

Life Cycle Assessment of Electricity Production in Ireland

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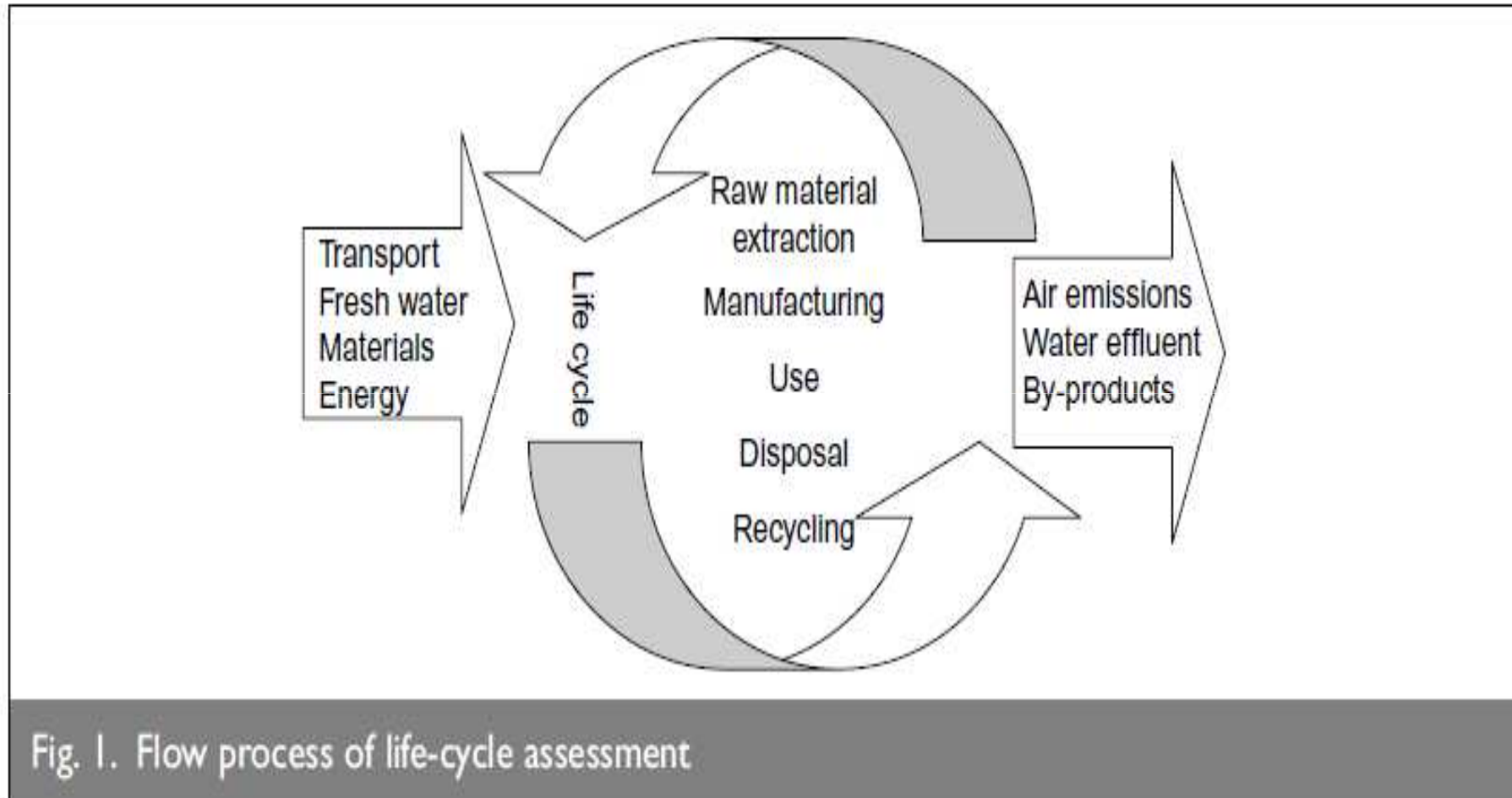
Life Cycle Assessment (LCA)

'The compilation and evaluation of the inputs, outputs, and potential environmental impacts of a product system throughout its life cycle'

