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# CALCULATION OF PARAMETERS OF PHOTOVOTAIC INSTALLATION FOR POWER SUPPLY OF THE REMOTE PEASANT FARM HOLDINGS

**Annotation**

In the present, about 30,000 remote farms are not connected to electricity networks and are experiencing an acute shortage in autonomous power supplies. In this decentralized zone for power supply of farms, it is expedient to use photoelectric installations. Currently, the preferred field of application of the photoelectric installations (PI) - the personal subsidiary plot (PSP) and farms (F) [1-3].

***Key words:*** The personal subsidiary plot(PSP), photoelectric installations(PI), electrification, technological processes.

## Introduction

The results of determining the consumption of electrical energy for industrial and household loads of various types of farms served as initial data for determining the parameters of photovoltaic installations in the conditions of Almaty region.

Full-scale field researches of the power consumption modes of rural consumers are conducted on the example of Almaty region farms of the livestock direction. Characteristic agro formations with different levels of electrification of technological processes were revealed in the result of the survey inspection of dairy farms, as well as medium and small farms. Farmer (F) and the personal subsidiary plot (PSP) can be classified as energy-consuming objects with a mixed production-household load [3].

**Main part:** Daily schedules of electrical loads on medium dairy farms with a livestock of 50 ... 60 animal units. Farms (F) ‘Saidov’ and ‘Astan’ are given in the Figure 1.

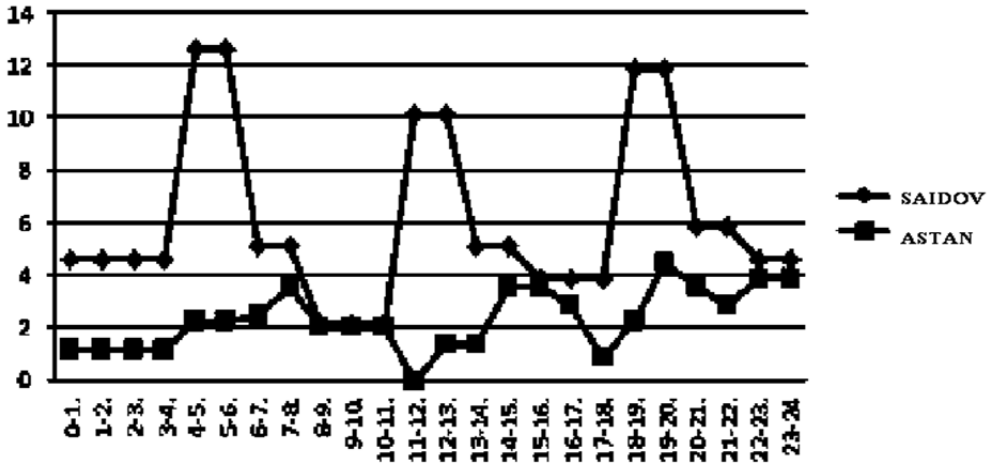


Figure 1 - Daily diagrams of electrical loads on dairy farms of the "Saidov" farm for 64 animal units and "Astan" farm for 60 animal units.

Daily schedules for small farms with a livestock of 18 … 30 animal unit. ("Ushkirbayev" farm, "Khalykov" farm) are provided in the Figure 2.

