

# Energy Efficiency (EE) e-training - East Africa

**Rahul Raju Dusa**  
Senior Expert

Thursday, 18 March 2021 | Copenhagen



**COPENHAGEN CENTRE  
ON ENERGY EFFICIENCY**  
SEforALL EE HUB

# Energy Audit and Management – for Buildings

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# Introduction

## Terminology



Source: <https://images.app.goo.gl/9BfE7p1Gu9bLvWJ86>

# Introduction

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## Terminology

A **vision** is a description of outcomes that the an individual an entity will strive to achieve.

A **strategic plan** is a document that is used to communicate the municipality's goals and how it will achieve those goals.

A **roadmap** normally covers one decade or longer and includes detailed steps to achieve certain objectives.

An **action plan** addresses the schedule of actions to be taken to achieve certain goals.

# Introduction

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## **Benefits of strategic energy efficiency planning**

- Engages various stakeholders and raises awareness on EE
- Raises awareness on EE and creates common understanding
- Creates certainty and enables long term investment.

Ireland public sector EE target by 33 per cent from the 2009 basis by 2020.

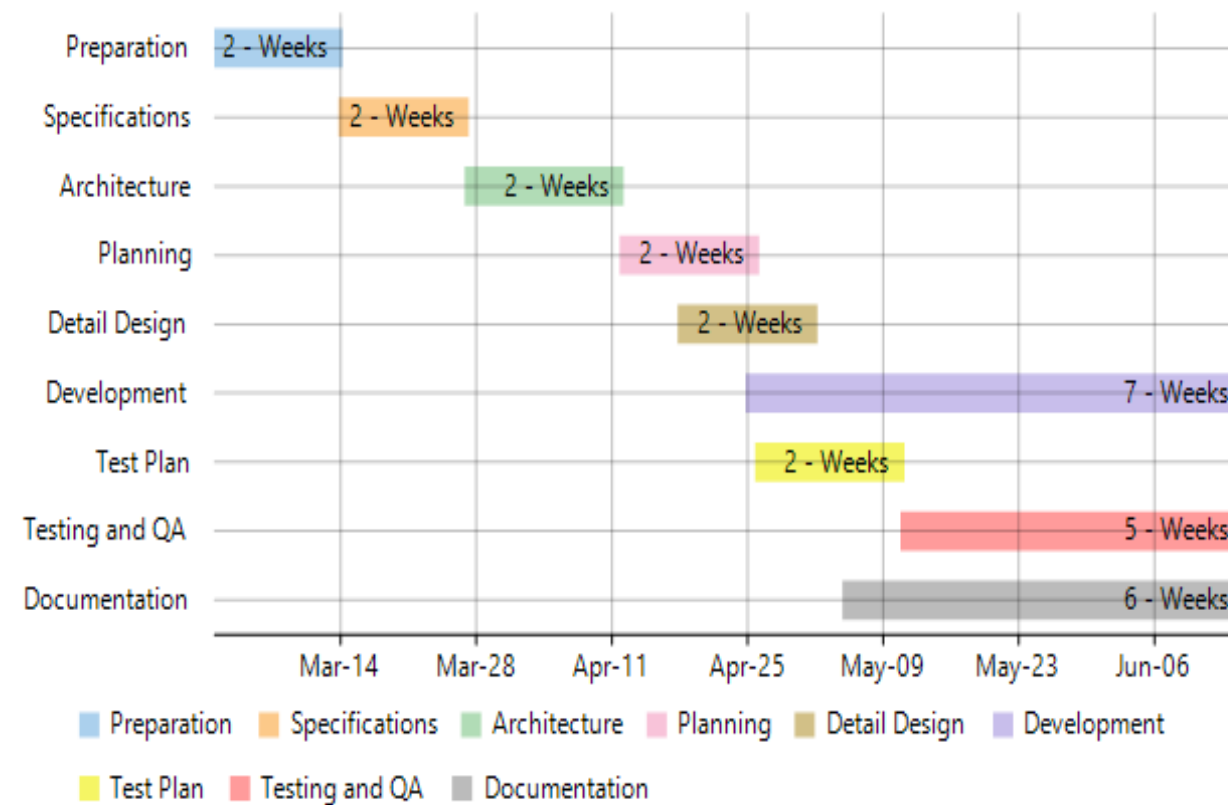
Enactment of a Public Sector EE Strategy in 2017.

By the end of 2018 – improvement by 27 per cent from 2009, EUR 1.3 billion in energy savings and 4.6 million tonnes of CO<sub>2</sub> emissions avoided since 2009.

