Forecasting indices of small-scale energy technologies

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ABSTRACT: The study of prospective techno-economic indices has been performed in Melentiev Energy Systems Institute with reference to stationary small-scale energy technologies. It provides estimates of current average rates of their specific cost change. The technologies considered include reciprocating engines, steam and gas turbines, fuel cells, and some their combinations below 30 MWe fuelled with natural gas, coal, and biomass. A comparison is made with wind and small hydro sources. For the majority of technologies the specific cost decreases at a rate of 2 to 14% over 10 years. In combination with the current average costs this allows to forecast likely structure of small-scale technologies up to 2030. The implications are discussed. They differ for West European countries and Russia. The major difference is the tendency to raise electrical efficiency, which is notably less topical in Russia. An inference is drawn that the most likely viable application of fuel cells is the combination with gas microturbines. The technologies of solid fuel gasification stay more viable than fuel cell options up to 2030. Though, their competition may be influenced appreciably by carbon sequestration policy and fuel supply infrastructure.

Keywords: small-scale power generation; new energy technologies; prospective cost

1. INTRODUCTION

A firm rise in economy and living standards accompanied by an increase in energy consumption as well as the reality of energy shortage threat bring about the demand for forecasts of energy development of the world, its regions, separate countries, and their particular territories. The techniques of energy development forecasting applied both in Russia and abroad are generally built according to uniform proven scheme and differ in peculiarities only [1]. The optimal structure of energy carriers and energy technologies is sought according to an economic criterion (objective function) under constraints of (a) available energy resources with an account of possible interconversion and transportation, (b) final energy demand determined by the chosen scenario of socio-economic growth, and (c) permissible environmental impact. In such models setting the initial closure, although laborious as it is, does not normally meet any theoretical difficulties. The most delicate part of the system of constraints is a self-consistent set of forecasted economic and demographic indices that are highly uncertain. The uncertainty significantly increases with the length of forecast term.

At medium-term (15 to 20 years) and long-term (30 years and longer) forecasting the issue of accurate prospective techno-economic indices of energy technologies becomes highly topical. The R&D progress in the sphere of energy production and conversion technologies (RDPE) is appreciably uneven at this time scale. This makes for higher risks in the market of new technologies and higher uncertainty of

REALITY OF CAVITATION INCEPTION IN CENTRIFUGAL PUMPS

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ABSTRACT: Pumps were designed and manufactured to operate far from the cavitation condition. Pump designer has defined the cavitation inception point as the point where the head drops by 3 %. This definition is incorrect, because the first appearance of vapour bubbles was observed earlier than 3 % drop in the head. Therefore using 3 % drop in head, as indication parameter for cavitation inception has always resulted in damage in pumps during operation. This paper describes visual studies conducted to determine the variation of net positive suction head with flow rate, rotational speed and water temperature. A special correlation between the visual net positive suction head and net positive suction head corresponding to 3%drop in head was predicted at various operating conditions.

Keywords: cavitation inception, net positive suction head, visulization

1. INTRODUCTION

The present study was intended to investigate visually the changes in flow rate, suction pressure, rotational speed and temperature of a pumped water on the cavitation performance of centrifugal pumps. These factors are generally termed "thermodynamic and thermodynamic effects" and studies on these aspects are numerous and comprehensive. For pump designers, knowledge of the cavitation phenomenon is very important for proper design. Some pump designers have defined the critical cavitation coefficient as the point where the head drops by 3 percent. This is because it was believed that if the performance was not affected no cavitation occurred and that the head first started to drop was the point of cavitation inception. This definition does not show the real state of cavitation inception in the pump, and that incipient of cavitation may exist long before the performance is affected [1] and [2]. At this point where the head drops by 3% cavitation erosion was noticed. Reliance on this definition can cause errors in the prediction of efficiency and performance at the design stage. Therefore, there is clearly need for reliable data on the variation of visual net positive suction head and NPSH corresponding to 3%drop in head at various operating conditions with a view to develop possible relationships between them. El-Kadi [3] has studied the cavitation in a centrifugal pump handling hot water from (28°C to 58°C). The suction side of the pump was made of transparent perpex material in order to notice out the cavitation degree at the corresponding flow condition, but no correlation between visual net positive suction head and net positive suction head corresponding to 3%drop in head was noticed. Selim, et. al., [2], have carried out an experimental work on

