

A REVOLUTION IN PHOTOVOLTAIC POWER PLANTS – UP TO 70% HIGHER EFFICIENCY

Developed in the Czech Republic for the USA

now available in the Czech Republic, far exceeding the subsidy for PV power stations

Telab s.r.o. has developed and patented a more efficient photovoltaic power plant for US Holding Future Product Design Inc. (FPD), which is now also available in the Czech Republic, where it is manufactured for the US. The development and launch of production were carried out by a team of experienced developers, the quality of which is evidenced by the fact that it was supported by an EU grant of CZK 100,000,000, supplemented by the holding's own investment of CZK 200,000,000. The FPD holding plans to dominate the global market with the new PV plant. The new PV plant will deliver significant savings by generating up to 70% more energy from the same number of panels for an investment ten times lower than is typical for standard PV plants. The principle behind the higher output is the sophisticated automatic tracking of the photovoltaic panels towards the sun, controlled by software developed and manufactured exclusively by Telab on a global scale.

Efficiency is even higher, particularly in the morning and afternoon when energy demand is at its peak. At midday, efficiency is lower (but this is when energy is cheapest). The average annual efficiency of the PV system is 40% higher, which, for example, for a 100kWp PV system that sells for an average of CZK 2,500,000, results in savings of CZK 1,000,000 per year by generating more energy; without this higher efficiency, one would have to (though this is not possible on roofs fully covered with panels, so increasing output is only feasible by increasing efficiency).

As an example of calculating the payback period for additional components for a fixed installation, which converts a 100,000 kWp PV system into a tracking system, a tariff of CZK 5/kWh is used, and the fact that a 100,000 kWp PV system generates



Fig. 1 "Jack Ready" 15° with PV panel in landscape orientation

100,000 kWh of energy worth 500,000 CZK/year (specific figures for the given installation may be used). The cost of the additional tracking components that convert a fixed PV system into a tracking one amounts to only 10% of the PV system's price, which is 250,000 CZK. Furthermore, thanks to the tracking system, which has an annual efficiency 40% higher than a standard PV system, the annual energy production will generate electricity worth 200,000 CZK per year, which can be added to the profit from the fixed part

Payback on the cost of the rotating

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is practically one year, after which the tracking system begins to generate an additional 200,000 CZK per year on top of the earnings from the fixed part of the PV system, which has a standard payback period of 5 years. Over the 20-year lifespan of the PV system, the tracking component will generate an additional CZK 4,000,000, which would not be achievable on a roof fully covered with photovoltaic panels. Maintenance is included in the price of the fixed part of the PV system and must be carried out.

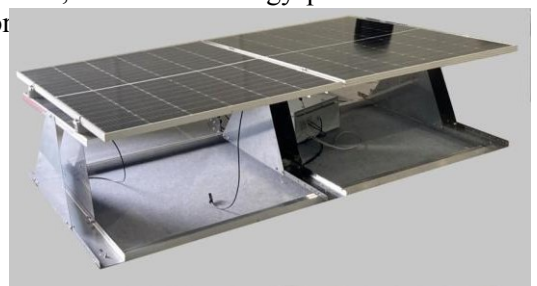


Fig. 2 Rotating PV system with an inclination of up to 45°

The standard 30% subsidy for PV systems in the Czech Republic (where available) amounts to a one-off payment of just CZK 750,000. In contrast, the rotating section generates an additional CZK 200,000 worth of energy annually. Over the years, a more efficient PV system with tilting panels will far outperform a standard PV system and the subsidy provided in the Czech Republic. Unbelievable? Come and see for yourself; we have one installed at our retail centre in Prague 4 – Háje, which you may be familiar with (it houses, for example, Alza, Auto Kelly and Lidl).