Source: Sustainable Energy Authority Ireland, 2019

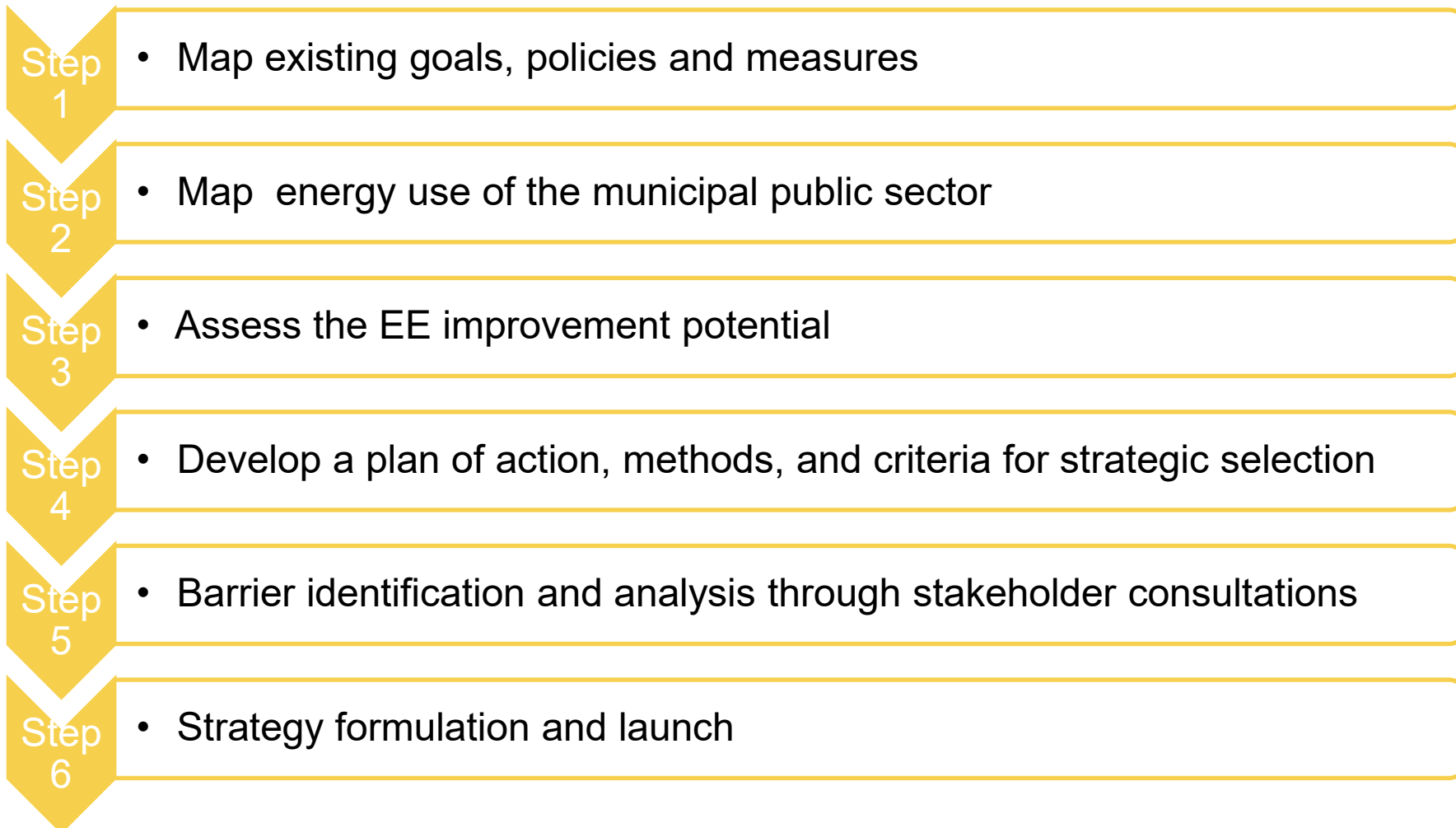
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# Introduction



Source: <https://images.app.goo.gl/Wb3AuyyBaBTS2KHE9>

# Steps in strategic planning



# Step 1 – Mapping existing goals, policies and measures

## National/ regional policy context

- National policies and targets on EE
- National development strategy and priorities
- National regulations on municipal governments' roles and responsibilities in local EE, public sector operation costs and investment

## Municipal policies and context

- Development of strategy and priorities
- Local energy supply and demand
- Municipal EE targets and priorities
- Local municipal EE institutional setup and stakeholders

## Individual context

- Mandatory emission reduction targets as a result of above policies
- Mandatory or voluntary energy efficiency improvement targets
- Compliance to associated standards and certifications.
- Divisional and departmental operational SOPs.



# Step 1 – Mapping existing goals, policies and measures

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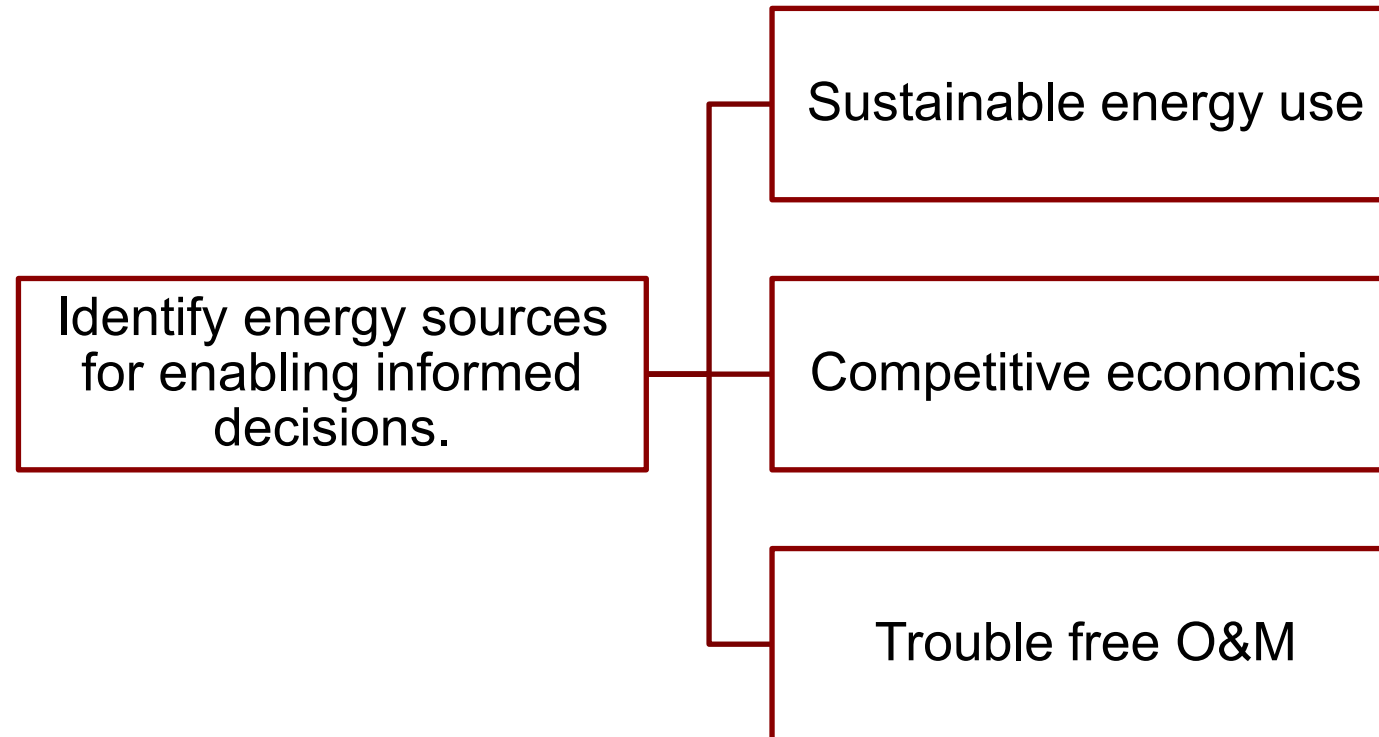
## Stakeholder mapping