Life Cycle Analysis of Biodiesel: An Application to Portugal

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ABSTRACT: The main objective of this research was to update the GREET model (developed by the Argonne National Laboratory, USA), to accomplish the Portuguese reality. Following this step, a LCA for biodiesel in Portugal was carried out. A case study was selected, considering the use of biodiesel in the urban buses fleet of the city of Braga, in the north of Portugal.
Through the study it was possible to verify that throughout the biodiesel's life cycle (well to wheels), the total energy consumption is about 17.820 kJ/km, while for diesel is 16.292 kJ/km. This increase of 9.5% in energy consumption is due not only to the increase of fuel use (due to biodiesel's lower PCI) but also to higher energy consumption during the production stages of biodiesel (about 6% higher). With the use of biodiesel, significant reductions can be obtained for most of the pollutants considered. For emissions of CO_2 there is a 15% reduction compared with diesel, for CO and NO_x the reductions are about 17%, for VOC the reduction is 16%, for emissions of particulate matter and CH_4 the reductions are about 22% while in the case of the SO_x the reduction is 52%. The only exception to the trend occurs in the emissions of N_2O where there was a total increase of 0.5% compared with the emissions obtained for diesel.

Keywords: biodiesel, buses, GREET, LCA, Portugal

1. INTRODUCTION

Transportation sector has a major influence in energy consumption and, as consequence, in greenhouse gases emissions. The high dependence of transportation on fossil fuels leads to an urgent need of alternative fuels.

The European Commission defined a strategy to stimulate demand for biofuels and emphasize their use on road vehicles; namely in 2003, the Biofuels Directive set the objective of replacing 2% of vehicle fuel supply by 2005 and 5.75 % by 2010 [1]. The 2005 target was not met and it seems unlikely that the 2010 target can be reached. On the other hand, some institutions (such as the European Environment Agency) are concerned with environmental impacts of biofuel use in Europe and defend that the 10% biofuels target should be suspended.

Through Life Cycle Assessment (LCA) it is possible to identify and quantify the impacts that production and use of biofuels have on environment. To fully evaluate energy and emission impacts of advanced vehicle technologies and new transportation fuels, the fuel cycle from wells to wheels and the vehicle cycle through material recovery and vehicle disposal need to be considered. Figure 1 establishes the different stages in a life cycle and the LCA phases.

However, the existing models / databases on biodiesel do not accomplish the reality of Portugal (most of them have data inputs from the US background).

Reverse Series Triple-effect Absorption Cycle Integrated with Exhaust Heat Recovery Generator (Oral Presentation)

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ABSTRACT: A single absorption loop is proposed to be integrated with the gas-fired reverse series triple-effect absorption cycle to recovery exhaust waste heat to generate more refrigerant vapor. The simulation of the novel cycle and life cycle saving economic analysis are carried out to investigate the performance of its energy efficiency improvement. The results are also compared with an earlier double-effect study. It is shown that the exhaust temperature could decrease from 252□ to 136□ in the triple-effect cycle application with COP increasing by 2.6%, which is more significant than the efficiency improvement of the double-effect cycle. For a case study, the extra investment of the exhaust generator in the triple-effect cycle can be repaid in 4.3 years and revenue of RMB¥14000 is expected to be produced in the lifetime of this system, which indicates that this new cycle offers more benefits than the double-effect counterpart. The results can be used in future design of the triple-effect absorption machines.

Keywords: triple-effect; reverse series; exhaust; absorption; recovery generator

1. INTRODUCTION

Concerns about environmental pollution caused by CFCs emissions and electric capacity shortage of peak power load have generated renewed and growing interest in absorption chillers. In the market, the popular double-effect absorption chillers representing COP of 1.30 can not be comparable with typical electric centrifugal chillers even on the equivalent primary energy basis. In attempt to improve the energy efficiency of the absorption systems, a variety of triple-effect cycles that have the potential to be as energy efficient as the best electric chillers have been investigated [1]. In 2005, Kawasaki Thermal Engineering successfully developed a commercially viable version of the triple-effect absorption chiller, indicating that the triple-effect absorption chiller has the potential for large scale utilization in the near future.

The discussions of the triple-effect cycles are mainly focused on three kinds of configurations, i.e. parallel flow, series flow and reverse series flow, with the combination of lithium bromide-water solution as working fluid. The parallel-flow cycle gives the highest COP due to the relatively larger heat exchanger area. However, Y.Kaita [2] pointed out that the lowest operation pressure and solution temperature, which was advantageous in respect of vessel pressure regulation and

Experimental Investigation of a Steam Ejector Using a Spindle and Different Nozzles

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ABSTRACT: This paper presents results of an experimental investigation of a steam jet refrigerator. The primary flow rate of the ejector is controlled by a spindle to provide fine tuning for ejector operation. Two nozzles with different lengths were designed and applied in the ejector. The effect of the spindle position on the performance of the ejector was assessed. The performance of ejector was investigated for various boiler temperatures and spindle positions using the two nozzles.

