GREEN OPEN DATA

LS1: KNIME Analytics Platform for Material Flow Cost Account (MFCA)

MAHLER CHOU
mahler@greenopendata.org

WORKSHOP GOALS

To understand the use of KNIME® and use it to do the MFCA calculation.

Material Flow Cost Accounting

KNIME

Green Open Data

*Image credits: https://pngtree.com/legal/license-terms

WORKSHOP LINEUP

A quick understanding of MFCA and hands-on practice of KNIME.

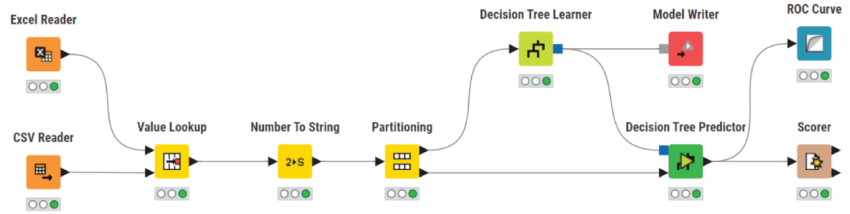
In this workshop, we will first understand the basic concepts of MFCA, and then teach how to use the KNIME tool software. Finally, there is a practical case analysis for practice.

- MFCA Fundamental
- KNIME Analytics Platform for beginner
- Case Study: TS Stainless-steel corporation
- Discussion

Approximate Time: 90 minutes.

Open for Innovation
KNIME

DATA SCIENCE • LOW CODE • FREE • OPEN SOURCE



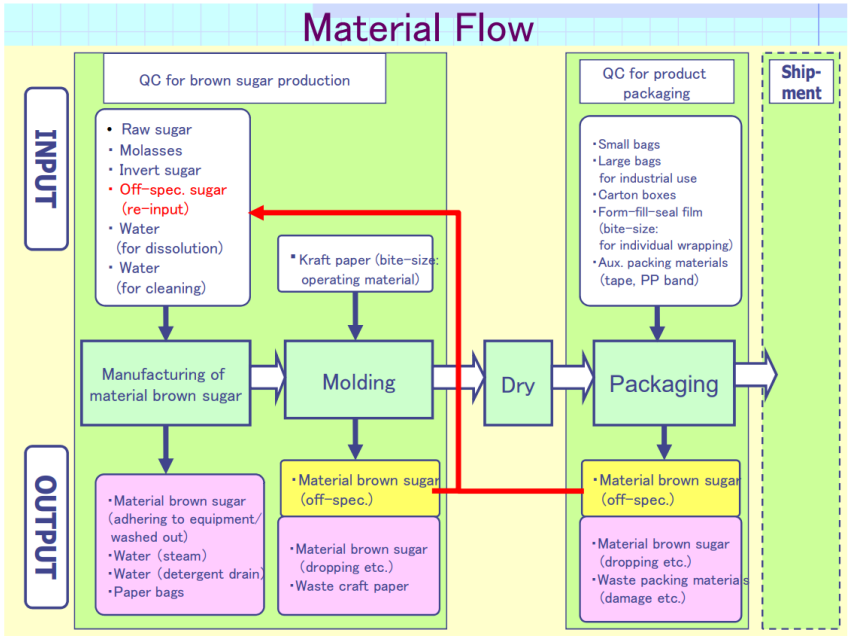
Green Open Data

MFCA FUNDAMENTAL

A quick and short explanation of what MFCA is and what it is used for.

Material Flow Cost Accounting (MFCA) is a management tool that aims to assist organizations in enhancing their material and energy efficiency. It achieves this by examining the physical material flows within a company or supply chain and identifying the associated costs.

- Focus on Material Loss in production.
- Economic Benefit, i.e., save costs.
- Reduce waste, energy, and lower GHG emissions.
- MFCA is ISO 14051 standard.



*MFCA Case Examples 2011.