- Roles and responsibilities.
- Suitable expertise – data collection and drafting the strategic plan
- Consultation of stakeholders and final decision makers.

# Step 2 – Mapping energy use

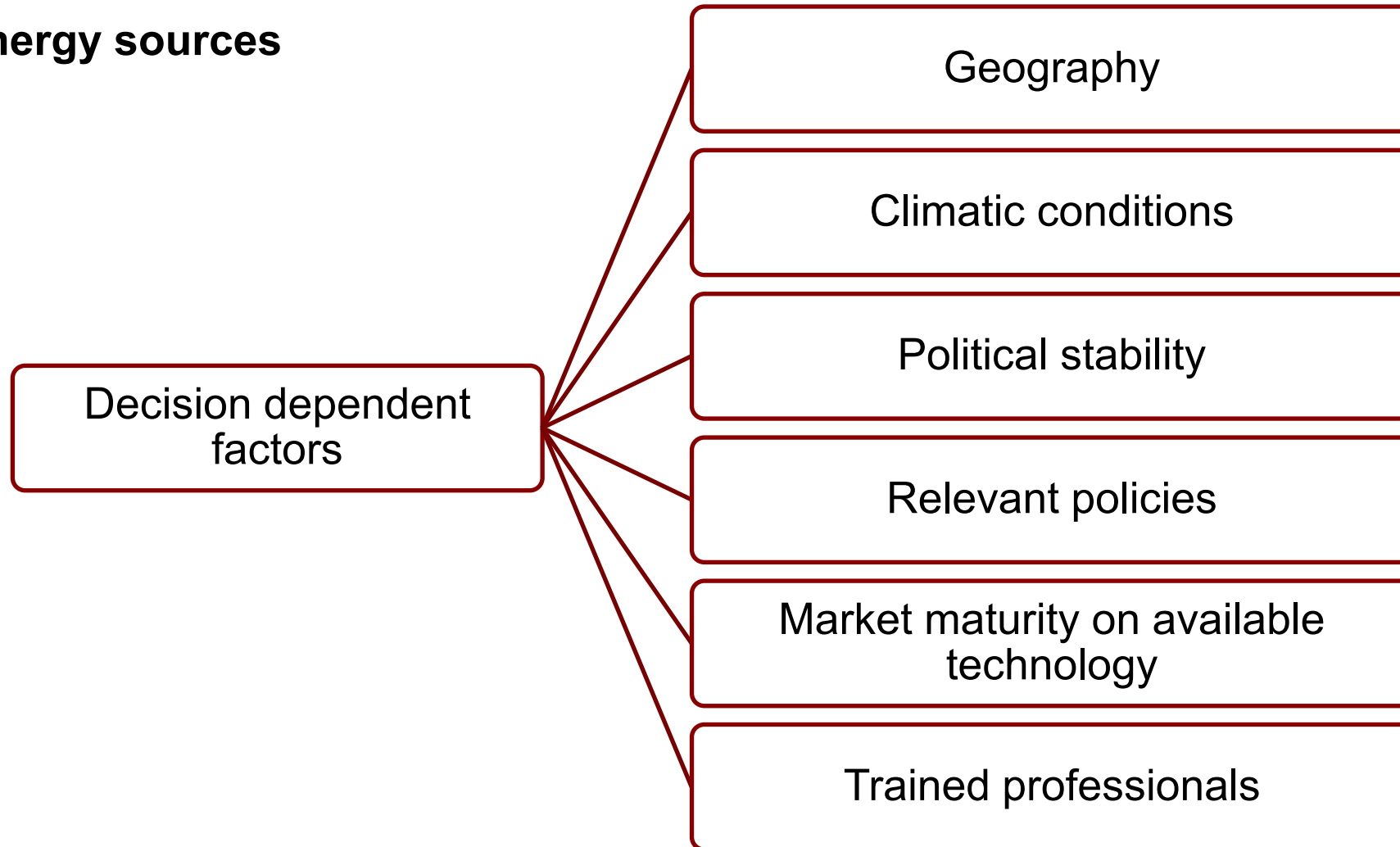
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## Energy sources