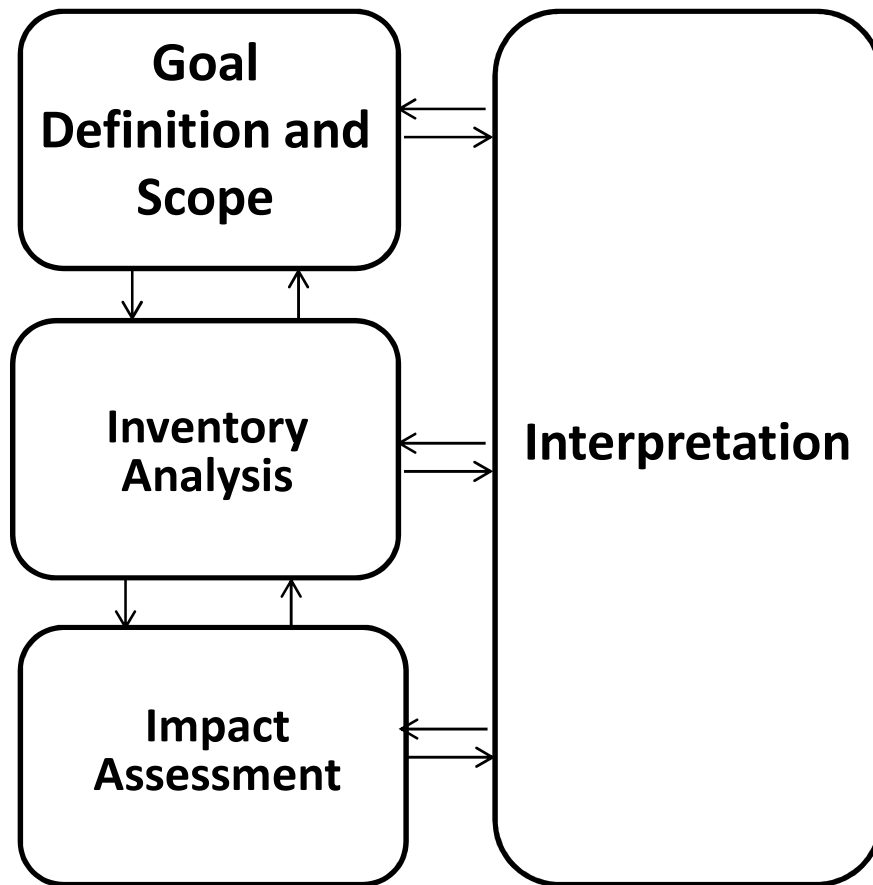
(ISO 14044, 2006)



Life Cycle Assessment (LCA)



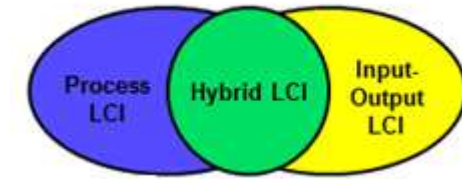
Life Cycle Assessment (LCA)



Four Stages:

- Goal and Scope Definition
- Life Cycle Inventory (LCI)
- Life Cycle Impact Assessment (LCIA)
- Interpretation

Life Cycle Inventory (LCI)



Three Methods:

Process LCI

- Involves the collection of data for each process of the life cycle, either technology specific or from databases
- It uses either a flow diagram or matrix expression to represent life cycle flows from one process to the next

Input-Output LCI

- uses national average data obtained from Input-Output (I-O) tables to estimate the environmental impact of a product or system
- Input-Output tables contain monetary data for aggregated sectors of an economy
- These tables along with environmental accounts data can be used to calculate the environmental impact of a product or system assuming fixed ratios

Hybrid LCI

- Hybrid LCIs aim to combine Process and Input-Output methods in a way to minimize their limitations

Motivation

- Electricity cannot currently be stored in bulk, thus electricity generation must meet electricity demand on a second-by-second basis in order to prevent over/under production.
- Smart meter data provides information on electricity consumption on a half-hourly basis.
- CO₂ emissions from electricity production/consumption are currently estimated using Emission Factors calculated from average fuel mix reports for electricity production.
- Life Cycle Assessment can be used to calculate the Emission Factors for electricity consumption in Ireland on a half-hour basis, using the Market Schedule to determine which generators are producing electricity, along with LCI data for fuel production.
- By using a Life Cycle approach to quantify these emissions, 'hot spots' can be identified, which will provide useful information for the development of effective policies that aim to meet government targets for the reduction of CO₂ emissions.

