

# One-Wire Electricity - where it is from?

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**Abstract.** One wire method of transmitting electrical energy was proposed, patented and verified in working pilot systems. Despite clear advantages, this method attracts objections. The main idea and basic components are shown in this article. The objections raised are analyzed by comparison with other historical examples.

**Keywords:** single line, converter, thee-phase, reactive power, intermediate stations, balanced system

## I. THE MAIN IDEA OF ONE-WIRE METHOD

It is known that active electrical power is transmitted from source to load and doesn't return to source. This suggests, that is possible to build electrical transmitting system using one wire only. This one-wire system was proposed and checked by simulations and pilot systems. The main idea is as follows [1]

The one-phase two-wire transmission system shown on fig 1. the currents in two wires have opposite polarity.

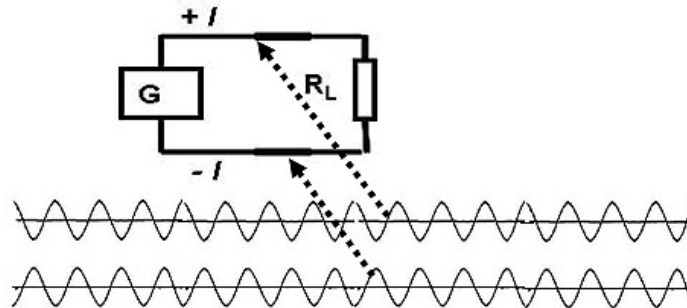


Fig. 1

Therefore, it is impossible to combine both wires because signals will cancel each other out [2, 3].

But if we will change polarity, we then can combine both currents. This combining can be done using two inverters, as shown in Fig 2.

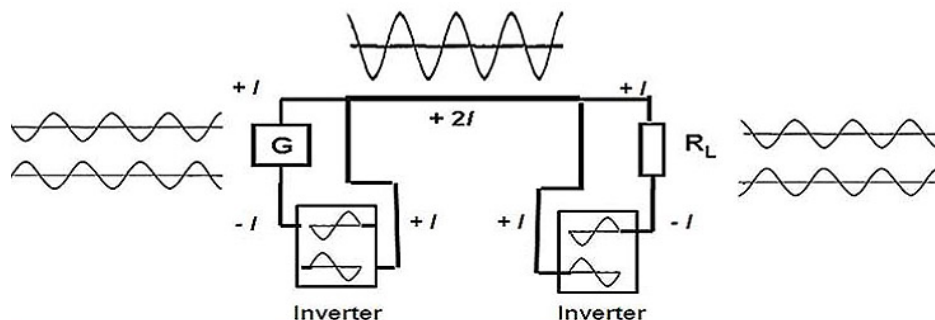


Fig 2. Two wires combining

## II. ONE-WIRE SYSTEM STRUCTURE

In this example, the one-wire system consists of a single transmission wire and two inverters. The inversions can be done by various methods. For example, by using a half wave length, delay line or by using phase shifters. At frequencies 50 or 60 Hz very convenient method is by using a transformer with opposite windings. This inverter can be used to invert one phase for the one wire system as shown in Fig 3

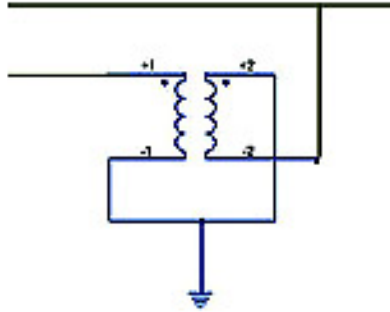


Fig 3 Converter 2 - 1

This method was implemented in simulation and then in a proof of concept implementation of the one-wire one-phase system working at a voltage of 6 kV. This schema and measurements results is shown on Fig. 4. This system is working in Tal Shahar, Israel.

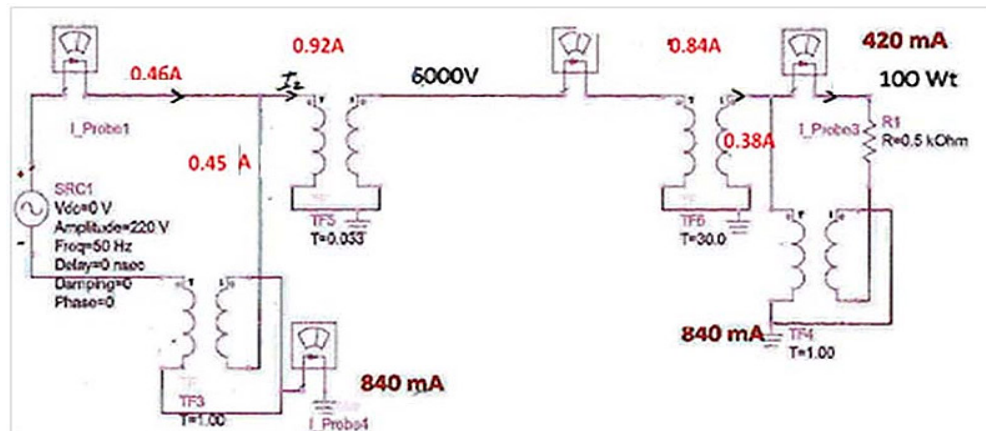


Fig 4. Pilot of one wire system example

This allows for the transmission of the three-phase signal by one wire. The explanation of converter 3 - 1 principle was given in Patent [4]. The possible schema of this converter is showed on Fig 5. Two of the three of phase vectors V1 and V2 has phases +60 degrees and - 60 degrees. Sum of these vectors has zero phase. Vector V3 after Vector V3 after inverting has zero phase also. Therefore, we can combine all vectors and receive one wire signal.