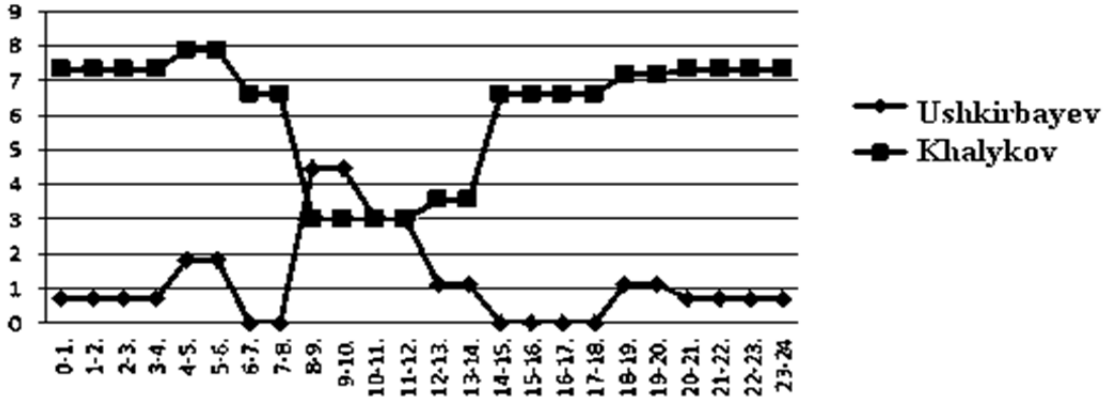


Figure 2 - Daily schedules of electric loads on dairy farms of "Ushkirbayev" farm for 18 animal unit and 20 animal unit of cattle for fattening,
"Khalykov" farm for 30 animal unit.

The analysis of electric loading schedules of the studied farms consists in the determination of the following coefficients characterizing various ratios of loadings both in size and on duration. The main factors of the schedule of electrical loads include the following factors - uniformity, filling, demand and loading, which are determined by formulas (1) .. (4). The results of the analysis and determination of the coefficients for all farms are given in Table 1.

Table 1 - Results of processing the graphs of electric loadings on farms

| № | Farms | Uniformity coefficient, $\gamma_p$ | Filling-in coefficient, $k_{зп}$ | Demand factor, $k_c$ | Load factor, $k_{зг}$ | Minimum load, $P_{min}$ kW | Maximum load, $P_{max}$ kW | Average load, $P_{ср}$ kW |
|---|---|---|---|---|---|---|---|---|
| 1 | Peasant farm «Astan» | 0,19 | 0,47 | 0,82 | 0,38 | 0,86 | 4,45 | 2,1 |
| 2 | Peasant farm «Saidov» | 0,16 | 0,48 | 0,85 | 0,41 | 2,1 | 12,62 | 6,125 |
| 3 | Peasant farm «Khalykov» | 0,38 | 0,58 | 0,9 | 0,54 | 3 | 7,87 | 4,6 |
| 4 | Peasant farm «Ushkirbayev» | 0,01 | 0,29 | 0,34 | 0,1 | 0,05 | 2,68 | 0,8 |

The analysis of data of table 1 shows that the highest values of the coefficients in the farm «Khalykov»: the uniformity $\gamma_p$ = 0,38; fillings $k_{зп}$ = 0,58; loadings $k_{зг}$ = 0,54; demand $k_c$ = 0,9.

On medium-sized farms with a livestock of 50 ... 60 animal unit. («Saidov» farm, «Astan» farm) the maximum of loading makes respectively 12.62 and 4.45 kW, respectively, and the total installed capacity of the equipment is 14.72 and 5.45 kW, as a result, the demand coefficient has the maximum values of 0.85 and 0, 82. The coefficient of uniformity with three-time milking is 0.16 ... 0.19.

For small farms with a livestock of 18...30 animal unit. («Ushkirbayev» farm, «Khalykov» farm) the maximum of loading makes respectively 4.5 and 7.87 kW, and the total installed capacity of equipment 6.32 and 7.5 kW, therefore, the demand coefficient has the maximum values for two farms - 0.71; 0.9. The coefficient of uniformity with three-time milking is 0.16 and 0.38. Based on the analysis of the electric load graphs of the studied farms, their classification by the rated capacity of electric equipment, daily and annual electricity consumption for conditions of Almaty region have determined the parameters of coefficient of photovoltaic installations for their power supply.[4]

In farming and peasant farms having small dairy farms, residential houses are located near farms therefore a type of electrical loading - production and household. The daily need for the electric power of processing equipment on a dairy farm for «Khalykov» farm makes 9,38 kW·h/days and the electrical appliances of the rural house - 4.47 kWh / day. Thus, the daily demand for the electric power of the production and household load for «Khalykov» farm makes 13.85 a kW·h / day. (Tables 2, 3).