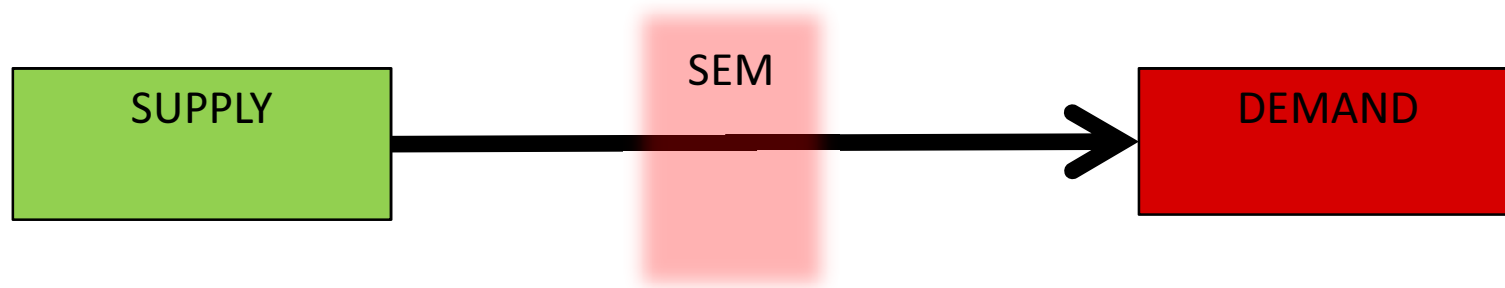


Objectives

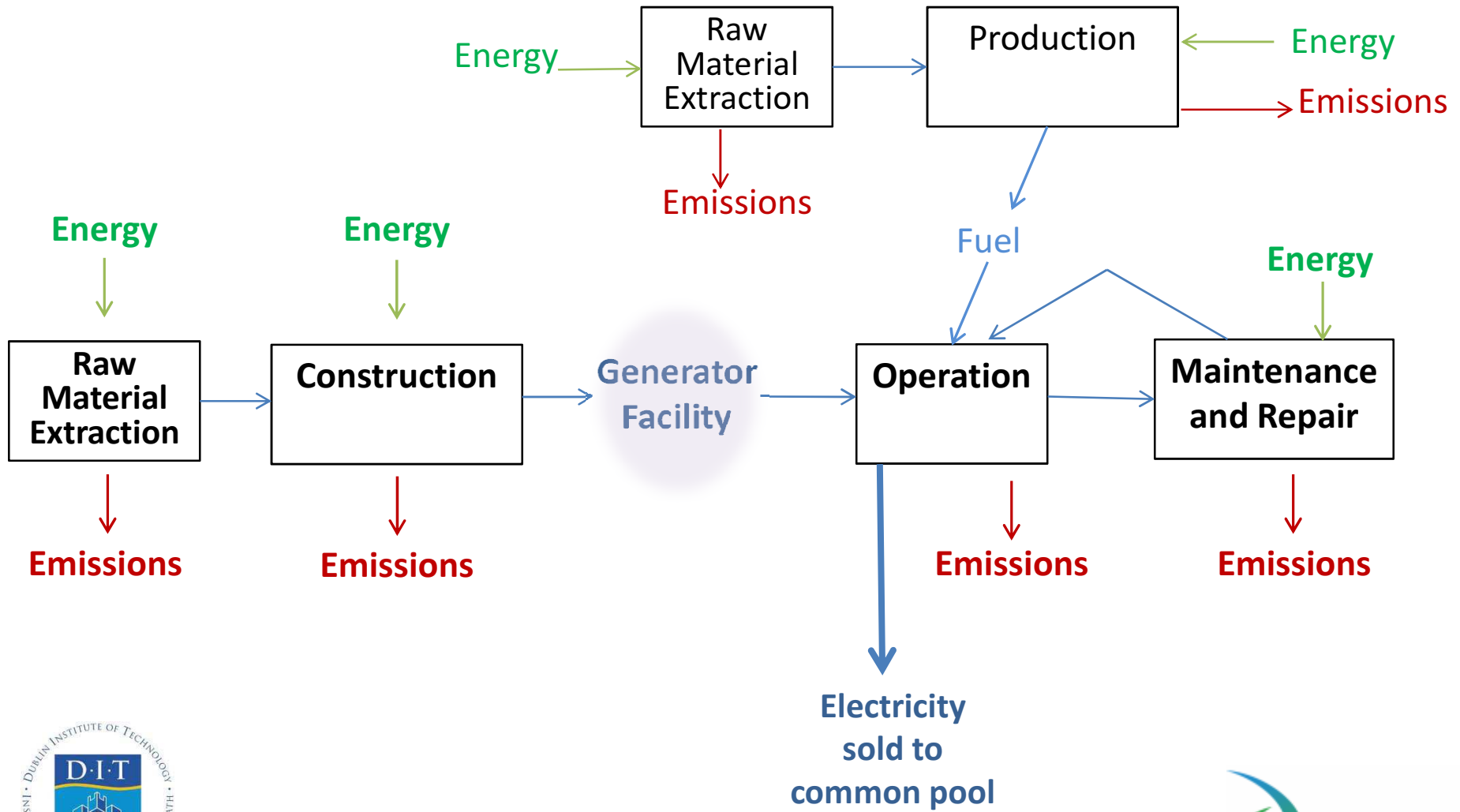
- To conduct an LCA of electricity production in Ireland based on half-hourly domestic consumption data and the corresponding Market Schedule of the producing generators
- To compare the Emission Factors calculated to those published for Ireland
- To identify ‘hot spots’ in the LCA, and test possible scenarios for reduction of these emissions
- To conduct a thorough uncertainty analysis of the LCA