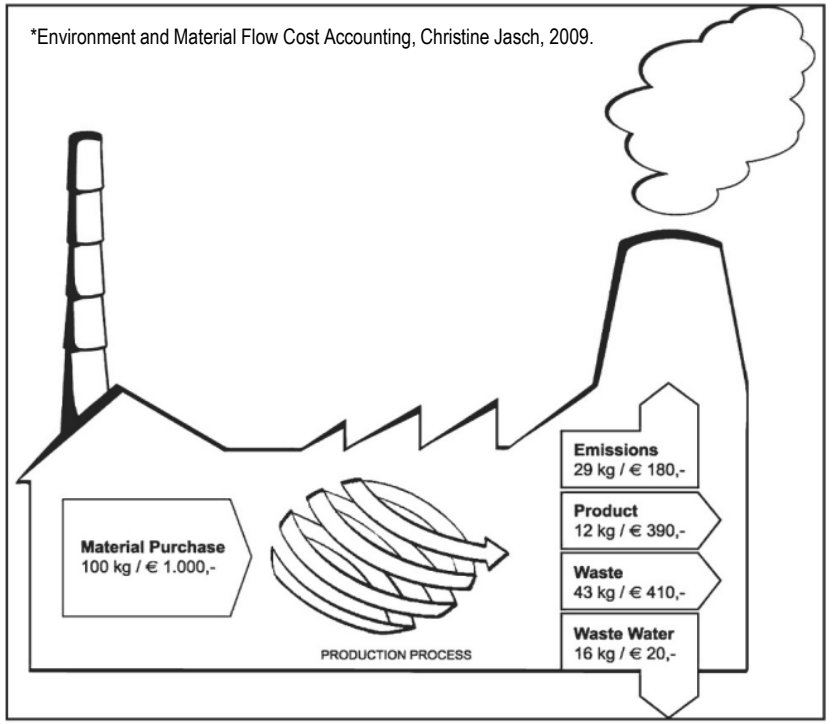
Green Open Data

MFCA QUANTITY CENTER

The quantity center is the central concept of the MFCA calculation process.

A “Quantity Center” is often used in Material Flow Cost Accounting (MFCA) to refer to specific areas or processes within a company where material quantities are measured and analyzed. These centers help track the flow of materials and identify inefficiencies or losses. Here are the primary cost elements in MFCA:

1. **Material Costs:** Costs associated with the purchase and use of raw materials.
2. **System Costs**: Costs related to the operation and maintenance of systems that process materials, including energy, labor, and equipment costs.
3. **Waste Management Costs**: Costs incurred from handling, treating, and disposing waste materials.
4. **Energy Costs**: Costs for the energy required to process materials and run equipment.
5. **Material Loss Costs**: Costs associated with material losses during production, such as scrap, emissions, and defective products.