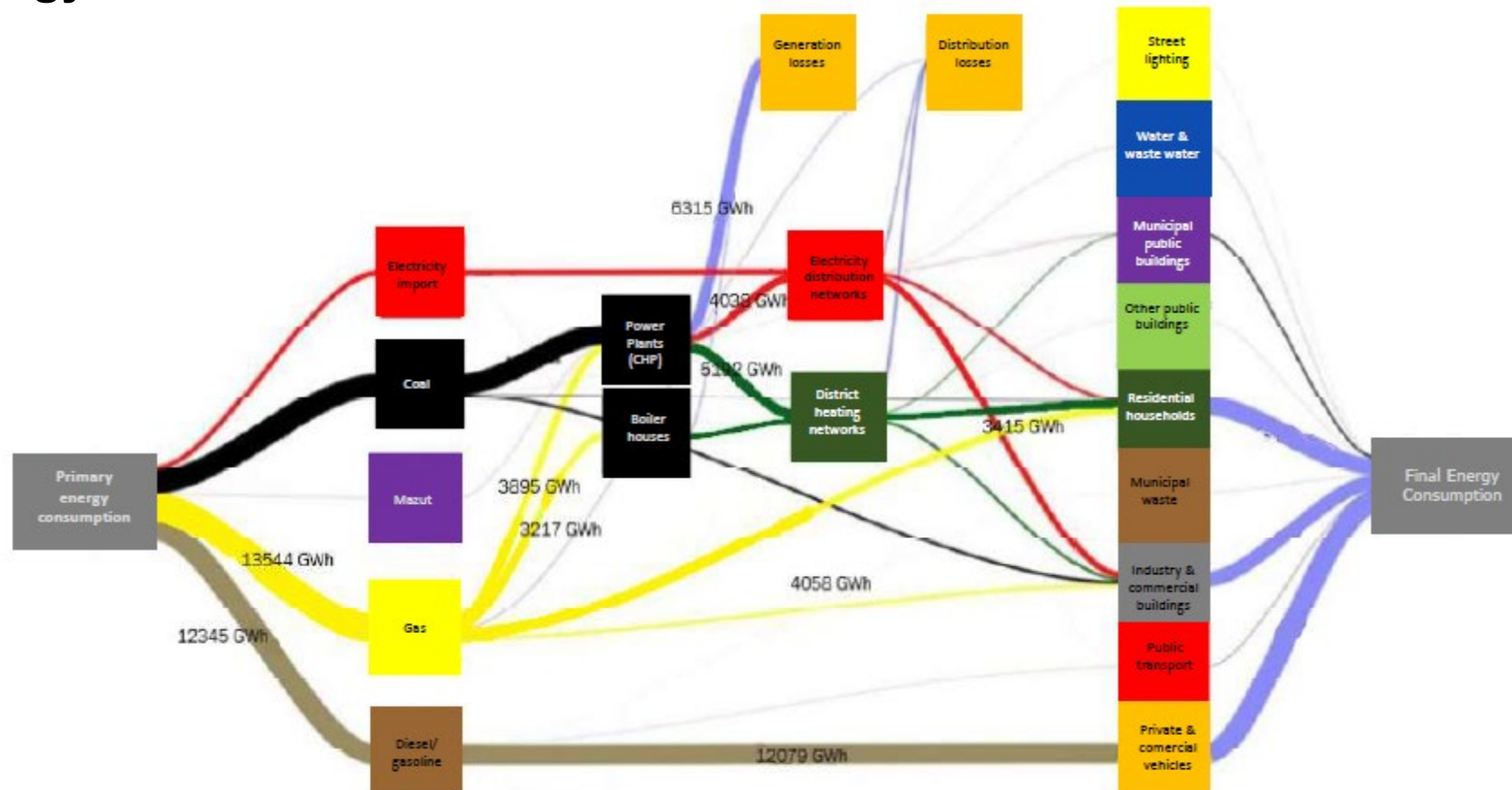
## Step 2 – Mapping energy use

### Energy sources



# Step 2 – Mapping energy use

## Energy sources



Source: World Bank's Energy Sector Management Assistance Program (ESMAP), 2017

## Step 2 – Mapping energy use

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*Energy mapping is a holistic approach, with the end goal being to define and integrate energy solutions across as many end users as possible*

- Scale of application – National, municipal, individual system level.
- Types and quantum of energy for types of end-use application.