Table 2 - Electrical demand of processing equipment of a small dairy farm

| № | Name, brand | Qty. PC. | Power $P_{уст}$, kW | Number of hours of use per day, hour | The consumed electric power, kW·h/days |
|---|---|---|---|---|---|
| Processing equipment | | | | | |
| 1 | Milking system portable «Klassik KMK-2» | 1 | 0,55 | 6 | 3,3 |
| 2 | Sanitary pump | 1 | 1 | 1 | 1 |
| 3 | Feed grinder | 1 | 1,5 | 3 | 4,5 |
| 4 | Illumination of a cowshed (LED lamps of 5 W) | 6 | 0,005 | 10 | 0,3 |
| 5 | Illumination of a calf house (LED lamps of 5 W) | 2 | 0,005 | 8 | 0,08 |
| 6 | Illumination of maternity ward (LED lamps of 5 W) | 2 | 0,005 | 10 | 0,1 |
| Installed capacity, $P_{уст}$ | | | 2,61 | - | - |
| | | | | In total | 9,38 |

Table 3 - Electrical demand of electrical appliances of the rural house

| № | Electric appliance | Qty. PC. | Power $P_{уст}$, kW | Number of hours of use per day, hour | The consumed electric power, kW·h/days |
|---|---|---|---|---|---|
| 1 | Computer | 1 | 0,2 | 4 | 0,8 |
| 2 | Refrigerator | 1 | 0,1 | 12 | 1,2 |
| 3 | TV | 1 | 0,08 | 4 | 0,32 |
| 4 | Iron | 1 | 1,4 | 0,25 | 0,4 |

| | | | | | |
|---|---|---|---|---|---|
| 5 | Electric kettle | 1 | 1,5 | 0,25 | 0,4 |
| 6 | Energy-saving LED lamp | 5 | 0,005 | 6 | 0,15 |
| 7 | Microwave oven | 1 | 0,8 | 0,5 | 0,4 |
| 8 | Washing machine | 1 | 0,8 | 1 | 0,8 |
| Installed capacity, $P_{уст}$ | | | 4,885 | - | - |
| In total | | | | | 4,47 |

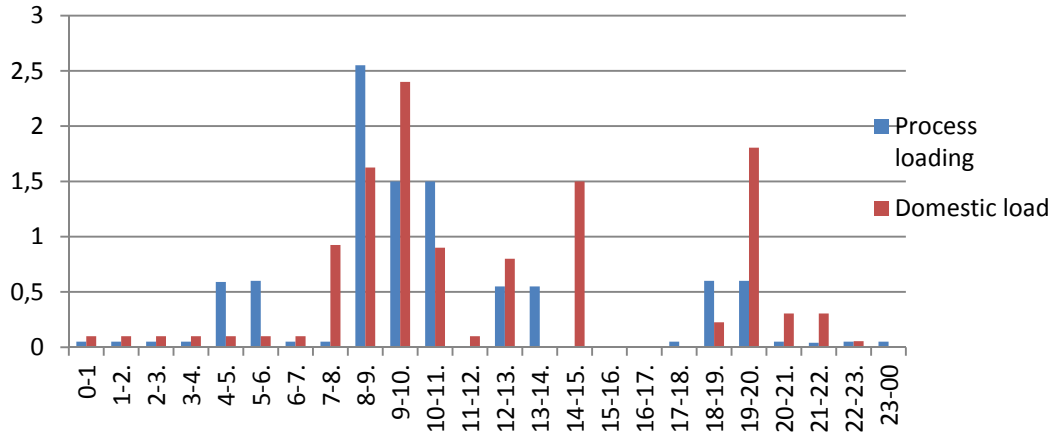


Figure 3 - The daily schedule of production and household loading of «Khalykov» farm with a dairy farm for 20 cows.

The daily consumption of electricity by technological equipment of a dairy farm and electrical appliances of a rural house is determined [5].

$$W_d = \sum_{i=1}^{n} P_{inst \cdot i} Ч_{use\ i}, \text{kW} \cdot \text{h/day} \quad (1)$$

Where, $Ч_{use\ i}$- number of hours of use of the i-th technological equipment per day, h; $P_{inst\ i}$ – installed capacity of the i-th technological equipment (power electric drive, lighting equipment and electro thermal equipment), kW.

Specific power of coefficient of photovoltaic installations [6, 7].

$$W_{sp.\ cpi} = P_{\Sigma} \cdot \eta_{сэ}, \text{ kW} \cdot \text{h}/m^2, \quad (2)$$

Where, $P_{\Sigma}$ – the total solar radiation within 24 hours for the Almaty region $P_{\Sigma}$= 9,675 kWh $\cdot\ h/m^2$, $\eta_{сэ}$ – efficiency of coefficient of photovoltaic installations.