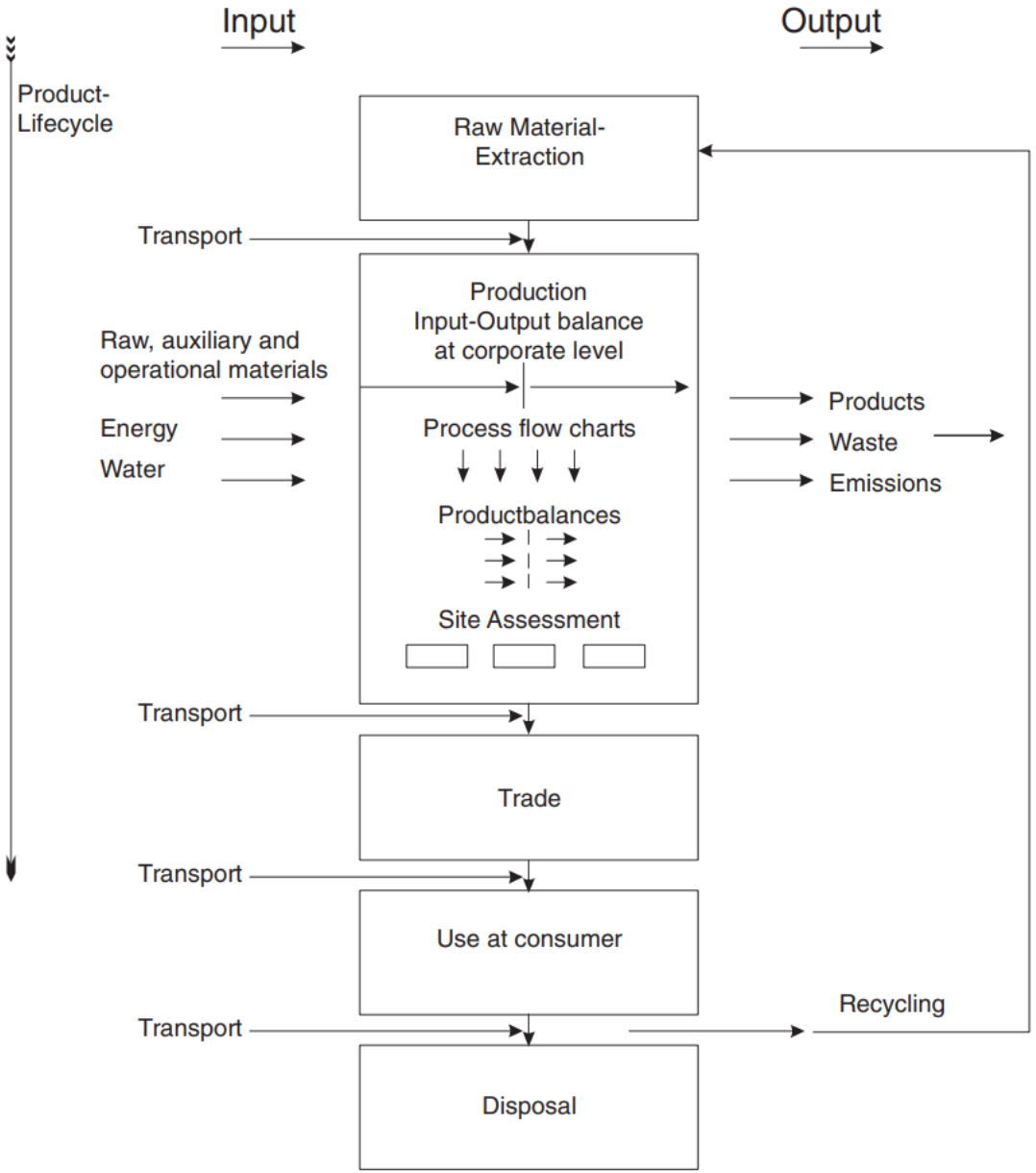
Green Open Data

PRODUCTION LIFE CYCLE

The manufacturing process life cycle of products.

The manufacturing process of a product can be divided into different stages input, operation, and output.

1. **Input:** Resources such as raw materials, energy, manpower, or equipment required for production.
2. **Operation**: The operation will process raw materials through operators or automatic or semi-automatic equipment.
3. **Output**: After production, there will be finished products - good products, defective products, semi-finished products and waste.



*Environment and Material Flow Cost Accounting, Christine Jasch, 2009.

Green Open Data

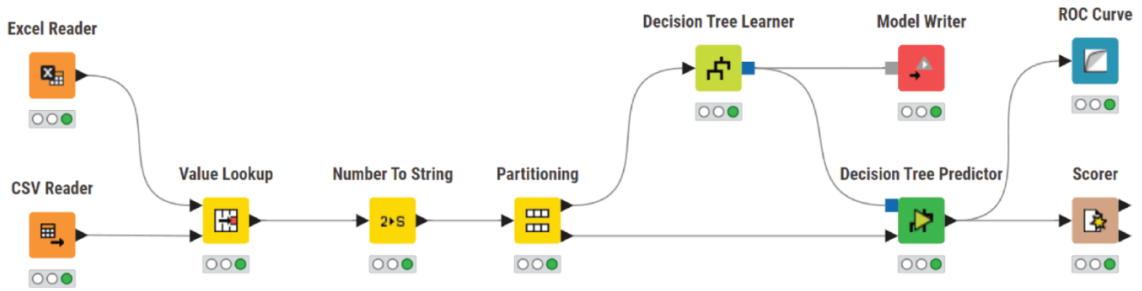
KNIME ANALYTICS PLATFORM

The key features of open source data science tools.

KNIME, known as **Konstanz Information Miner**, is an open-source data analytics platform. It is designed for data integration, preprocessing, analysis, and visualization. KNIME allows users to create data workflows using a drag-and-drop interface, making it accessible to both data scientists and non-technical users