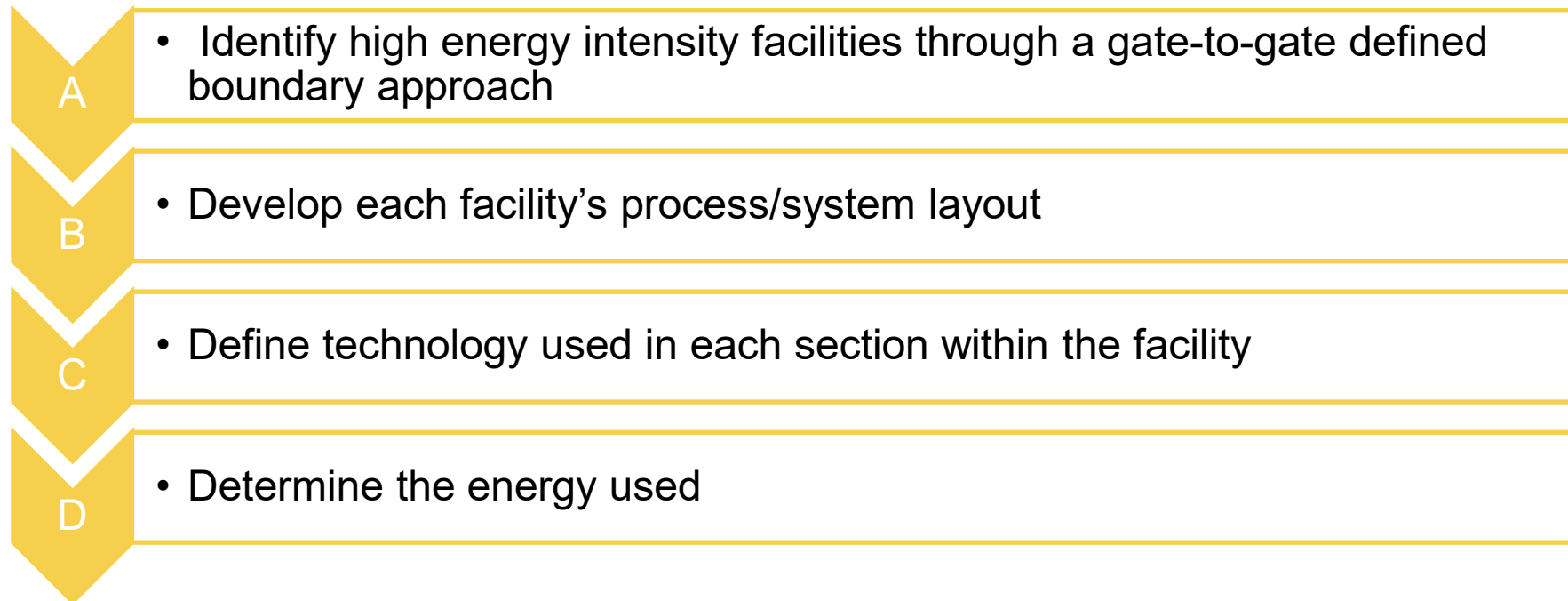
Source: [Energy Mapping Feasibility Study, Edmonton. 2014.](#)

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## Step 2 – Mapping energy use

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### Key recommended steps in energy mapping approach



# Step 2 – Mapping energy use

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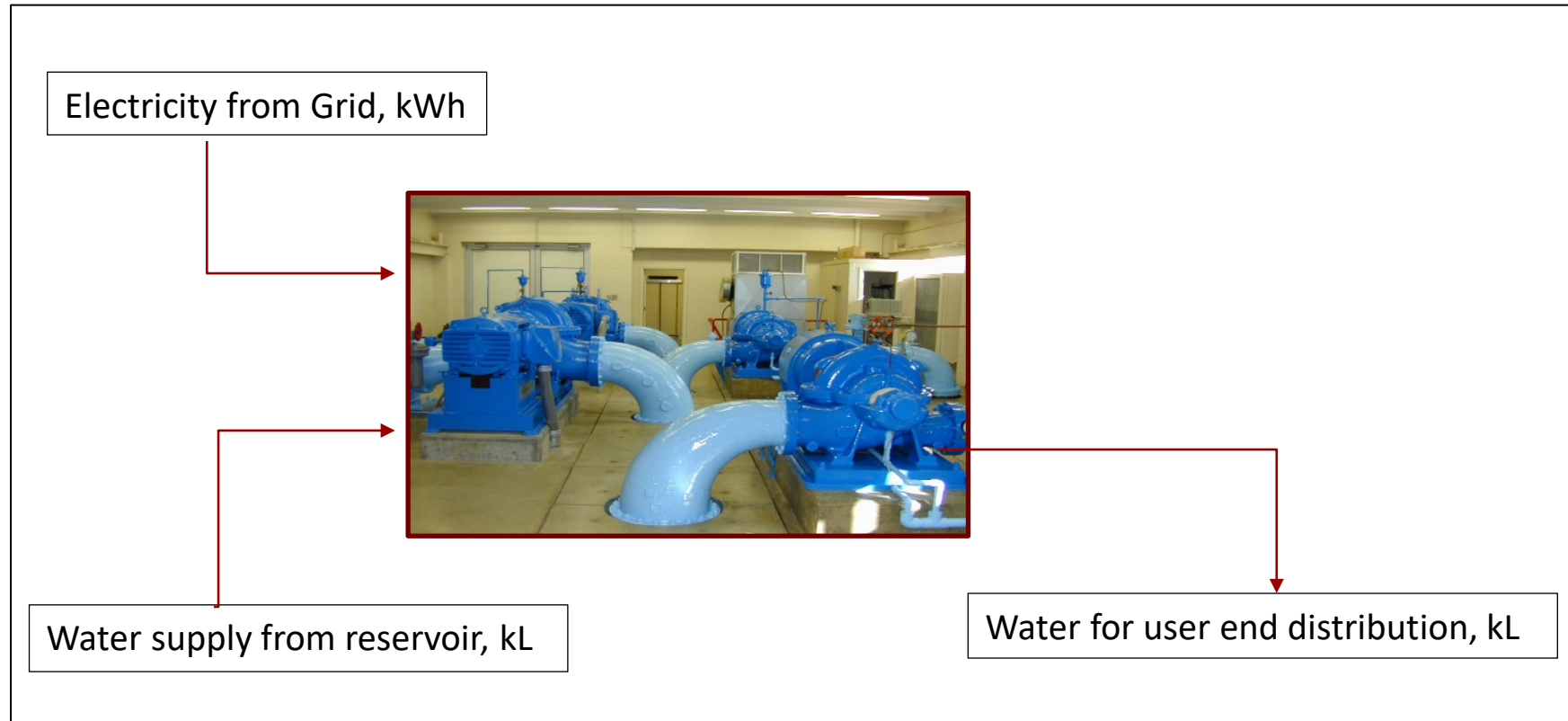
## A. High intensity facilities and boundary approach

