
Contents

1 Introduction.....	1
1.1 Background	1
1.2 General motivation	4
1.3 Objectives.....	7
1.4 Methodology	8
2 Literature review.....	11
2.1 Introduction	13
2.2 Thermoelectric Generator.....	14
2.3 Rankine Cycle	18
2.4 Stirling cycle.....	22
2.5 Brayton cycle.....	25
2.6 Summary	30
3 Thermodynamic analysis	33
3.1 Introduction	35
3.2 Engine energy levels.....	35
3.2.1 Gasoline engine	38
3.2.2 Diesel engine.....	39
3.3 Cycle description.....	40
3.3.1 Ideal cycle	43
3.3.2 Machine selection.....	50
3.3.3 Non-ideal cycle	53
4 Heat exchanger	61
4.1 Introduction	63
4.2 Heat exchanger efficiency	64
4.3 Pressure drop	67
4.4 Pressure wave transmissivity.....	75

5 Heat recovery system model.....	85
5.1 Introduction	87
5.2 Simple machine model	90
5.2.1 Poppet valve	93
5.2.2 Reed valve	110
5.2.3 Camless poppet valve.....	117
5.3 Heat exchanger tube length	119
5.4 Heat transfer model	127
5.5 Mechanical losses.....	129
5.6 Indirect losses	134
5.6.1 Exhaust backpressure pumping losses	134
5.6.2 Additional weight.....	135
6 Conclusions and future work	137
6.1 Conclusions	139
6.2 Future work	142
7 Bibliography	145
