ECAM 2.0
Energy Performance and Carbon Emissions Assessment and Monitoring Tool
The Energy Performance and Carbon Emissions Assessment and Monitoring Tool (ECAM), enables utilities to quantify their Greenhouse Gas emissions and contributions to Nationally Determined Contributions and offers solutions for reducing emissions from energy use and wastewater management.

Limiting climate change to 1.5°C requires substantial reductions in Greenhouse Gas (GHG) emissions in all sectors. The urban water sector has under-recognized opportunities to reduce carbon emissions, mitigate climate change and contribute to the successful implementation of the Paris Agreement by accounting for the Nationally Determined Contributions (NDCs) of supporting countries.

Global demand for water will increase by 55% by 2050, while water availability will decrease by 40%. While the water sector has to cope with the impacts of climate change, it also contributes 3-5% of global CO₂ emissions as well as methane and nitrous oxide emissions from wastewater. If appropriate measures are not implemented in the sector, emissions could increase by at least 50% by 2050.

Carbon reduction measures can be achieved by working with utilities in emerging economies, where emissions are the highest due to a large portion of treated or poorly treated sewage, as well as poorly managed sewage sludge.

ECAM was developed to be consistent with the Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories and peer-reviewed literature. It offers a transparent and sound approach for emission calculation within the water sector. ECAM helps link Monitoring, Reporting and Verification of mitigation actions in the water sector to the national level.
The ECAM tool is the first of its kind. It follows an holistic approach to the urban water cycle to drive GHG emission reduction in utilities, even those with limited data availability.

**What ECAM offers for water and wastewater utilities:**

- **ECAM** is a tool for GHG reduction.
- **ECAM** is a tool to assess carbon footprint, energy consumption and service levels.
- **ECAM** is a tool to reduce operational costs.
- **ECAM** is a tool to strengthen performance monitoring and decision making.
- **ECAM** is a tool to develop scenarios on the future impact of GHG reduction measures.

**What ECAM offers for the water sector:**

- **ECAM** is a tool for monitoring, reporting and verifying the water sector’s GHG reduction contribution to the NDCs.
- **ECAM** only requires data typically available in utilities of developing and emerging economies.
- **ECAM** facilitates national benchmarking and knowledge exchange between utilities.
OVERVIEW OF ECAM ELEMENTS

ECAM follows a tiered approach with an increasing level of detail from Tier A to Tier B. Tier A can be used with limited data inputs for an initial assessment, Tier B with detailed data for each stage of the urban water cycle for a more accurate assessment.

Assessment Options

General Information
Enter the assessment period, file name, currency and if desired, make comments. The specified assessment period will affect the results that are stated per annum.

Configuration
Activate the elements of the urban water cycle that are going to be assessed. Selecting a country will set standard literature values for the grid emission factor, annual protein consumption and BOD, loads per person. Different global warming potentials for CH₄ and N₂O can be selected by choosing the respective IPCC assessment report. Activating the option for fuel engines will add corresponding input fields in Tier A and Tier B.

Population
Set the numbers for resident population and serviced population; for the wastewater system, the connected population to the sewerage and the population with on-site treatment. Estimations of wastewater loadings and corresponding emissions are based on specified populations.

Initial Assessment
Use the Initial GHG Assessment (Tier A) when available data or time is limited. Tier A provides an overview of GHG emissions and energy consumption, using data readily known and accessible to utility managers and operators, and provides complementary basic assumptions.
**Tier B**

**Abstraction**
Insert the **energy consumed** and, if available, the **volume of abstracted water**. Assessments of pump efficiency, energy production and GHG reduction potential with new pumps are optional.

**Treatment**
Specify the **energy consumed** and, if available, the **volume of treated water**. Pump efficiency evaluation is optional.

**Distribution**
Insert the **energy consumed** and, if available, the **volumes of water injected to the distribution system**, the **authorized consumption** and **billed metered consumption**. By providing a value for the different volumes of water, the fraction of water losses and non-revenue-water are calculated. Assessments of service performance, topographic energy, pump efficiency and new pumps are optional.