- Identify high intensity facilities – Gate to gate defined boundary approach
- The boundary includes all energy consumption against total output or reference (material, production, energy, area, etc..)
- Energy (and Material) types – Inputs and Outputs.
  - kWh/m<sup>2</sup>/year (for buildings); kWh/kl (water pumping stations); toe/tonne (manufacturing industries) etc..
- Baseline with respect to
  - Energy consumption
  - Technology and operations
  - Policy regulations

# Step 2 – Mapping energy use

## A. High intensity facilities and boundary approach

Boundary approach for municipal water pumping and distribution station

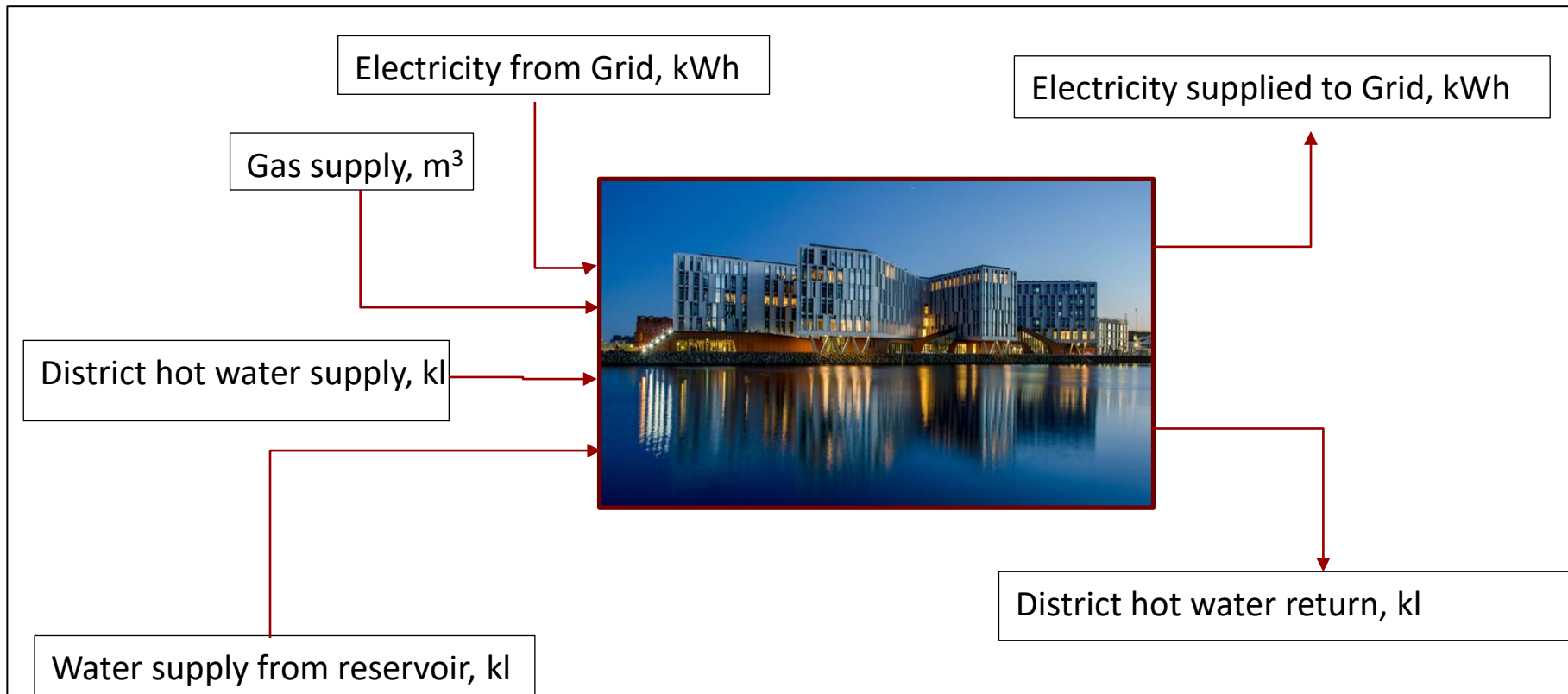




## Step 2 – Mapping energy use

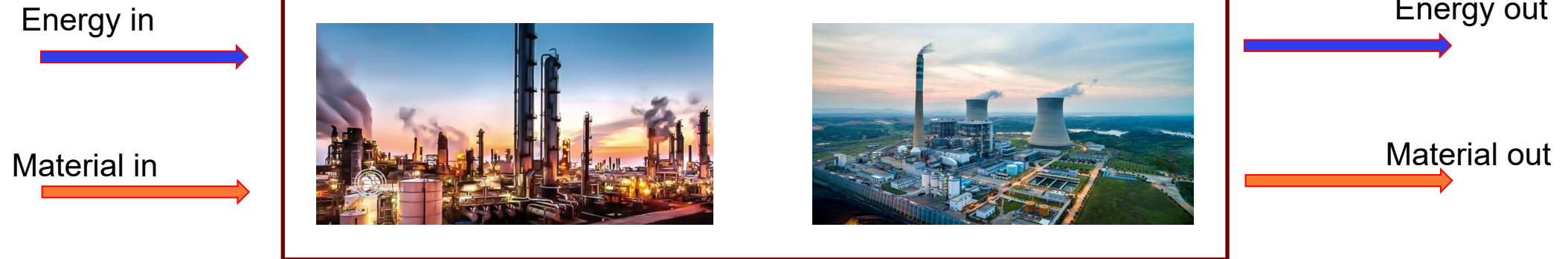
### A. High intensity facilities and boundary approach