Open for Innovation
KNIME

DATA SCIENCE • LOW CODE • FREE • OPEN SOURCE



KNIME Website:

https://www.knime.com/

Green Open Data

*Image credits: https://pngtree.com/legal/license-terms

DOWNLOAD KNIME 5.3

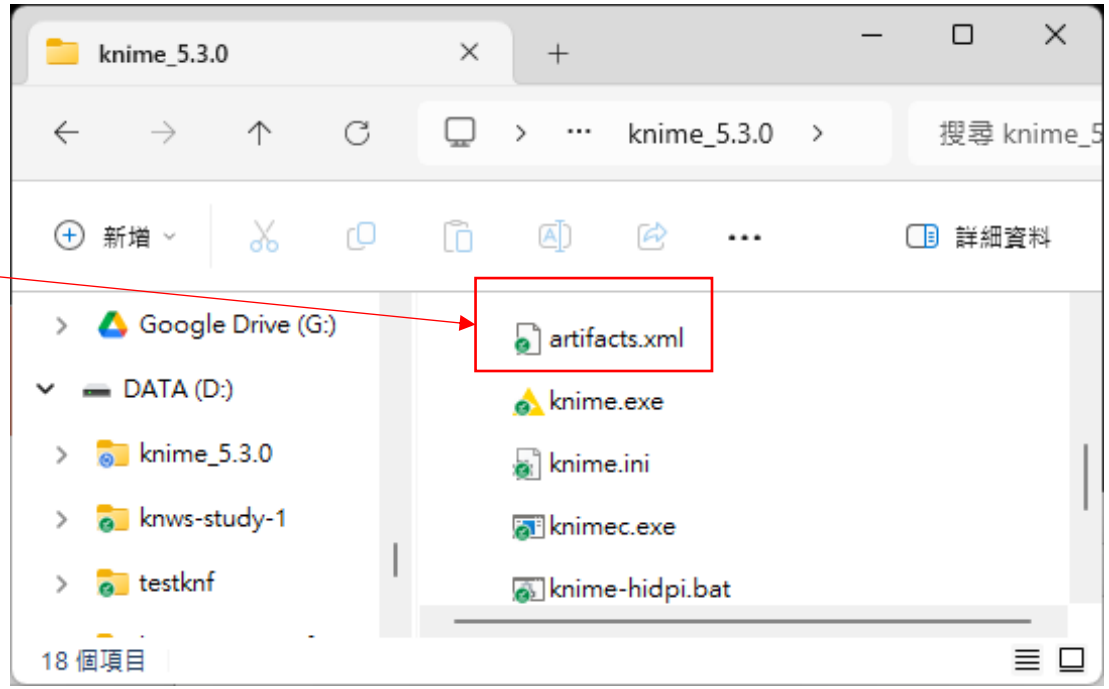
Install and running your first data analytics tool.

For Today's Workshop

- Download https://t.ly/v5zks
- Unzip *knime_5.3.0_mfca.zip*
- *Click "knime.exe" to start KNIME*