Keywords: Ejector refrigerator; Spindle; Nozzle

1. INTRODUCTION

Ejector refrigeration is seen one of the most appropriate systems for large scale refrigeration in the present energy and environmental situation. Ejectors can utilize low-grade waste heat from power plants, incinerators and industrial processes to generate useful refrigeration effect. An ejector refrigeration system is simple in construction, has few moving parts and does not include any chemical that could cause corrosion. Moreover, water, the most environmentally friendly substance can be used as a working fluid.

In this study, a novel steam ejector was designed and evaluated, using a spindle to provide fine tuning for ejector operation. As the spindle tip travels forward, the primary nozzle throat area decreases, and consequently the mass flow rate decreases. Therefore, the primary flow rate can be adjusted in order to maintain the entrainment ratio and COP under flexible operation conditions. Two nozzles with different lengths were designed and applied in the ejector. The performance tests were carried out for various boiler temperatures, spindle positions and different nozzles conditions.

2. EXPERIMENTAL DETAILS

2.1 Ejector Unit and Ejector Cycle

A nominal 5kW cooling capacity steam ejector with a generator temperature of 90°C that is suitable for use with solar collectors was designed and manufactured by Venturi Jet Pumps Ltd, UK. The design specifications were provided by FEUP [1], as part of a solar driven air conditioning system for operation in Mediterranean countries.

A review of level of energy consumption in the transportation sector in Iran and policies for reduction in the energy consumption in this sector

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ABSTRACT: Nowadays, the energy consumption in different fields is the most important issues in most countries of the world.
Considering more need for energy, the transportation section is one of the greatest sections of energy consumption and is considered to be the main consumer of oil products with its increasing consumption.
Because of the abundant oil resources in Iran, in the past, no working policy has been followed in controlling the energy consumption, however, over the recent years the continuation of this process has caused some concerns, so that the authorities in charge of transportation are taking into consideration the reduction of energy consumption by designing some systems.
In this paper, the rate of fuel and energy consumption is studied in all the road, railroad, airline and maritime transportation systems (specially road transportation), and through comparing it with the world standards, the executive strategies used to reduce the fuel consumption in the above-mentioned parts over the recent years are elaborated upon.

Keywords: energy, consumption, Polices

1. INTRODUCTION

Transportation sector is one of the greatest sectors of energy consumption and is regarded as the main consumer of oil products; it has different growth in different countries.

Iran enjoys the enormous energy reservoirs in world but unfortunately it faces the abundant consumption of energy. It is attempted that the rate of fuel consumption is studied in various transportation industry in Iran and then this problem is studied through comparing our standards with the

Variable Length Intake Plenum (Oral Presentation)

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ABSTRACT: This paper describes the initial works related to the study of intake plenum which is a part of intake manifold. The effects of intake plenum length/volume on the performance characteristics of a spark-ignited engine with electronically controlled fuel injectors were investigated with the aim of constituting a base study to design a variable length intake manifold plenum. The results showed that the variation in the plenum length causes an improvement on the engine performance characteristics especially with the fuel consumption at high load and low engine speeds which are put forward the system using for urban roads. According to the test results, plenum length must be extended for low engine speeds and shortened as the engine speed increases.

Keywords: Intake manifold, Intake plenum, Engine performance

1. INTRODUCTION

Internal combustion engines dominate transportation propulsion - cars, trucks, off-highway vehicles, railroad, marine, motor bikes - as well as provide mechanical and electrical power for a wide range of large and small applications. The two dominant types of internal combustion engines are spark-ignition and diesel. Their performance, efficiency, and emissions depend on the details of the processes which take place within the engine during the engine's operating cycle, and the characteristics of the fuel used. With stringent new emission and fuel economy standards, and major changes in fuels ahead, the research on the effects of the operating parameters on the engine performance is vitally important.

To improve the internal combustion engine performance and to reduce the fuel consumption, the operating parameters such as ignition or injection timing, valve timing and compression ratio should be continuously changed. Additionally, variation of the length of the intake manifold with the engine speed assists in the improvement of the engine performance.

The main function of intake manifolds is to provide an optimized and evenly distributed flow of fresh air from the air filter to the combustion chamber. A static intake manifold can only be optimized for one specific rpm, so it is beneficial to develop a method to vary the intake length and/or volume. By adjusting the length of the intake manifold runners, a charging effect can be achieved in defined speed ranges which improve the engine performance and torque.

The pressure in intake manifold varies during each cylinder intake process due to