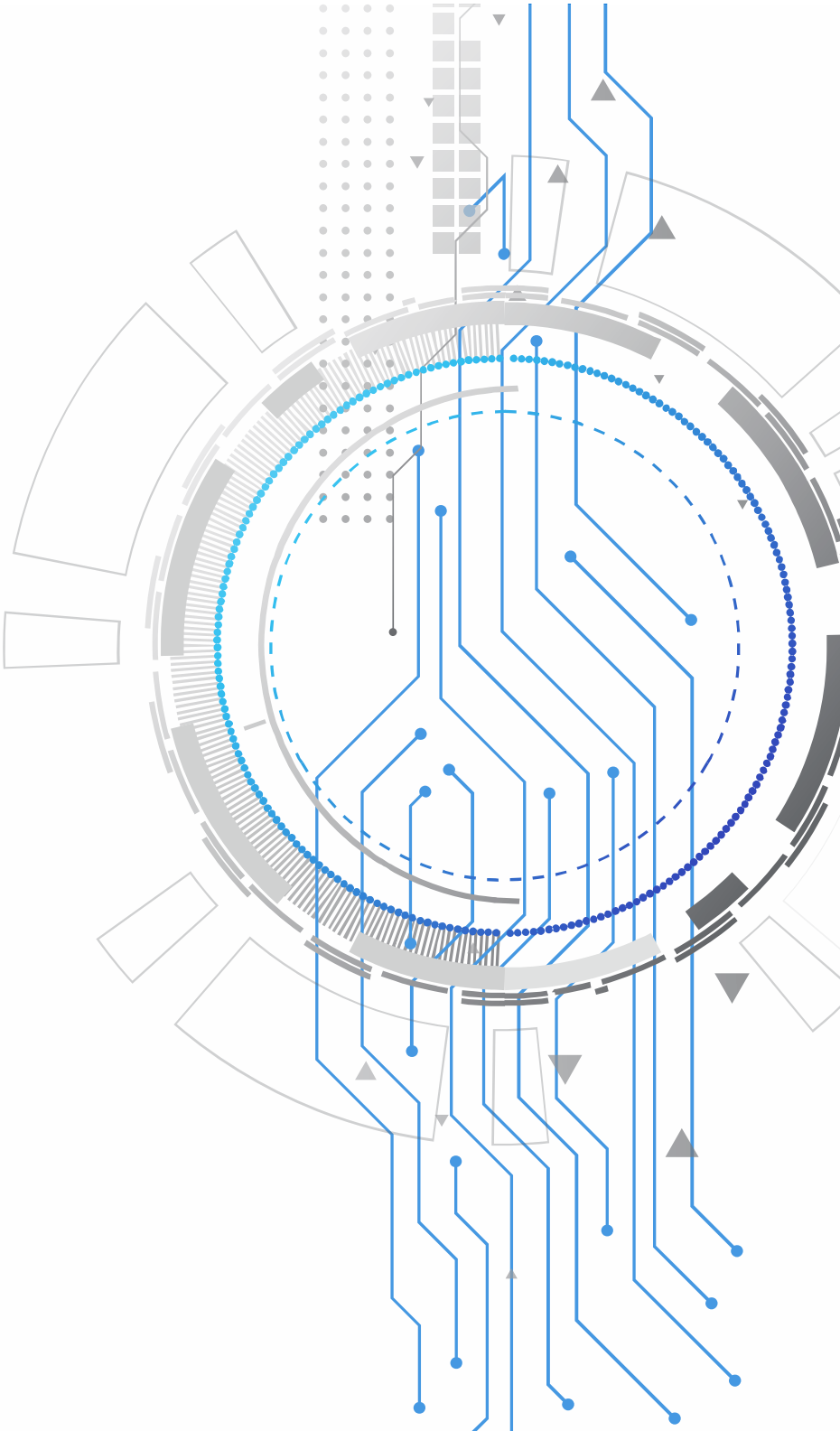
SOLARGROUP

White Paper 2018

DUYUNOV'S INDUCTION MOTORS



DUYUNOV'S INDUCTION MOTORS. ABOUT THE PROJECT

Duyunov's project is the technology of new generation induction motors essential for the modern society.