Fig. 3 The 'Jack Ready' horizontal system is a fixed structure that is ready for future conversion to a tracking PV system.

or rotating configuration, depending on current operational needs. The conversion from fixed to rotating operation is very simple and is achieved by loosening the screw connection on one side of the rotating supports that carry the panels, to the base

But the benefits don't end there. If you'd prefer to invest even less initially, you can take advantage of the modularity of the so-called 'Jack Ready' system, where you can install just the fixed part of the PV system and add the rotating components at any time in the future – for example, once the PV system starts generating a profit – for an additional investment of just 10% of the purchase price of a standard PV system. Or, for those who are sceptical, you can install our standard fixed "Jack Ready" system and wait until the pioneers have built a rotating one and it has proven itself. Then, without any worries, for just 10% of the PV system's price, you can convert it to a rotating system and start generating power straight away earning money! Why buy a standard PV system for the same price when, for the same cost, this offers up to 70% more output? Furthermore, this modularity allows the PV system to be operated in a fixed



Fig. 5 Example of a modular PV system that can be operated as a tracking PV system with higher efficiency, or as a standard fixed PV system



Fig. 6 East-west

rotation, or conversely, by installing the connection for fixed operation. Adding a rotating section to the standard fixed part of the PV system is also very simple, as the modular PV system is 'Jack Ready', i.e. prepared for the installation of a jack with pre-prepared mounting points. All you need to do is attach the rotating section to these brackets using screws, without any need to dismantle the mount or other parts of the PV system, and carry out a quick and easy installation directly on the roof, which will start generating 70% more energy.

A more efficient PV system can be achieved with panels laid horizontally at a 15° tilt with 30 cm aisles, which has the advantage not only in terms of appearance—as it has the same size and height as a standard system and looks the same— but also in that it offers the same wind resistance, meaning the same structural calculations apply, and the PV system can be installed on roofs with low load-bearing capacity.

Wind resistance can be increased by using an anemometer, which tilts the panels to a horizontal position in strong winds, offering minimal wind resistance and making it suitable even for roofs with minimal load-bearing capacity.

The new PV system is therefore modular, designed with standard fixed base modules ready for future installation of a tilt mechanism to adjust the angle according to the sun's position. It is therefore a standard fixed structure, facing south or a so-called roof-mounted system with a choice of fixed angles of 15° or 30°, which can be used for continuous operation, just like any other standard PV system, but with the advantage over such a standard system that it can be upgraded at any time to a new type of tracking PV system with up to 70% higher efficiency. This offers the advantage of a low initial investment for a standard fixed PV system; for example, once the PV system starts generating revenue, it can be upgraded with a tracking component – without any additional investment – to achieve 70% higher output at a fraction of the cost compared to investing in a standard PV system for the same increase in output. This increase in efficiency costs 10 times less than a conventional investment in a PV system expansion for the same energy gain. This is because the investment is limited to



When choosing from the standard fixed “Jack Ready” mounts available, there is an additional option for a 15° vertical angle and 60 cm aisle width. Another advantage of the PV system with higher efficiency is that standard PV panel mounts, which Telab has been manufacturing in the Czech Republic for years and has

Figure 7: “Jack Ready” mounts assembled facing south

adding a tilt mechanism and other mechanical parts to the PV system structure, and there is no need to purchase additional expensive components such as panels, mounts, inverters, etc., which remain in their original quantities.

The basic components of the new modular PV system that increase efficiency are standard fixed PV panel mounts, but they are ‘Jack Ready’ – meaning they are ready for rotation without dismantling or further work on the roof, simply by screwing on the part for the rotating section of the mount. Naturally, it is possible to install a new, more efficient rotating PV system from the outset, with the advantage of higher energy production at a far lower cost for the rotating component than expanding the PV system in the traditional way.

with a track record of hundreds of PV systems in operation over 10 years.

These fixed mounts have now been adapted to “Jack Ready”, which are available at the same price as the standard version, with the difference that they can be upgraded to swivel mounts with higher efficiency at any time. So why purchase a PV system with standard mounts where the output cannot be increased, when for the same price you can purchase “Jack Ready” modular mounts, which can be upgraded to up to 70% higher efficiency at a fraction of the cost, or utilised with this higher efficiency straight away? Moreover, these are proven products with a track record of 10 years in operation.

Using the basic components of the “Jack Ready” modular PV system, it is therefore possible to build a fixed PV system with panels tilted southwards or as a so-called canopy with an east/west tilt at standard efficiency, which can be increased by up to 70% by converting it to a tracking system.