For General Use

- Go to KNIME website https://www.knime.com/downloads

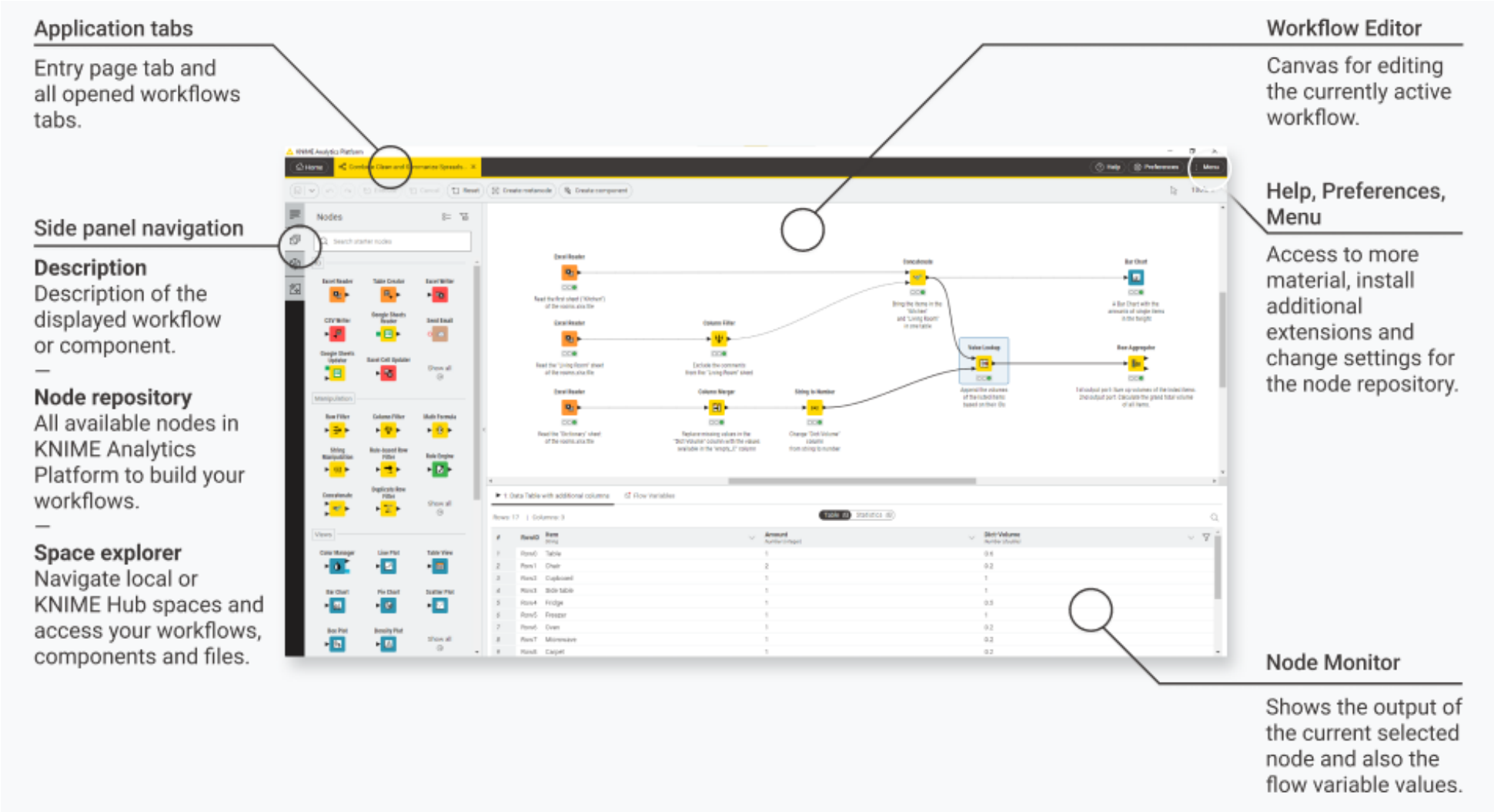


Green Open Data

*Image credits: https://pngtree.com/legal/license-terms

GETTING STARTED

First look of KNIME analytics platform



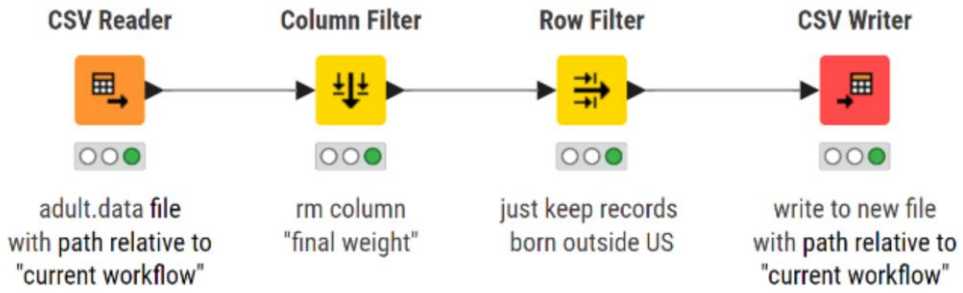
*credits: https://docs.knime.com/latest/analytics_platform_best_practices_guide/index.html#_what_is_knime_software

Green Open Data

YOUR FIRST KNIME WORKFLOW

What is a Workflow?

A KNIME workflow is a visual representation of a data analysis process. It consists of interconnected nodes representing a specific task, such as data reading, transformation, analysis, or visualization. These nodes are linked together to form a sequence of operations that process data step-by-step.



1. **Drag and Drop Nodes**: Select nodes from the node repository and drag them onto the workflow editor.
2. **Connect Nodes**: Link the nodes to define the data flow between them.
3. **Configure Nodes**: Double-click on each node to configure its settings, such as specifying the data source or transformation parameters.
4. **Execute Workflow**: Run the workflow by clicking the execute button, either for the entire workflow or node-by-node.

KNIME NODE STATES

What is a Workflow?