**Collection**
Enter the **energy consumed** and **volume of wastewater conveyed**. If desired, the predefined country-specific values for BOD₅ loads and annual **protein consumption** per person can be modified. Water efficiency, pumping efficiency and new pumps assessment is optional.

**Discharge / Reuse**
Specify the **volume of discharged wastewater**, **energy consumed**, the **treatment technology** and BOD₅ **influent** and **effluent loads**. If desired the estimated value for BOD₅ removed as sludge can be adapted. Assessment of treatment performance, pump efficiency, biogas production and valorization and sludge management is optional.

**Greenhouse Gas Summary**
See the **total emissions** and how they are distributed across the water and wastewater system and the different stages. Understand what the sources of emissions are and what their relative contribution is with the graphs. Identify to what UNFCCC (United Nations Framework Convention on Climate Change) category the emissions are attributed.

**Energy Summary**
View where and how much **energy** is **consumed across the stages**, water and wastewater system and in total. If substages are assessed, their relative energy consumption can be seen.

**Opportunities**
Get an overview of the **potentials** and **opportunities** to reduce GHGs. The potentials are based on the proceeding assessment.
Tier A is an Initial GHG Assessment that helps utilities to understand their overall energy usage and total GHG emissions at system-wide level (portable water and wastewater). Tier A uses a number of assumptions that allows the user to reduce the amount of data inputs.

Main Assumptions in Tier A
- Influent and effluent BOD₅ loads
- Mass of BOD₅ removed as sludge
- CH₄ emission factor of technology
- Mass of sludge produced
- Volume of produced biogas
- Volume of valorized biogas
- Dry weight of sludge disposed
- Temperature in fluidized bed reactor (only for sludge incineration)

Tier B is a Detailed GHG Assessment looking at energy use and GHG emissions at the individual stage level of the urban water cycle (i.e. abstraction, drinking water treatment, distribution, collection, wastewater treatment, wastewater discharge), providing a more thorough assessment.

Advanced Assessment in Tier B
Tier B allows the user to display additional input fields that can be optionally used for an advanced assessment. Depending on the stage, this advanced assessment includes pumping performance, the use of topographic energy, water efficiency, sludge management, treatment performance, biogas production and more.

In Tier B you will find pre-filled input fields with values based on the assumptions from Tier A. Values can be edited if more accurate data is available.
WHAT DATA IS REQUIRED? WHAT CAN BE EXPECTED?

BENEFITS OF ECAM AT A GLANCE

- GHG & Energy Assessment
- Holistic Approach
- Free & Open-Source
- Monitoring
- Opportunities to improve Service
HOW TO FILL IN DATA?

**ECAM Navigation Bar**

Navigate through ECAM by clicking on the icons.

**Setup and Configuration of Data**

- **Inputs:** Enter values from your system
  - **Water supply:**
    - Energy consumed from the grid: 15,000,000 kWh
    - Volume of water injected to distribution: 9,000,000 m³
    - Volume of authorized consumption: 5,200,000 m³
    - Volume of billed metered consumption: 4,300,000 m³
    - Running costs: 7,000,000 USD
    - Energy costs: 5,500,000 USD
  - **Wastewater:**
    - Energy consumed from the grid: 9,000,000 kWh
    - Volume of treated wastewater: 2,000,000 m³
    - Volume of discharged wastewater to water body: 2,000,000 m³
    - Running costs: 2,000,000 USD
    - Energy costs: 0 USD
    - Average Total Nitrogen at discharge: 0 mg/L
- **Are you producing biogas?**
  - No
  - Yes
- **Are you valorizing biogas?**
  - No
  - Yes

**Advanced Assessment**

- Do you want to evaluate treatment performance?
  - No
  - Yes
- Do you want to evaluate pump efficiency?
  - No
  - Yes
- Are you producing biogas from anaerobic digestion?
  - No
  - Yes
- Are you valorizing biogas?
  - No
  - Yes
- Evaluate sludge management (SM)?
  - No
  - Yes
  - Evaluate sludge storage in WWTP?
    - No
    - Yes
  - Is sludge sent to composting?
    - No
    - Yes
  - Is sludge sent to incinerate?
    - No
    - Yes
  - Is sludge sent to land application?
    - No
    - Yes
  - Is sludge sent to landfilling?
    - No
    - Yes
  - Is sludge sent to stockpiling?
    - No
    - Yes
  - Do you truck transport sludge to disposal site?
    - No
    - Yes

Find self explanatory input fields, tick boxes and drop down selections in Tier A and Tier B to fill in data.