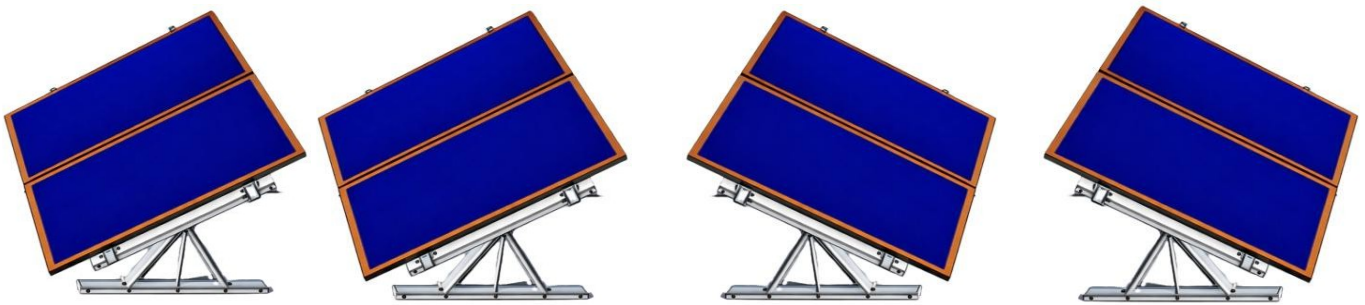


Fig. 8

For the initial fixed installation of a more efficient PV system, it is advantageous to choose a fixed system with half the panels tilted east and half tilted west, which has approximately 10–15% higher efficiency than conventional canopies. This is because, whilst canopies block the sun's rays, this system allows them to penetrate beneath the bifacial panels and generate energy by reflecting off the base surface through the open space between the brackets. This fixed system can be immediately converted into a rotating system simply by adding a lifting mechanism for a single row (for which holes are already prepared in the base, so there is no need to dismantle the brackets for the conversion), which simultaneously rotates the other rows using tie rods, which are also simply inserted into the prepared holes. The modification for the entire roof can be completed in a day by two fitters.

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Fig. 9

Fig. 9 shows the PV system after conversion to a rotating system with all panels at the same angle; in this figure, they are horizontal for midday sun rays above the horizon.



Fig. 10

Fig. 10 shows the tilt towards the east in the morning, when the advantage of the rotating system is clear, as the rays strike all panels, whereas with a fixed roof, for example, they strike only half; efficiency is therefore 100% higher.

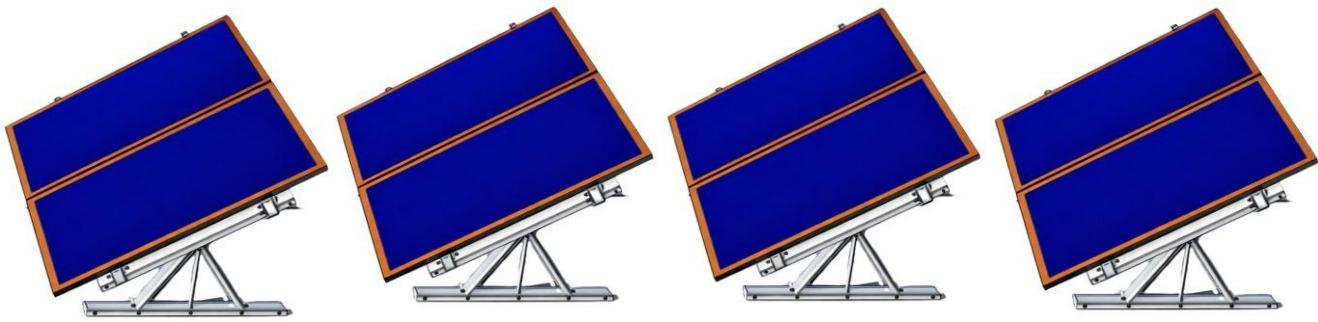


Fig. 11

Fig. 11 Shows the panel rotated westwards in the afternoon, again with 100% efficiency compared to a fixed roof system, where the rays hit only half of the panels facing west. Efficiency is also high compared to a south-facing PV system, where, particularly in the morning and afternoon, the sun shines from the east or west and the south-facing panels cannot fully capture the rays. In the morning and evening, the sun even shines from the north-east and north-west, and south-facing panels do not capture it at all. And the morning, midday, afternoon and evening hours are precisely those that are most valuable,