Boundary approach for large office building

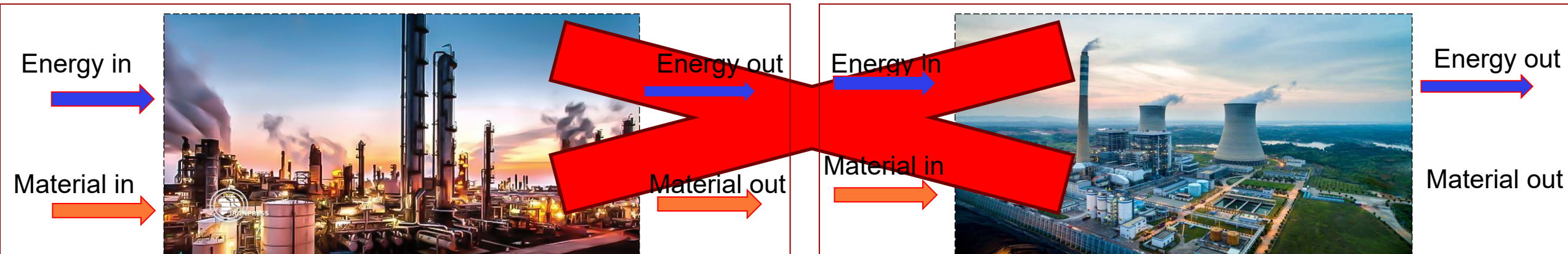


# Step 2 – Mapping energy use

## Baseline



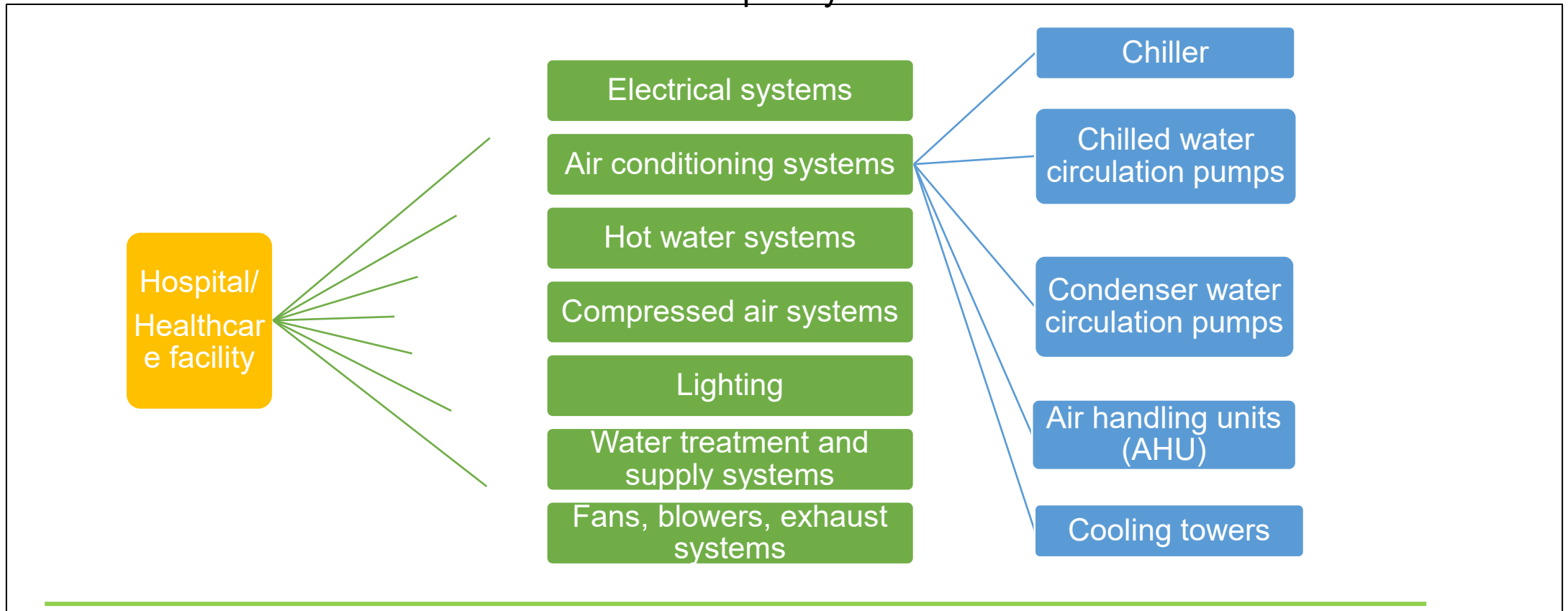
## Verification



## Step 2 – Mapping energy use

### B. Develop each facility / process / system layout - Example

Example of a public building Air-Conditioning system illustrating for macroscopic and microscopic layout.