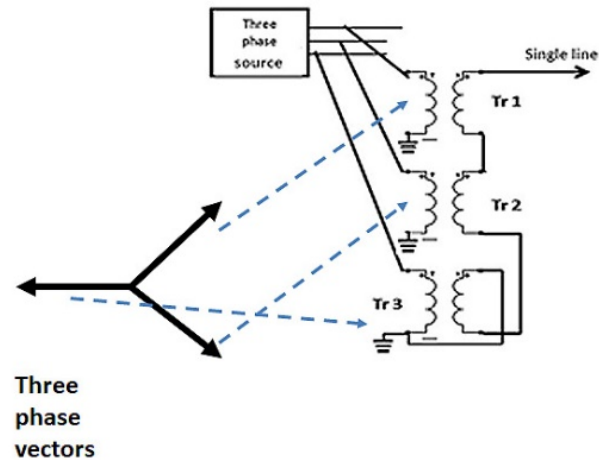


Fig 5 Converter 3 - 1

In [1] is shown that voltage in one wire line equals of voltage between two phases in three-phase system. The voltage equals 1.7 of phase voltage. Therefore, current in one wire will be by  $1.72 = 3$  smaller than in one phase. This explanation shows that in one wire system one can use the same wire, as an equivalent to the three-phase system.

This converter schema can not only make transformation to one wire signal, but increasing voltage. Therefore, its using does not increase system price.

In output of one wire system can be different converters. In case of receiving one phase signal one can use converter on Fig 6.

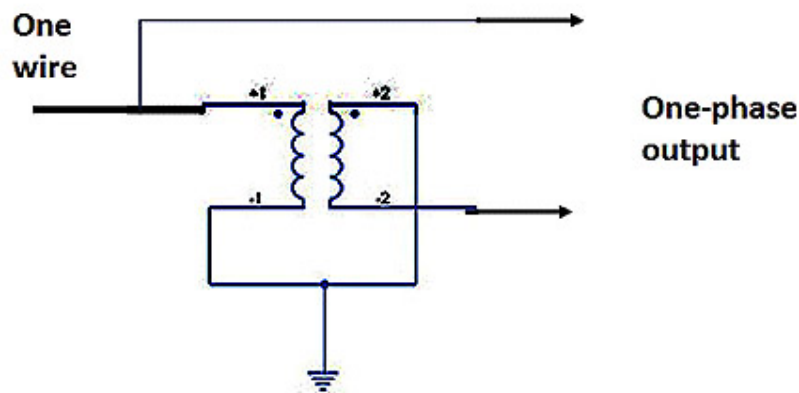


Fig 6. Converter 1 - 2

In case of receiving three-phase signal one can use converter on Fig. 7

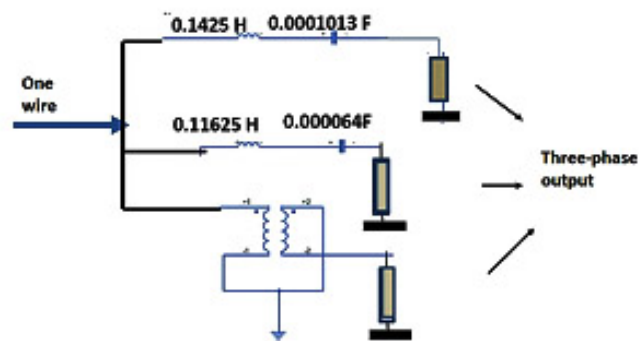


Fig 7. Converter 1 – 3

In this converter two vector we receive by phase shifts in sequenced resonance circuits. The third vector we receive by inverting input signal.

And in case of receiving signal DC one can use converter on Fig 8.

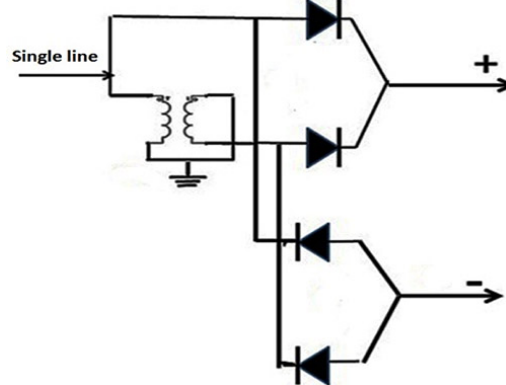


Fig 8. Converter 1 – DC

The choosing of output converter depends on the system structure and its purpose. For example, if one-wire system must implement for electrical car charging [5], DC output allows achieve simple and cheaper system.

### III. ADVANTAGES OF ONE-WIRE METHOD IN COMPARISON WITH THREE PHASE SYSTEMS

These advantages are:

- This system by three to four times cheaper. It is known, that in electrical transportation system the most expensive part is the wires
- It can be located underground. Three phase system needs distances between wires. Therefore, underground wires are practically impossible.
- One wire system doesn't need intermedium stations. Proposed one wire system is balanced systems [6]. Reactive power does not arise in it. In order to compensate for reactive power in three-phase systems, expensive intermediate stations are necessary.
- it uses the same wire like one of wires in three phase system (see explanations after Fig 5)
- low level corona effect

#### IV. RETREAT

Unfortunately, despite the obvious benefits, this one wire proposal met with objections from large electric companies, even though the underground single-wire system will dramatically reduce the number of power outages. The author did not yet receive any serious technical objections. Most of the objections seem to come from the reluctance to change a status quo infrastructure. Apparently electrical firms afraid that their incomes may decrease. The main objections are: This is not can be never. Who are you? We are working with three-phase system 120 years. But history shows that useful inventions can find correct way always. Examples of known inventors and they inventions from one city only S. Petersburg one can find in <https://ofdma-manfred.com/s-petersburgs-inventors>.

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