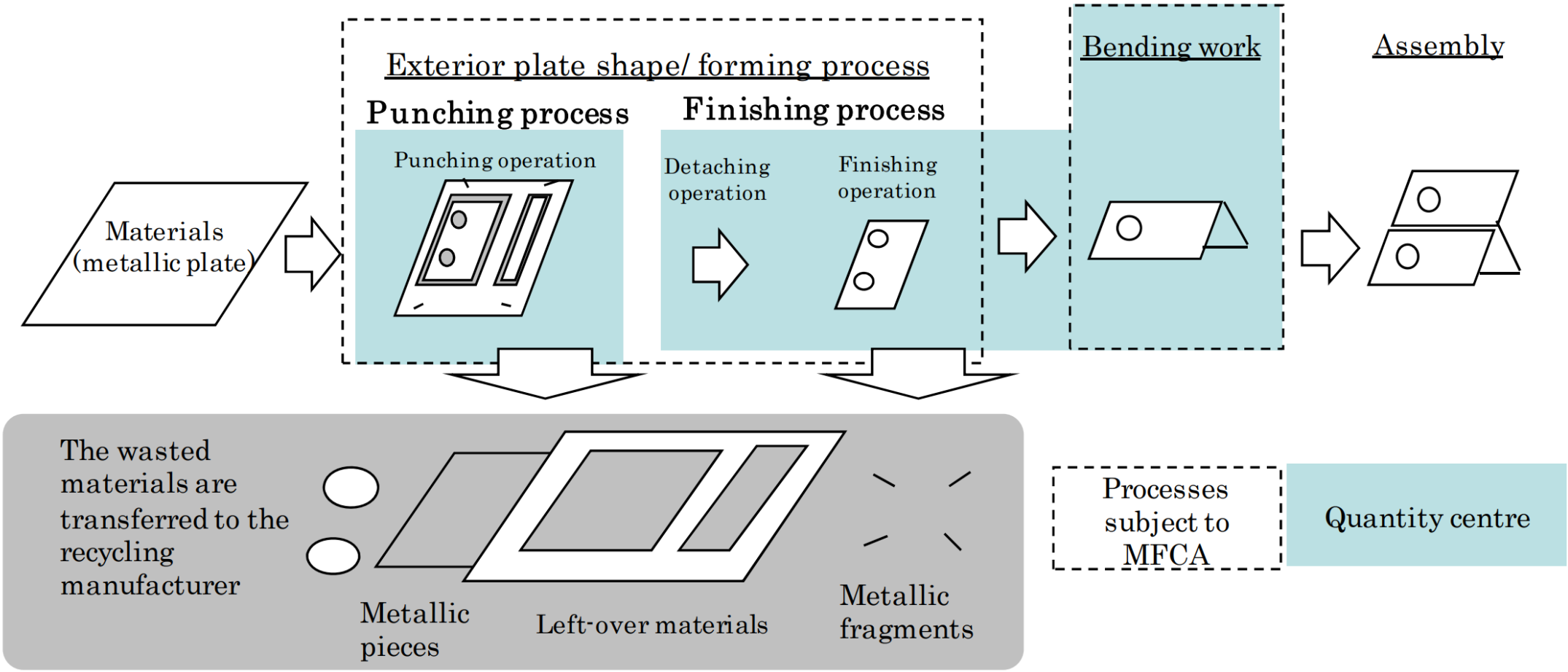
Every node in KNIME has 4 states:

1. **Inactive and not yet configured** → **red** light
2. **Configured but not yet executed** → **yellow** light
3. **Executed successfully** → **green** light
4. **Executed with errors** → **red with cross** light

Green Open Data

CASE STUDY – TS CORPORATION

TS Corporation is a stainless-steel manufacturer.



*Source: MFCA Case Examples 2011.

Green Open Data

CASE STUDY – TS CORPORATION

The punching process has a metallic plate input to be pressed and detached as production output.

INPUT →

Stainless steel plate, 2000 kgs.

$3.15 per kg

PUNCHING PROCESS

Energy, Staff, Equipment costs

OUTPUT →

Semi-finished products 1350(50) kgs.

