

# The Condensing Engine Project NEWSLETTER

## No 2 - December 2019

The newsletter is published monthly, and reports things of interest about the project itself, about activities in this field worldwide, as well as ongoing research work in the area of low-temperature heat engines.

**Editorial:** we are now closer to defining where the crowd funding project will actually go. We want to build a ½ bhp engine as the smallest commercial size, demonstrate its functionality and then look at a typical application.

We are also looking at why you should contribute.

### The Condensing Engine

In the last Newsletter, we had already introduced the principle of the condensing engine. In our work we improved the engine by introducing variable expansion (which saves steam), we found that we can run the engine at temperatures below the boiling point of water (which widens the range of application) and we employ the uniflow-configuration to simplify the engine (this reduces the number of valves to one only).

Fig. 1 shows our 30 watt bench scale model which is nearly ready to go.



Fig. 1: our new 30 Watt, Uniflow - engine

This engine is a mini-version of the engine we want to build within this project.

### Available heat energy: *waste steam*

Waste steam is produced in many different industries such as paper making, tyre making, food processing etc. The used steam is mostly and simply blown off into the atmosphere. To appreciate this, we need to look briefly to the physics of the evaporation of water. It takes an energy of 430 kJ to heat one kg / one litre of water from 20C to 100C. In order to evaporate

this one litre, we need an additional energy of 2256 kJ – seven times as much. A tyre factory which blows off 300 litres of steam per second therefore wastes an enormous 800 kJ.s or 800 kW. Unfortunately, the laws of physics mean that we can theoretically recover 20% of this energy. A real engine with friction etc, can probably recover 10%. But, 80 W is enough electricity for 80 houses – and all that energy is simply blown away.

For us, waste steam is the most promising resource since we could simply connect our engine to the steam pipe – et voila!



Fig 2: Waste steam from a paper mill

How much steam is blown off from the paper mill in Fig. 2? 2000 litres per second? 5000 litres per second? A lot, and much energy could be recovered here.

### The project: *why should you contribute?*

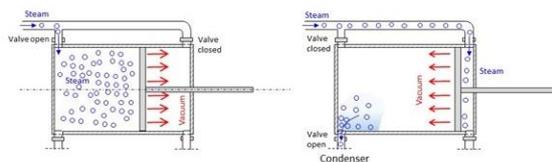
Well, for the good of mankind, and of course to save the climate and the planet - that would be the altruistic version. However, we want to create something which will eventually be cost-effective under market conditions so that people can actually make money from it. This means, that in this our more self-centred world, we think that the combination of doing something good and profiting from it is the secret for progress.

So, why should you contribute? We are thinking of offering three types of reward:

1. For contributions of less than 100 € / 120 US\$ we will provide an extremely cool steam-punk t-shirt.
  2. For contributions between 100 to 1000 € / 120 to 1200\$ you will get access to project information, videos and pictures of the tests, and test results so that you can assess the technology with the real data. Plus the T-shirt of course.
  3. For contributions of more than 1000 € / 1200 US\$ we will provide the rewards from (1) and (2) plus the possibility to acquire an engine at cost-only basis. There will also be the possibility to buy shares in the company which we will form at the end of the project. This last point still needs to be clarified in details, but that's what we intend to offer.
- In all, we need €40k / US\$50k, so that's our aim. Ambitious? Possibly, but we'll see..

### The technology: *the condensing cycle*

We've seen already, that there is an enormous amount of energy in steam. Now, if we add the components that (a) steam condenses when cooled, and that 1 litre of water gives us 1690 litres of steam (and vice versa), then we are approaching the way the Condensing Engine functions. .



**Fig. 3: Power generation – principle**

The figure above shows how it works: the cylinder is filled with steam at atmospheric pressure, i.e. without any pressure at all. Then, the condenser valve is opened (the condenser has a vacuum and is cold), the steam rushes into the condenser, where it condenses which reduces its volume to 0.0002%, or for all practical purposes a vacuum. So, the cylinder is emptied, the pressure near zero and the outside pressure pushes the piston downwards.

The advantage of the condensing cycle is of course that it does not need pressure. This sounds trivial, but.. explosions of pressure boilers were a big problem in the steam age, and still occur today:



**Fig. 4: Aftermath of a boiler explosion**

This means that pressurized boilers need to comply with strict safety regulations, they need to be inspected regularly, and they cannot be located in residential buildings etc. – all of which does not apply to the Condensing Engine

### Next Edition:

In the next Newsletter, we will look at some of the competitors

### Who are we, actually?

Well, we are a group of researchers at Southampton University's Water and Environmental Engineering Group WEEG. Our work covers the areas of Water and Energy which we consider as the most important issues for the next decades. Our work encompasses hydropower with ultra-low low-head differences, wave power, and low-temperature heat. And, we are looking for technological innovation, believing that cost-effective technology is THE core issue for the utilisation of renewable energy sources.

The emphasis here is on "cost-effective", the technology has to pay for itself within a reasonable time similar to other investments. Otherwise, you could argue, and since much of the costs for a technology is related to the energy required to make it, more energy is used to make the technology than it produces during its lifetime and the world would be better off without it.

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