The application area of induction motors is wide and relevant for each and every of us: it's the basis of heat and water supply equipment, conditioning and ventilation systems, electric transport and even household appliances and handheld power tools.

The modern world sets its priorities in the requirements to mechanisms and technologies: we aspire to use powerful but energy efficient equipment, travel by fast but safe and environmentally friendly transport, think about saving our planet's environment.

The major auto groups have started a race for determining the best electric car producer. The most powerful world states are going to desist from using petrol and diesel engines and are formalizing it in their legislation. The age of petrol as the main fuel source is coming to an end.

Dmitriy Duyunov – the engineer and developer from Russia – has managed to put into action the trends and needs of the modern world in a specific product. He is the one who has made a one-of-a-kind invention capable of totally changing the vision of electric drive motors.

Dmitriy Duyunov together with his team has set the goal to develop and launch on the world market conceptually new electric motors that are needed in the progressively developing world.

After multi-year research the operational samples have been made, dozens of patents for the inventions have been obtained. The incontrovertible advantage of Duyunov's invention consists in the unique winding type dubbed "Slavyanka".

The essence of the technology is parallel connection of classic winding types – "star" and "delta" which allows to make a motor able to reduce power consumption manifold, protect the environment from the harmful effect and still provide high level power.

It is vital that the size of these electric motors is more compact than that of the currently used motors alongside the unlimited area of application of the former.

Currently Duyunov's electric motors have no rivals. A lot of development engineers and winding specialists in conventional motors admit that using new motor design principles with the patented "Slavyanka" winding leaves the most up-to-date electric motors far behind.

One of the much-talked-of developments based on Duyunov's technology was the induction hub motor – the electric motor installed into the wheel of a bicycle, car, scooter, motorcycle and other vehicles.

The popularity of hub motors is growing with every year. Currently all the models presented in the market are BLDC motors and have permanent magnets in their design. The raw materials for making magnets – rare-earth metals – are produced only in China. It makes China the monopolist in producing BLDC motors.

By making the world's first induction hub motor without permanent magnets in 2015, Dmitriy Duyunov presented a cheap to produce, energy efficient and environmentally friendly alternative to the world.

Duyunov started working on his technology back in 1995. A lot of research has been made (including testing in the University of Bologna and the University of Düsseldorf) and the technology has been practically implemented in various equipment and vehicles.

From 2011 to 2016, the author already patented the windings, entered into license agreements with repair facilities giving them the license for motor modernization, thus, bringing profit to these companies.

Dmitriy Duyunov has enunciated a wide range of main advantages of motors with "Slavyanka", among them – reducing energy consumption by 10 to 40%, going from energy efficiency class E1 to E3 and E4, improving motor reliability, reducing product cost due to using 30% less copper and electrical steel and others.

For launching the technology internationally, the project has chosen the way of attracting investment through crowdfunding (crowdinvesting) for the purpose of building the design and engineering enterprise with the main activity area focusing on developing customized electric motors using Duyunov's technology.

The main project goal

One of the main project goals is building a design and engineering department (D&E) and engineering center capable of implementing activities in the following areas:

- **Development and design of new customized electric motors using the unique combined winding technology "Slavyanka"**
- **Redesigning motors used by customers by applying the combined winding technology "Slavyanka"**
- **Producing own motors in pilot batches**
- **Setup of electric motor production at the customer premises (introducing the technology, making the tooling, choosing the equipment, training the employees, etc.)**

The construction of the enterprise is planned on the territory of one of the special economic zones of the Russian Federation (SEZ) due to a range of reasons, such as: free infrastructure, tax relief, convenient location and traffic interchange.

At the current stage, the project application for obtaining the resident status in SEZ "Technolopis Moscow" at "Alabushevo" site located not far from Moscow is being processed.

For achieving the goal, the project is attracting investment by means of crowdfunding (crowdinvesting) for implementing the project in the amount of $40,000,000 in the course of 3 years. The investments attracted in the project are disbursed stagewise in accordance with the project implementation plan.

Any individual from any world country can take part in the project. In order to do that, you need to register in the backoffice, replenish your account and purchase the company investment package.

The raised funds are spent on developing the technology, purchasing the required equipment, repairing and equipping the production areas and research laboratory, creating tangible and intangible company assets, building the design engineering department and marketing costs.