$??? per kg

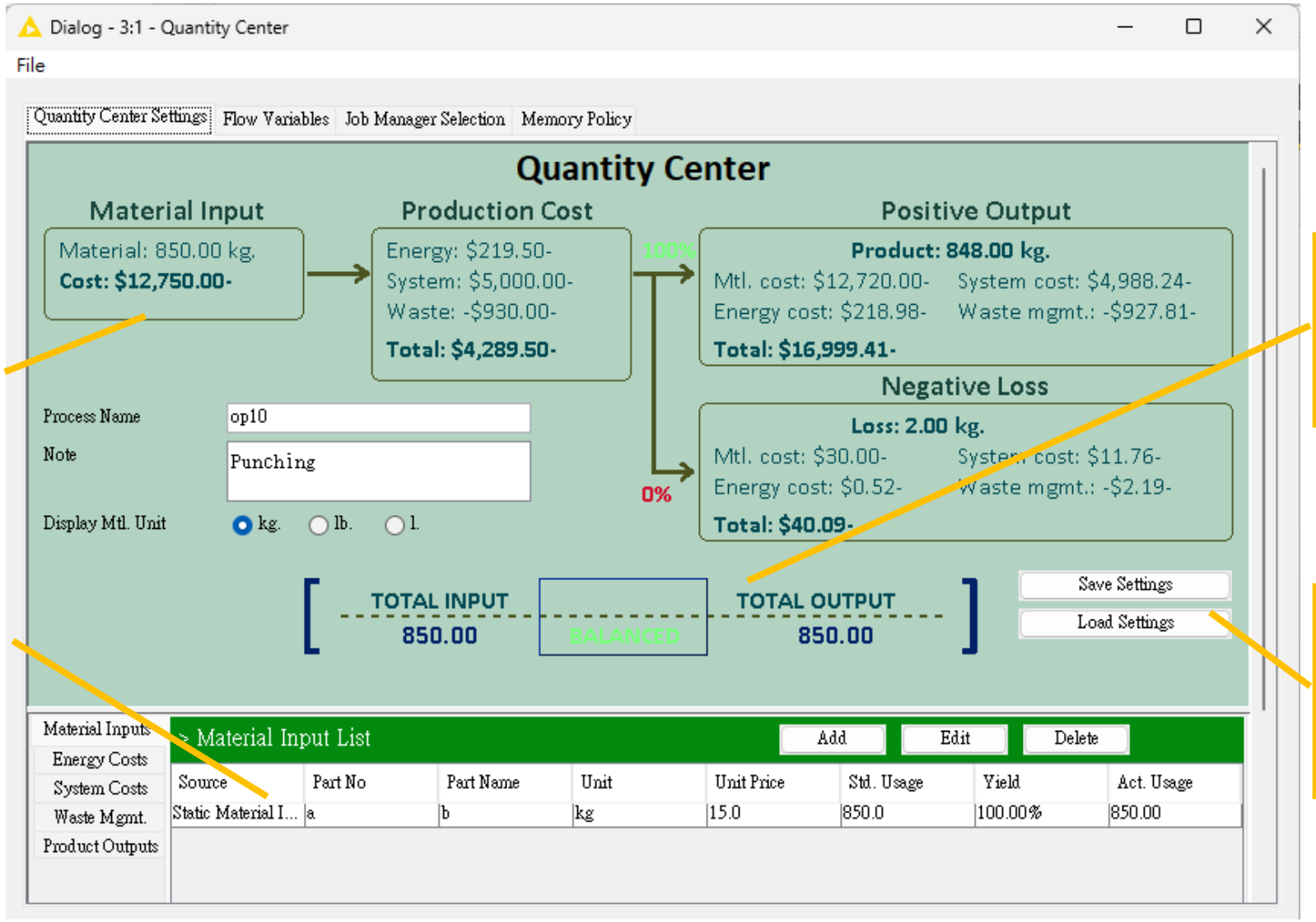
WASTE →

Scrap stainless steel 600 kgs.

$1.56 per kg

THE MFCA QUANTITY CENTER NODE

The quantity center node calculates MFCA in a single production operation.



MFCA dashboards show the aggregation result of its data list.

You have the option to add a material input row item here, where you can include the quantity and unit price.

