; forestry; fishing (ISIC A)
  - Mining and quarrying; manufacturing; electricity, gas, steam and air conditioning supply; constructions (ISIC B, C, D and F) – “MIMEC”
  - All the service sectors (ISIC E and ISIC G-T)
- WUE is computed as the sum of the three sectors, weighted according to the proportion of water used by each sector over the total use.

Step by step methodology (UN WATER): see http://www.unwater.org/publications/step-step-methodology-monitoring-water-use-efficiency-6-4-1/
6.4.1: Change in water-use efficiency over time

Water use efficiency in irrigated agriculture

\[ A_{we} = \frac{GVA_a \times (1 - C_r)}{V_a} \]

Where:
- \( A_{we} \) = Irrigated agriculture water use efficiency [USD/m³]
- \( GVA_a \) = Gross value added by agriculture (excluding river and marine fisheries and forestry) [USD]
- \( C_r \) = Proportion of agricultural GVA produced by rainfed agriculture
- \( V_a \) = Volume of water used by the agricultural sector (including irrigation, livestock and aquaculture) [m³]

\( C_r \) can be calculated from the proportion of irrigated land on the total Arable land and Permanent crops (hereinafter “cultivated land”, as follows:

\[ C_r = \frac{1}{1 + \frac{A_i}{(1 - A_i) \times 0.375}} \]

Where:
- \( A_i \) = proportion of irrigated land on the total cultivated land, in decimals
- 0.375 = generic default ratio between rainfed and irrigated yields
6.4.1: Change in water-use efficiency over time

Water use efficiency of the MIMEC sectors

In formula:

\[ M_{we} = \frac{GVA_m}{V_m} \]

Where:

- \( M_{we} \) = Industrial water use efficiency [USD/m\(^3\)]
- \( GVA_m \) = Gross value added by MIMEC (including energy) [USD]
- \( V_m \) = Volume of water used by MIMEC (including energy) [m\(^3\)]

Remarks:

- Does not include water used for hydropower generation
- Includes losses for evaporation from artificial lakes used for hydropower production
6.4.1: Change in water-use efficiency over time

Water use efficiency of the service sectors

In formula:

\[ S_{we} = \frac{GVA_s}{V_s} \]

Where:

- \( S_{we} \) = Services water use efficiency [USD/m\(^3\)]
- \( GVA_s \) = Gross value added by services [USD]
- \( V_s \) = Volume of water used by the service sector [m\(^3\)]
6.4.1: Change in water-use efficiency over time

Data needs

- Annual quantity of water use for the 3 sectors
- Value added for each of the sectors.
- For the calculation of the GVA produced by irrigated agriculture additional statistics on the irrigated land, total arable land and permanent crops

Data sources:

- Eurostat/OECD Joint Questionnaire on Inland Waters
- Water accounts
- AQUASTAT
Level of water stress: freshwater withdrawal as a proportion of available freshwater resources

SDG Indicator 6.4.2
6.4.2 : Level of water stress: freshwater withdrawal as a proportion of available freshwater resources

• **SDG Target 6.4**: By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity

**Custodian agency:**

• Food and Agriculture Organization of the United Nations (FAO)
6.4.2 : Level of water stress: freshwater withdrawal as a proportion of available freshwater resources

Indicator definition

The ratio between total freshwater withdrawn by all major sectors and total renewable freshwater resources, after taking into account environmental water requirements.

Main sectors, as defined by ISIC standards, include agriculture; forestry and fishing; manufacturing; electricity industry; and services.

This indicator is also known as water withdrawal intensity.
6.4.2: Level of water stress: freshwater withdrawal as a proportion of available freshwater resources

Rationale

- Shows the degree to which water resources are being exploited to meet the country's water demand
- Indicates the likelihood of increasing competition and conflict between different water uses and users in a situation of increasing water scarcity
- Increased water stress, shown by an increase in the value of the indicator, has potentially negative effects on the sustainability of the natural resources and on economic development.
Level of water stress: freshwater withdrawal as a proportion of available freshwater resources

Rationale

Levels of water stress by country (%) (2000–2015)

The world’s average water stress level stands at almost 13 percent with more than 2 billion people living in countries experiencing high levels of water stress.
6.4.2 : Level of water stress: freshwater withdrawal as a proportion of available freshwater resources

Calculation of the indicator

- Ratio between total freshwater withdrawn (TWW) by all major sectors and total renewable freshwater resources (TRWR), after taking into account environmental water requirements (Env.):
  - Stress (%) = TWW / (TRWR - Env.) * 100

Disaggregation:
- By sector
- By hydrological unit

6.4.2: Level of water stress: freshwater withdrawal as a proportion of available freshwater resources

Data needs

- Total freshwater withdrawn (abstracted) per year
- Total renewable freshwater resources: long-term annual average (LTAA): Sum of internal and external renewable water resources: Precipitation – actual evapotranspiration + external inflow
- Environmental water requirements

Remarks

- Industrial water withdrawal does not include hydropower, but it is recommended to include in this sector the losses for evaporation from artificial lakes used for hydropower production
- Cooling water is included in the total freshwater abstracted
- Environmental water requirements: FAO launched “Guidelines for a minimum methodological standard for global reporting” on how to incorporate environmental flows into “water stress” indicator 6.4.2. in January 2019 (see webcast http://www.unwater.org/environmental-flows-in-the-indicator-6-4-2/)
Thank you very much for your attention!

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