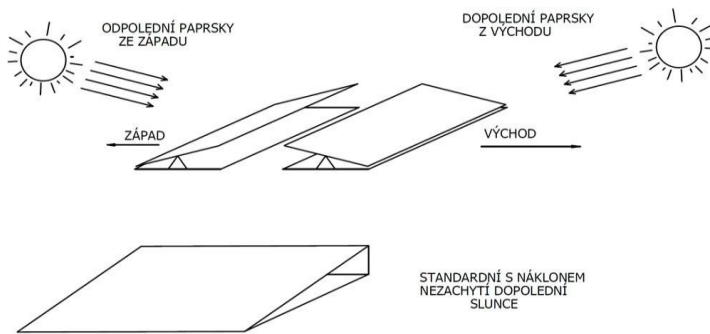


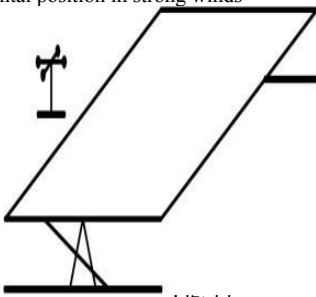
Fig. 12

The principle behind the higher efficiency of the new PV system lies in the fact that the sun, which rises in the north-east (in summer) to south-east (in winter) and sets in the north-west (in summer) to south-west (in winter), cannot fully strike south-facing panels until a certain time. At this time, however, these rays do strike the panels of the new east/west-facing rotating system, and therefore the new

PV system produces up to 100% more electricity in the morning. At this time, south-facing panels produce energy equivalent to the incidence of diffused light, which is almost negligible compared to direct sunlight. This nearly 100% higher efficiency, generated at a time when energy is most expensive, decreases at midday, when the rays also fully strike the south-facing panels; however, energy is traded at a much lower price than during the aforementioned morning and afternoon hours, sometimes even at zero

Compared to the so-called 'roof cap', which is often used on flat roofs

The anemometer tilts the panels to a horizontal position in strong winds



surface with the rays all day long; the canopy captures them in the morning and afternoon hours with just one panel, meaning that during these hours the rotating system is 100% more efficient. These are the most expensive hours. At midday the rays illuminate both panels of the roof, although not at full strength due to the panels being tilted east and west; they therefore generate

to a limited extent. However, these are the hours when electricity is traded at a much lower price than in the morning and mid-morning, and therefore, in terms of profit or savings, the rotating system remains approximately 70% more efficient than a fixed roof during the expensive mid-morning and afternoon hours, and on average 40% more efficient.

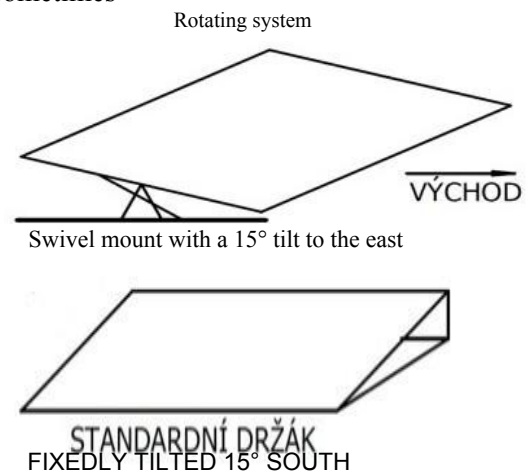


Fig. 13

It is evident from the top right of Figure 13 that the rotating system with panels laid flat has the same size and height as the fixed system tilted southwards in the figure below it, so there is no noticeable difference in appearance. Wind resistance is also the same, so the structural calculations made for the fixed system with a 15° tilt apply. Furthermore, when using the anemometer shown in Fig. 14 on the left, in the event of wind the panel tilts to a horizontal position, in which it offers minimal resistance to the wind, so it can also be used for roofs that cannot bear the heavy loads associated with the anchoring of the south-facing system and canopies.