Use the advanced assessment questions to display additional input fields.

Add substages in order to separately assess different pumping stations, treatment facilities, etc.
## How are Results Presented?

### Greenhouse Gas Emissions

Sources of emissions and their distribution within the urban water cycle are shown graphically. The UNFCCC category to which the emissions are attributed is also displayed.

### Energy Consumption

Where and how much energy is consumed within the urban water cycle are displayed. The contribution of energy costs to total operational costs is indicated.

### Table: GHG Emissions

<table>
<thead>
<tr>
<th>System</th>
<th>Emissions (Kg CO₂ eq)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total GHG</td>
<td>15,000,000</td>
</tr>
<tr>
<td>Water supply (185,000 people)</td>
<td>8,500,000</td>
</tr>
<tr>
<td>Wastewater (90,000 people)</td>
<td>6,500,000</td>
</tr>
</tbody>
</table>

### Diagrams

- **GHG Emissions by System**
- **GHG Emissions by Stage**
- **GHG Emissions by Source**
- **GHG Emissions by UNFCCC Categories**
- **Energy Consumption by System**
- **Energy Consumption by Stage**
- **Energy Fraction of Operational Costs**

Note that benchmarking results and performance indicators are shown within Tier B in the advanced assessment.
Work Offline...
The ECAM source code can be downloaded. To run the tool offline, you need a web server programme. Find full instructions on the ECAM help page.

Opportunities...
ECAM allows you to see the greatest opportunities for reducing GHG emissions from various measures within the whole urban water cycle.

Understand Equations...
Click on a variable's code in Tier B to see its description, the formula to calculate it and the current value. Highlight relevant term input variables.

Export Your Data...
By going to the export page within ECAM, highlighting the desired tables and then copying them into a data spreadsheet.
MONITORING, REPORTING AND VERIFYING
CLIMATE MITIGATION IN THE WATER SECTOR

ECAM provides a transparent, holistic and consistent approach for monitoring, reporting and verifying mitigation (MRV) in the water sector, a prerequisite for accessing climate financing.

ECAM as a Tool for MRV
Methods to measure, report and verify information differ on the level of assessment and the objective. Sometimes a variety of methods is available; for building national inventories only IPCC Guidelines are accepted internationally.

ECAM can provide the methodology for MRV of GHG emissions in the water sector, since it is mainly based on IPCC Guidelines. ECAM supports developing a national GHG inventory and can also support a facility level GHG inventory.

ECAM TRAININGS MATERIAL

Materials for Trainers
- Trainer manual
- PowerPoint slides
- Solutions for exercises
- ECAM files for exercises
- Background information
- Agendas

Materials for Participants
- Participants manual
- ECAM files for exercises
- Agendas
- Feedback forms

Training Modules
1. Introduction
2. Setting the Scene
3. Roadmap
4. ECAM Tool
5. GHG Assessment
6. Energy Assessment
7. Sludge Management
8. Opportunities
9. Bringing it all together
10. Wrap-Up and Closure

FAQ - FREQUENTLY ASKED QUESTIONS

- Where can I find ECAM?
  ECAM is available via www.wacclim.org/ecam

- What is required to use ECAM?
  Only a web browser with an internet connection is needed. ECAM is optimised for Google Chrome, but most browsers based on Chromium work well. Offline use can also be set up.

- Do I need to register or pay in order to use ECAM?
  ECAM is a free tool and can be accessed by anybody without the need for registration.

- What happens with my data?
  The input and output data are only stored temporarily in your local browser cache. You can also save the data in a .json file on your hard disk.

- Where can I get more information?
  Detailed documentation can be found, including a methodology guide, on the ECAM help page.
ECAM was developed by the WaCCliM project which is part of the International Climate Initiative (IKI). The German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) supports this initiative on the basis of a decision adopted by the German Bundestag.