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Energy Procedia 128 (2017) 423–430

Energy

**Procedia**

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International Scientific Conference “Environmental and Climate Technologies”, CONECT 2017,  
10–12 May 2017, Riga, Latvia

## Case analysis in Latvia on involvement of end users in energy system

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### Abstract

In recent years' technology have made a huge development leap. As technologies are developing, the prices for them are decreasing and renewable energy technologies becomes more available for households. For residential buildings, when using renewable energy technologies, the unused electricity goes to waste and is not used by anyone. For this reason, the NET payment system was introduced, where net metering can be conducted. But, as in every system, there are loopholes that need to be resolved and there is still potential to optimize the system to improve overall efficiency.

The aim of the research was to evaluate and improve end-user involvement in single energy system to promote overall energy efficiency and the use of renewable energy. The way to do it is to evaluate existing solar PV system in microgeneration regime and potentially optimize end-user behavior, energy use patterns and integrate technical improvements, such as new inverter, accumulation tank for hot water and visible metering system.

Because of optimization with changed inverter, additional accumulation tank and visible metering system, household self-consumption of energy from solar PV increased from 31.21 % to 79.85 % from total energy produced.

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Peer review statement - Peer-review under responsibility of the scientific committee of the International Scientific Conference “Environmental and Climate Technologies”.

*Keywords:* solar PV optimization; microgeneration; NET payment system

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10.1016/j.egypro.2017.09.049

## 1. Introduction

Over the last years renewable energy technology is making its progress not only in big companies, but also in residential buildings, where it is possible to produce alternative energy and use it for their self-consumption [1–5]. By this consumer can become more involved in reducing the usage of non-renewable resources and become more energy independent.

NET payment system is allowing renewable energy technologies to develop and become more demanded in households. But the system is just a way not to lose extra produced energy and get it back, when is needed, the system does not provide household with energy efficiency and financial savings. This paper aim is to calculate and understand how to make more efficient solar PV microgeneration system to those households, which already have and use them [6–8].

In this article is described and optimized solar PV microgeneration in NET payment system.

## 2. NET payment system

NET payment system starts with microgeneration. Microgeneration is a small-scaled energy generation for households and mini businesses for their self-consumption [6]. It can produce electric and heat energy from renewable resources. Microgeneration (distributed energy production) is an alternative to traditional centralized grid-connected power system. Distributed energy production in time could decrease GHG emissions and increase overall efficiency of power grid by reducing distribution losses and involving smart grid principles. Case study, microgeneration is regulated by Electricity Market Law [9] that determine overall principles – energy has to come from renewable resources and working power is not more than 400 V and 16 A, accordingly – single phase – 3,68 kW or three phase 11,04 kW capacity in electrical grid.

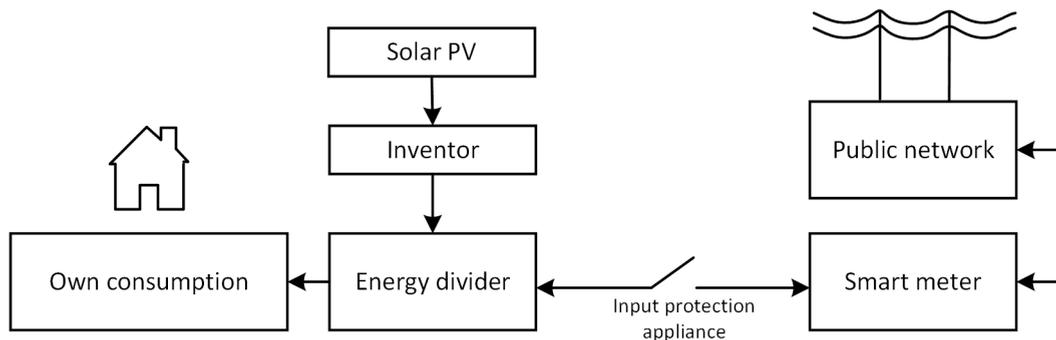


Fig. 1. NET payment system scheme.

Microgeneration has many benefits from end-user perspective, for example: increasing independence from centralized grid-connected power, saving money on energy costs and being eco-friendly. Microgeneration works simultaneously with centralized grid and gives energy that is not used to meet consumer's needs, back to the public grid, so it does not get lost. After energy is produced and inverter has transformed it to alternating current (AC), energy goes primary to meet consumer's needs, and, if produced energy is more than needed, it goes into the public grid [8]. To get energy back from public grid, when it is needed, NET payment system is implemented.

Inverter is the key part of energy transformation and possible losses. Energy losses in inverter can be defined as systems energy loss and can be optimized and reduced.

NET payment system is based on double energy flow from households, where the energy is produced from renewable resources, and public grid. In Latvia, the electricity NET payment system started in January 1st, 2014 with Section 30.1 of the Electricity Market Law. In 2016, already 245 households have applied to NET payment system.

As seen in Fig. 1 after solar energy is received on solar PV, inverter transfers it to AC and could be used for household self-consumption. After that, unused energy goes to public grid. In order, not to disrupt public and

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