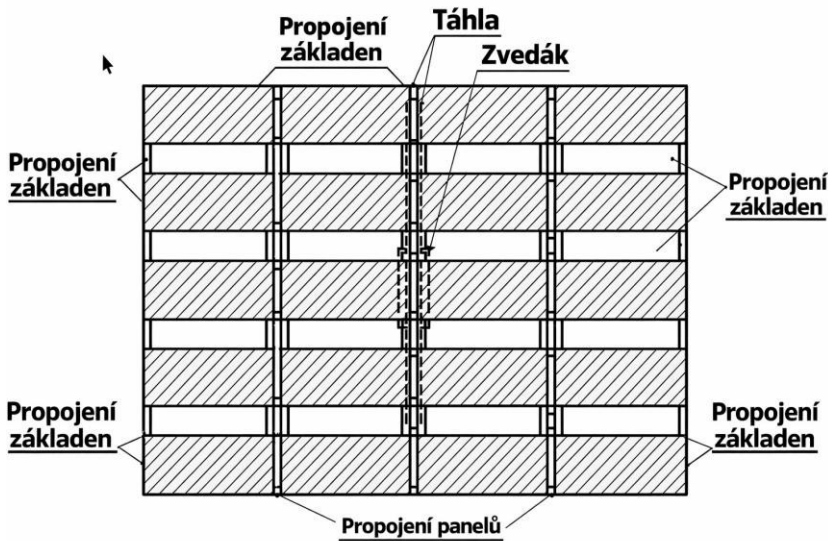


Fig. 15

Figure 15 on the left shows the rotation transmission between rows via link rods, so that only one actuator is required for up to 200 panels, depending on the roof's configuration.

From the history of the FPD holding

Finally, an interesting tidbit from the history of the FPD holding company. In 1980, the leading US firm Motorola switched to a digital switchboard and was looking for someone to buy a licence for the analogue version, which Motorola had ceased manufacturing. FPD purchased this licence and had it manufactured in Czechoslovakia by Tesla Liptovský Hradok, exporting it to the USA, among other places. This caused major problems for Motorola, as it had not been expected that Tesla would be able to manufacture the switchboard so cheaply. Tesla was selling it below cost, as Czechoslovakia was in desperate need of foreign currency at the time, so it paid off. Furthermore, it was not expected that US companies would prefer a cheap, yet well-established analogue switchboard in the US, over the new, modern digital one that Motorola had begun manufacturing. And so FPD, as the exclusive importer of this switchboard to the US, imported large quantities of these analogue telephone switchboards into the US. This reduced sales of Motorola's new digital exchanges, and Motorola protested that the licence could not be used for re-export, but Motorola had not included such a clause in the licence agreement. FPD thus became a major supplier of telephone exchanges in the US. In 1990, FPD established its European headquarters and continued its successful trade in telephone exchanges, this time also importing them from the US to Czechoslovakia from the US-based Harris Group, and dominated the Czechoslovak market ahead of companies such as Siemens, Alcatel and others, through sales to major firms such as Česká spořitelna, Benzina, ČEZ and others. Among its other activities, it participated in the construction of mobile networks for all Czech operators.

It traded on a global scale in components for mobile networks, and the purchase of the entire Vodafone mobile network during its upgrade to a new system can be considered a masterstroke; it then sold the components as second-hand parts worldwide.

At the time of the railway accident in Studenka, FPD developed a safety system designed to prevent such accidents (see videos from leading Czech and Slovak television stations <https://vimeo.com/230124297>, <https://vimeo.com/227866132>, <https://vimeo.com/235730606>) and which was also implemented internationally, e.g. in Canada, the USA and Russia. The development of a more efficient PV system for US Holding FPD was handled by a member of the TELABU holding for the USA, where there was a major boom in PV systems, slightly later than in the EU.

We are sharing these interesting facts from the holding's history to inform you that you are in the capable hands of a company with a long tradition and that you will be able to enjoy the exceptional profits made possible by the development work of Telabu's experienced team, not least because the licence has been made available by the US holding for the Czech Republic as well.

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