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# APPENDIX

## Appendix <sup>\*</sup>

### Marshall and swift equipment cost index

Most cost data that are available for immediate use in a preliminary or pre-design estimate are based on conditions at some time in the past. Because price may changes in economic conditions, some method must be used for updating cost data applicable at the present time can be multiplying the original cost by the ratio of the present index value.

To convert to present price use Marshall & swift cost according this calculation:

$$\text{Present price} = \text{Original price} \times \frac{\text{index value at present time}}{\text{index value at original time}}$$

The Marshall and swift cost index are based on an index value of 100 for the year 1926. These indexes take into consideration the cost of machinery and major equipment plus cost for installation, fixture, tools, and other minor equipment. The Marshall and Swift Cost Index – Annual average value are tabulate as below.

1975	=	444
1980	=	660
1985	=	790
1990	=	915
1991	=	931
1992	=	943
1993	=	964
1994	=	995
1995	=	1027
1996	=	1039
1997	=	1056
1998	=	1062
1999	=	1075

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\* Reference (19,28)

## Utilities Cost

- Water
  - cooling tower, 75 °F inlet, 95 °F out = \$ 0.50/1000 gal (50psi)
  - Boiler feed water = \$ 1.50 / 1000 gal
- Electric power, 220 v = \$ 0.0354/kwh
- Fuel (1 ft<sup>3</sup> of natural gas = 1000 BTU), = \$ 3.5 per million BTU
- Steam
  - 10 psig = \$3.5/1000 lb
  - 100 psig = \$3.72/1000 lb

## Miscellaneous

- Operating days per year = 320 day, day working 8 hour
- Depreciation life = 15 years (only for preliminary analysis)





## **BIOGRAPHY**

Miss Natthineepon Soisungnoen was born on 21<sup>th</sup> November, 1978 in Bangkok. She finished his higher secondary course from Sathreprasertsin School, Trat in March, 1996. After that, she studied in the major of Environmental Science in Faculty of Science and Technology at Thammasat University. She continued her further study for Master's degree in International Environmental Management Science at Chulalongkorn University and achieved her Master's degree in April, 2002.