The total area of the coefficient of photovoltaic installations of solar panels is determined by the formula

$$S = \frac{W_d}{W_{sp.cpi}}, m^2 \quad (3)$$

For «Khalykov» farm the area of solar panels for coefficient of photovoltaic installations, at a daily electric power consumption $W_d$ = 13,85 $kW \cdot h/day$ is determined

$$W_{sp.\ CPI} = 9{,}675 \cdot 0{,}14 = 1{,}35\ kW \cdot h/m^2;$$
$$S_{CPI} = \frac{13{,}85}{1{,}35} = 10{,}3\ m^2. \quad (4)$$

The results of the area calculations of coefficient of photovoltaic installations, the number of photoelectric panels with a power of 200 W for various types of farms are given in Table 4.

Table 4 – Coefficient of photovoltaic installations parameters for power supply of various types of farms

| Consumer name | $P_{inst}$, kW | $S_{CPI}$, $m^2$ | The number of panels with a power of 200 W, Pcs. | Total power of coefficient of photovoltaic installations, W |
|---|---|---|---|---|
| F of the dairy direction: | | | | |
| 1 type | 8,26 | 9,89 | 8 | 1600 |
| 2 type | 8,56 | 13,65 | 11 | 2200 |
| 3 type | 9,19 | 17,86 | 14 | 2800 |
| F of the meat direction: | | | | |
| 1 type | 4,92 | 5,92 | 5 | 1000 |
| 2 type | 5,02 | 7,4 | 6 | 1200 |
| 3 type | 5,45 | 9,34 | 8 | 1600 |

**Conclusions**

The method of calculation of key parameters and operating modes of the combined photovoltaic installation is developed for creation of energy-efficient small power systems for power supply of the remote peasant farm holdings.

For the power supply of farms of the dairy direction for F-1 (the 1st type, in Table 4) requires coefficient of photovoltaic installations, consisting of 8 panels with a total power of 1600 W; for F-2 (the 2nd type, in Table 4) requires coefficient of photovoltaic installations, consisting of 11 panels with a total power of 2200 W; for F-3 (the 3rd type, in Table 4) requires coefficient of photovoltaic installations, consisting of 14 panels with a total power of 2800 W.

For power supply of farms of the meat direction for F-1m (the 1st type, in Table 4) requires coefficient of photovoltaic installations, consisting of 5 panels with a total power of 1000 W; for F-2m (the 2nd type, in Table 4) coefficient of photovoltaic installations, consisting of 6 panels with a total power of 1200 W is required; for F-3m (the 3rd type, in Table 4) coefficient of photovoltaic installations, consisting of 8 panels with a total power of 1600 W is required.

**References**

1. Statistical collection. Fuel and Energy Balance of the Republic of Kazakhstan of 2007 2011, Astana: Agency of Statistics of the Republic of Kazakhstan, 2014, p.183.

2. *Elistratov V.V., Aronova E.S.* Solar photo energy technologies for electric power consumers. Applied Solar Energy, 2009, Vol. 45, No. 3: pp. 143–147.

3. *Nesterenkov A.G., Nesterenkov V.A., Shishkin A.A.* The efficiency of the solar module with a concentrator. //Power and Fuel Resources of Kazakhstan, 2010, No. 4. - Page 30-32.

4. Report on research (interim): Development of a resource-saving energy supply system for farms based on the multifunctional electrified process modules and a combined photovoltaic system: – Almaty, 2015. – 111 p. No. GR0115RK02201. – Inventory No. 0214 RK 02972.

5. *Chokin Sh.Ch., Syundyukov R.H.* Energy of agriculture of Kazakhstan. – Alma-Ata: Kainar, 1988.-241 p.

6. *Keshuov S.A., Barkov V.I.* Energy saving in agrarian and industrial complex based on use of renewable energy sources. – Almaty: Limited liability partnership "T.E.K. & COMPANY, 2011. – 248 p.

7. Practical recommendations for determining the specific indicators of energy consumption and the needs for fuel and energy resources in the social and engineering sphere of the village. - Moscow: The All-Russian Scientific Research Institute for Electrification of Agriculture (VIESH), 2008. - 95 p.