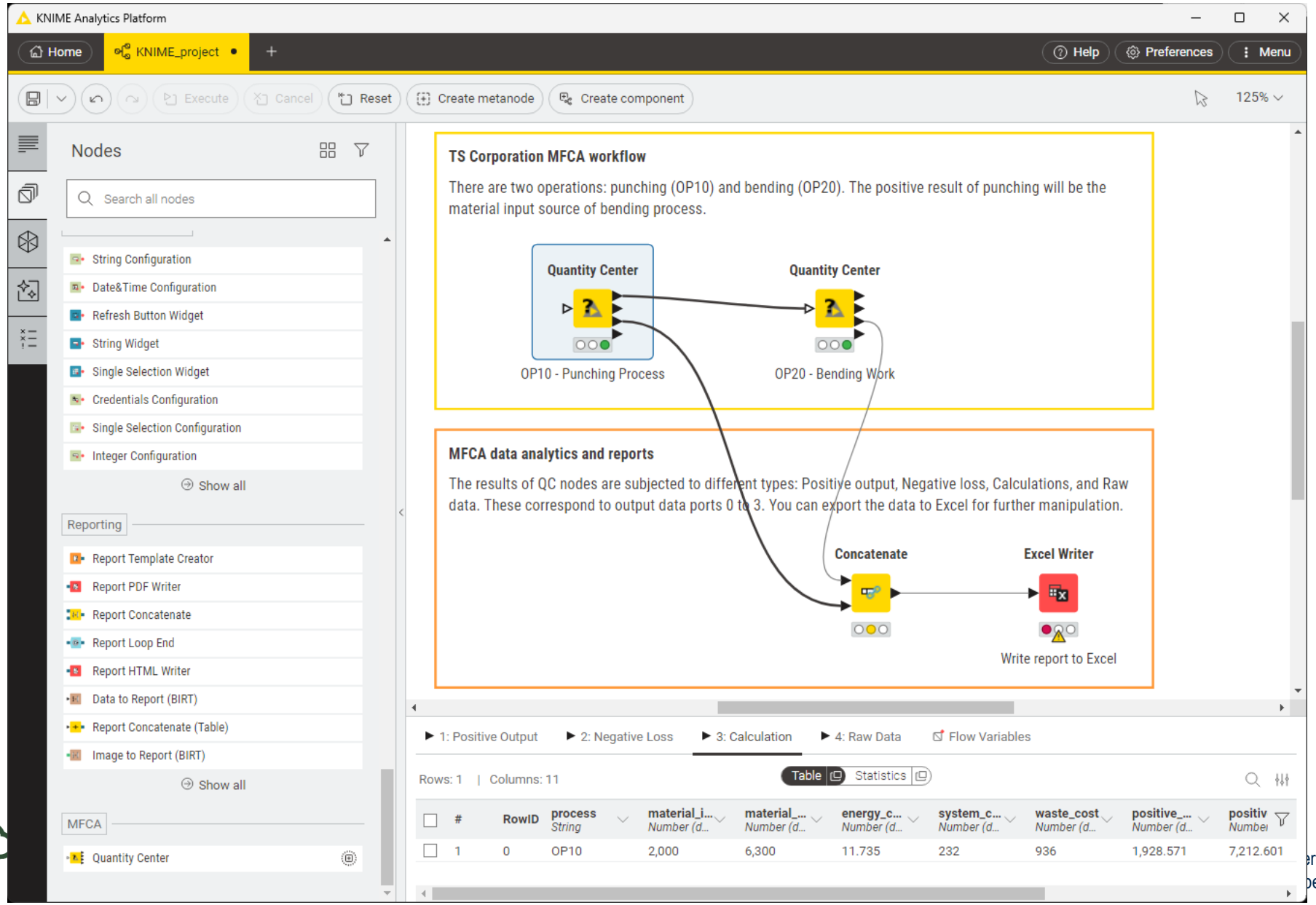
Check if the total input and output quantity are balanced.

Save current QC settings to file or load settings from previous saved one.

Green Open Data

PRACTICE: CREATING MFCA WORKFLOW

The quantity center node calculates MFCA in a single production operation.



REFERENCES:

Standing side by side with the MFCA community.

- KNIME: https://www.knime.com/
- 日本能率協会コンサルティング, Material Flow Cost Accounting MFCA Case Examples.
- Christine Jasch, Environmental and Material Flow Cost Accounting Principles and Procedures, Springer, 2009.
- Switch Med (EU), Material Flow Cost Accounting (MFCA), United Nations Industrial Development Organization, 2019
- Hiroshi Tachikawa, Manual on Material Flow Cost Accounting: ISO 14051, Asian Productivity Organization, 2014

Thank you

GREEN OPEN DATA