CHAPTER III
METHODOLOGY

3.1 Materials and Equipment

3.1.1 Software

- Commercial process simulation software SimaPro version 7.1

3.1.2 Equipment

- Laptop (Intel® core™ i7-3612QM, RAM 4 GB, Window 7 Ultimate and Microsoft Office 2007)

3.2 Experimental Procedures

3.2.1 Preparation

Literature survey and review the background of television including their environmental impact through LCA technique and also previous thesis.

Key words which need to be prepared;

a. Television (CRT and LCD).
b. LCA method.
c. End of Life
d. Base line 2000.
e. Eco-design 95.
f. The regulation.
g. Sima pro version 7.1

3.2.2 Goal, Scope, Functional Unit, and System Boundary

The goal of this LCA study was to assess the energy and environmental impacts of the end-of-life waste management of CRT-TV. The methodology used in this

study was based on ISO14040 series. The inventory data were collected secondary data sources (National Thai LCI database, Pollution Control Department (PCD), and selected references) and compiled by using commercial LCA software, SimaPro 7.1, with Eco-Indicator 95 and CML 2 baseline 2000 methods. The energy resource, environmental impacts and generated profit of all scenarios were compared.

Planning flow diagram, determine the system boundary as show in Figure 1 and asking process information. Figure 3.1 shows the entire life cycle of TV product, however, the system boundary set in this study covered only use phase, transportation, and end-of-life which includes waste management, landfill, incineration, and recycle (indicated by dashed line).

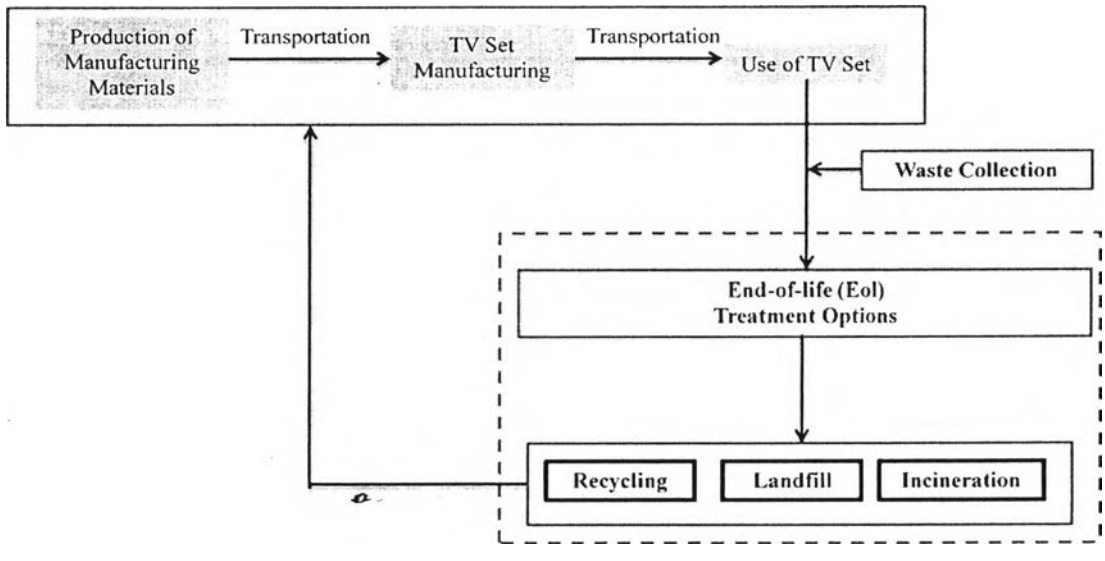

Figure 3.1 System boundary of this study (dashed line).

3.3 Inventory Analysis

3.3.1 Collecting Information

In this step, data within the system boundary (dashed line) were collected with a focus on route of waste management and three identified technologies.

This included all relevant input-output data such as raw materials consumption, energy & utilities consumption, and emissions to air/soil/water. The sources of input-output data are shown in Table 3.1.

3.3.2 Identification and Quantification

Identification and energy quantification, water and materials usage, and environmental release. (e.g. solid waste disposal).

Table 3.1 Sources of the inventory data used in this study

Phase		Key Parameters	Data Source
Production of Manufacturing Materials	Steel, Aluminum, Copper, Glass, PE, PVC, and PS	Energy consumption, Atmospheric emission, Water waste, Solid waste	Song et al., 2012
TV Set Manufacturing		Electricity consumption	Song et al., 2012
Transportation		Fuel consumption, Atmospheric emission	Thailand database, PCD (2011)
Use of TV Set	Life time =10 yr.	Electricity consumption	Song et al., 2012, Thailand database
Waste Management (End-of-life)	Recycle, Landfill, Incineration	Solid waste, Atmospheric emission	Recycle shops (Bangkok and Kalasin province) Thailand LCI database, PCD (2011)

3.3.3 Scenario Analysis for CRT-TV Waste Management

In this section, five waste management scenarios were created by varying the percentage of different waste treatment technologies (recycle, landfill, and incineration) in order to simulate various waste management situations of CRT-TV in Thailand as described in Table 3.2. The current situation of CRT television waste management in Thailand was set as the base case.

- Base case represents the current situation of CRT-TV waste management in Thailand (86 % land filling, 12.2 % recycling and 1.8 % incineration) (Interview at SueYai Uthit, October 2014).
- Case 1 is the improved current waste management (base case) by increasing the discarded CRT-TV materials recycling from 12.2 % to 51.28 % (achieved by diverting funnel glass and panel glass from landfill to 30% and 80 % recycling, respectively).
- Case 2 represents the best achievable waste management of CRT-TV which assumes that highest of recycled mass fraction (92 %) (all of materials are managed by recycling, except only other wastes (8 %) which are still disposed to landfill).
- Case 3 (modified technology) is current situation method of CRT-TV waste management in Thailand and combines with discarded CRT-TV technology in China (Song *et al.*, 2012), which improves more recycling of funnel glass to 100 % and recycling of panel glass to 30 %.
- Case 4 (modified technology): current situation method of CRT-TV waste management in Thailand combine available recycling technology in Japan which improves recycling rate to 79 % (Sony Corporation, 2015).

Table 3.2 Five different scenarios of CRT-TV waste management

Disposition	Base Case	Case 1 (Improvement)	Case 2 (Best)	Case 3	Case 4
Hazardous/Solid Waste Landfill	86.0 %	48.7 2%	8 %	46.72 %	20.7 %
Recycling	12.2 %	51.28 %	92 %	53.28 %	79.3 %
Incineration	1.8 %	0 %	0 %	0 %	0 %

3.4 Impact Assessment

3.4.1 Calculate Impact Potentials

Calculate impact potentials based on the LCI results by using software, SimaPro version 7.1, with Eco-indicator 95 and CML 2 baseline 2000 methods.

3.4.2 Analyze and Compare

Analyze and compare the impacts on human health and the environment burdens associated with raw material and energy inputs and environmental releases quantified by the inventory. Relevant impact categories included in this study are:

- Global Warming Potential (GWP)
- Acidification Potential (AP)
- Human Toxicity Potential
- Energy resources

3.5 Interpretation

This step involves the combination and interpretation of the results of the inventory and impact assessment to provide conclusions and recommendations consistent with the goal and scope of the study.

3.6 Report Preparation

3.7 Presentation of Work Progress

3.8 Submission of Report