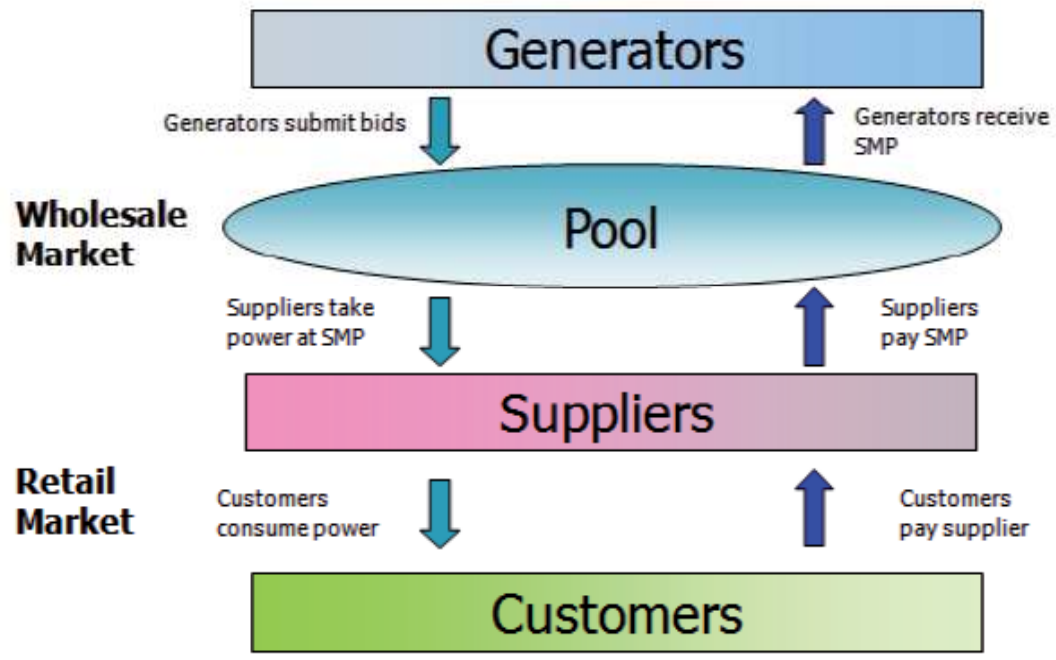
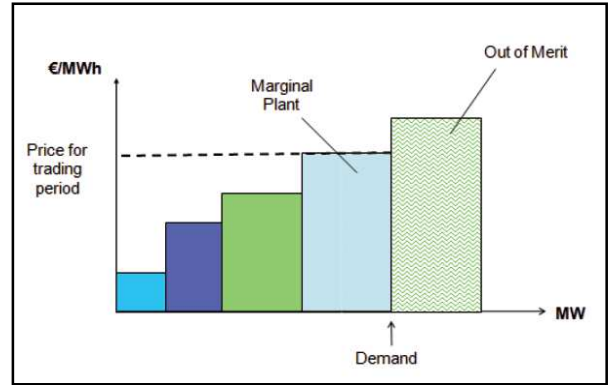
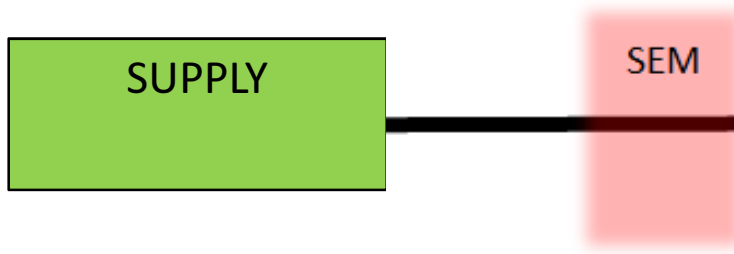