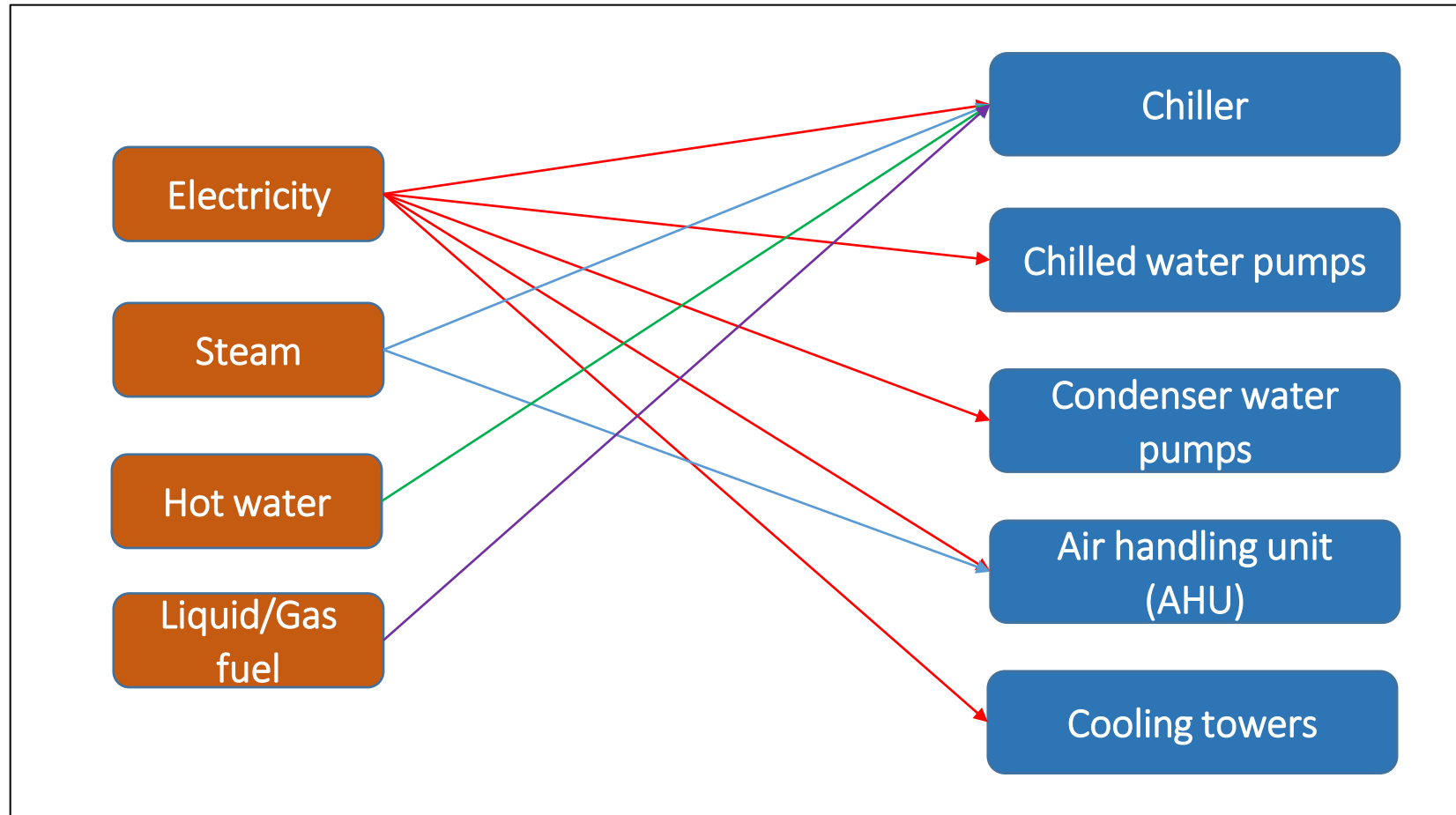
## Step 2 – Mapping energy use

### C. Defining technology used in each section - Example

Chiller	Chilled water pumps	Condenser water pumps	AHU	Cooling towers
<ul style="list-style-type: none"><li>• Electricity (Vapor compression system)</li><li>• Steam (Vapor absorption machine - VAM)</li><li>• Hot water (VAM)</li><li>• Liquid/Gas fuel (Direct fired VAM)</li></ul>	<ul style="list-style-type: none"><li>• Electricity (electric motor driven centrifugal pump sets)</li></ul>	<ul style="list-style-type: none"><li>• Electricity (electric motor driven centrifugal pump sets)</li></ul>	<ul style="list-style-type: none"><li>• Electricity (electric motor driven fans and blowers)</li><li>• Steam (for integrated dehumidifiers and RH control)</li></ul>	<ul style="list-style-type: none"><li>• Electricity (electric motor driven fans)</li><li>• No energy input (Natural Draft)</li><li>• Not applicable (Air cooled chillers)</li></ul>

## Step 2 – Mapping energy use

### C. Determine the energy used - Example



## Step 2 – Mapping energy use

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### Further actions

- Categorize personnel accountable – operations/process, technology, energy.
- Study of data collected – potential optimization of resources and operations.

## Step 3 – Assess energy efficiency improvement potential

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- Energy efficiency interventions by the Ministry of Regional Development, Construction, Housing and Municipal Economy of Ukraine and Federal Ministry for Economic Cooperation and Development (BMZ) has resulted in 5-10 per cent reduction of the annual energy cost of the municipalities. ((BMZ), 2015)
  - Energy audit studies of municipal water systems in India have indicated at least 25 per cent energy and monetary savings potential. ((IFC), 2008)
  - Energy conservation measures in water utilities of Sharjah Electricity Water Authority have resulted in more than 56 per cent energy savings. (TERI, 2016)
  - Local technological improvements of street lighting systems in Timeri, Guyana resulted in a 29.7 per cent lighting energy consumption reduction. (TERI, 2014)
- BMZ, 2015. Energy efficiency in municipalities. Bonn: GmbH, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)

# Step 3 – Assess energy efficiency improvement potential

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- Benchmarks and standards
- Energy Audits

## Facility area or production related

- kWh/m<sup>2</sup>/year (Energy performance Index, EPI, of buildings)
- kWh/Mt clinker or cement produced (cement plant)
- kcal/kWh power produced (Heat rate of a power plant)

## Equipment / utility related

- kW/ton of refrigeration (air conditioning plant)
- % thermal efficiency (of a boiler plant)
- % effectiveness (in a cooling tower)





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# Thank You

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**Thank you for your attention**

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