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## ҚАШЫҚТЫҚ ФЕРМЕРЛІК ЖӘНЕ ШАРУА ҚОЖАЛЫҚТАРЫН ЭНЕРГИЯМЕН ЖАБДЫҚТАУ ҮШІН ФОТОЭЛЕКТРЛІК ҚОНДЫРҒЫЛАРЫНЫҢ ПАРАМЕТРЛЕРІН ЕСЕПТЕУ

**Аннотация**

Қазіргі уақытта, санақ бойынша 30 мыңға жуық фермерлік шаруашылық саналуда, яғни олардың электр желілеріне қосылмаған және автономды электрмен жабдықтау көздерінің жетіспеушілігі байқалып отыр. Бұл саладағы орталықтандырылмаған шаруашылықтарын электрмен жабдықтау үшін, фотоэлектрлі қондырғыларын қолдану орынды болып табылады. Қазіргі уақытта фотоэлектрлі қондырғыны пайдалану аймақтары – жеке қосалқы шаруашылықтар мен фермерлік шаруашылықтары.

***Кілт сөздер:*** жеке шаруашылықтар (ЖШ), фотоэлектрлік қондырғылар, электрлендіру, технологиялық жүйелер.

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## РАСЧЕТ ПАРАМЕТРОВ ФОТОЭЛЕКТРИЧЕСКОЙ УСТАНОВКИ ДЛЯ ЭНЕРГООБЕСПЕЧЕНИЯ ОТДАЛЕННЫХ ФЕРМЕРСКИХ И КРЕСТЬЯНСКИХ ХОЗЯЙСТВ

**Аннотация**

В настоящее время насчитывается около 30 тысяч отдаленных фермерских хозяйств, которые не подключены к электрическим сетям и испытывают острый недостаток в

автономных источниках электроснабжения. В этой децентрализованной зоне для энергообеспечения хозяйств целесообразно использовать фотоэлектрические установки. В настоящее время предпочтительная область применения ФЭУ – личные подсобные хозяйства (ЛПХ) и фермерские хозяйства (ФХ)

***Ключевые слова:*** личные подсобные хозяйства (ЛПХ), фотоэлектрические установки, электрификация, технологические процессы.

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# О СОЗДАНИИ УНИВЕРСИТЕТСКОЙ СИСТЕМЫ ПРОВЕРКИ ТЕКСТОВ НА ПЛАГИАТ

**Аннотация**

В данной статье рассматривается проблема обнаружения плагиата в текстах, заимствованных из других источников. Дается описание разработанной университетской системы проверки текстов на плагиат, способной проводить проверку заимствований как по внутренним источникам, так и по сети Интернет. Рассмотрены различные способы «обхода» плагиата, распространенные методы и нарушения системы проверки. Результаты исследования дополняют существующие теоретические представления в области разработки программного обеспечения на обнаружение заимствования текста и открывают перспективы для дальнейших исследований и совершенствования информационной системы «Антиплагиат КазНАУ».

***Ключевые слова:*** система проверки на уникальность, плагиат, антиплагиат, программное обеспечение, уникальность информации, синонимайзер.

## Введение

С развитием информационных технологий и сети Интернет появились огромные возможности в получении самой различной информации, в том числе учебно-методического характера, полезной для самообразования и расширения собственных горизонтов, но наряду с этим появилась также проблема заимствования плодов чужого труда без указания ссылок на первоисточник. В сети появились целые сайты, предлагающие пользователям на платной и бесплатной основе скачивать рефераты, курсовые и дипломные работы. В такой ситуации в учебных заведениях остро назрел вопрос о необходимости внедрения эффективных средств борьбы с плагиатом. Одним из таких средств является создание компьютерной системы проверки текста на наличие плагиата [1,2].

Плагиат - умышленно совершаемое физическим лицом незаконное использование или распоряжение охраняемыми результатами чужого творческого труда, которое сопровождается доведением до других лиц ложных сведений о себе как о действительном авторе [3].

Цель создания подобного рода системы – повышение качества подготовки выпускных квалификационных работ и научных работ обучающихся и их мотивация к академической честности. Руководители квалификационных работ проверяют коррект-