LCA Flow Diagram



SUPPLY

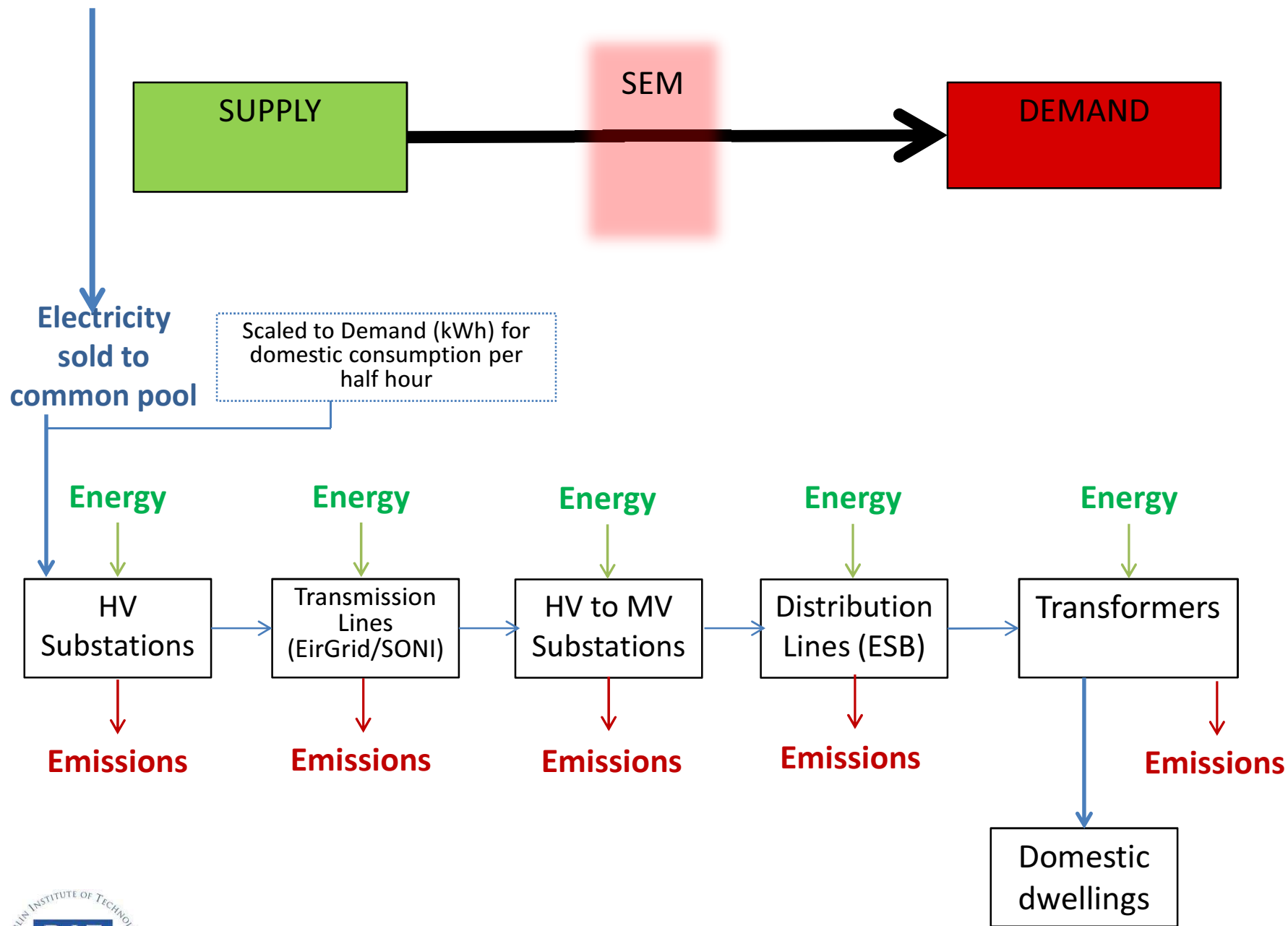




- All Generators larger than 10MW must sell all of their electricity to the common pool
- SEM is operated by SEMO which communicates with electricity suppliers and electricity generators
- Suppliers purchase electricity from generators at the System Marginal Price (SMP) as determined by SEMO

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Data Requirements

DEMAND:

- Smart Meter data from Smart Meter Trial Period 2009-2010
- Estimated transmission and distribution losses and emissions
- LCI data for construction of transmission and distribution lines and substations

SUPPLY:

- Fuel production LCI data
- Fuel consumption and efficiency of each generator
- Operation data from Input-Output tables
- LCI data for construction of each generator
- Maintenance and repair data for each generator
- Total electricity generation for each half hour for each generator



Thank You!

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