Our clients are:

20 000 +

companies producing electric motors that will be modernized using out technology

5 000 +

Motor vehicles manufacturers that can produce electric motors inhouse

The project structure is presented by the following companies:

OOO "SovElMash" – the implementer company that attracts investment and carries out the practical implementation of the project.

OOO "AS and PP" – the author and holder of Duyunov's technology, research and development enterprise of technology and innovation type. The company **OOO "AS and PP"** was founded in 2001. It specializes in energy saving technologies, development of plasma, welding, power supply and lighting technologies. It has been long known in the market since it's been modernizing electric motors using Duyunov's technology for many years and it also sells the license for this activity to other companies. The company is also known for selling the plasma cutter "Gorynych".

SolarGroup Limited – the company that organizes the process of attracting investment to OOO "SovElMash", presents the interests of the investors and has the 50% share in **OOO "SovElMash"**. The company responsibilities include marketing support of crowdfunding, organizing the investment facilitating system in the form of backoffice and payment acceptance function as well as preparing the legal base for accepting the investments from micro investors.

The company SolarGroup Limited has been established on the foreign state territory where crowdinvesting is regulated by law unlike in the Russian Federation. Moreover, it allows to legally attract investment not only in Russia but also worldwide, acting in accordance with the international legislation standards.

For a bit more than a year of its financial activity, Duyunov's project has attracted over 7,500 investors and $7,500,000 of investments.

We are offering you to become part of a project that thanks to its uniqueness and being in demand will take the leading positions all around the globe.

THE ISSUES
ELECTRIC MOTORS
IN THE WORLD

SOLARGROUP

10 000

INDUCTION MOTOR TYPES

7 BILLION

INDUCTION MOTORS ARE PRODUCED

60%

OF WORLD ENERGY IS CONSUMED BY INDUCTION MOTOR

13

INDUCTION MOTORS PER EACH PERSON ON EARTH

Using the old technologies, humanity will inevitably face the following problems:

- High cost of producing electric motors (due to using obsolete technologies)
- Environmental pollution
- Loss of efficiency
- Electric motors fleet wear of over 80%

WHAT SOLUTION WE OFFER

SOLARGROUP

COMBINED WINDING TECHNOLOGY "SLAVYANKA"

THE COMBINED WINDING TECHNOLOGY "SLAVYANKA" SOLVES THESE ISSUES AND PROVIDES THE FOLLOWING ADVANTAGES:

- Saving electrical energy up to 40%
- Reducing the motor production cost by 50%
- Changing the motor energy efficiency class from E1 to E3 or E4
- Improving reliability (service factor – 2.5)
- Increasing starting torque by 55%
- Reducing inrush current by 55%
- Significant reduction of noise and vibration level

TOP 10 TECHNOLOGY APPLICATION FIELDS

1. **Electric transport**
   - electric cars
   - electric bicycles,
   - hoverboards
   - electrically powered seacrafts and riverboats
   - hoverboards
   - electric aircarfts
   - elevators, escalators
2. **Handheld power tools**
   - angle grinders
   - plasma cutters
   - screwdrivers
3. **Home appliances**
   - air conditioners
   - ventilators
   - vacuum cleaners
4. **Space technology**
   - life support systems
   - equipment used in space
5. **Construction equipment**
   - cranes
   - load hoists
6. **Medical equipment**
   - wheelchairs
7. **Equipment for electrical power generation**
   - hydro and heat power plants
   - wind power plants
   - other power plants
8. **Military equipment**
   - tanks and other mobile machinery
   - radar equipment
9. **Equipment for extraction and processing of mineral resources**
   - drilling rigs
   - mining machinery
   - rinsing and cleaning equipment
10. **Production and industrial equipment**
    - reciprocating compressors
    - air ducts
    - hydraulic pumps
    - production machines

SOLARGROUP

Where the technology has already been applied

In the course of work on the technology we have been contacted by dozens of activist groups, received a lot of cooperation offers from various fields.

The result of partnership with a range of companies is the operating technology application samples. Here is just a small part of them:

The first Russian electric car Zetta equipped with four hub motors

ZAZ car in a car race in Monte Carlo

Motor with “Slavyanka” on a trolley bus in Kiev

Mining electric locomotive ERA with our motor

Electric bicycles with the induction hub motor

The race winners from «KAMAZ-Master» sport team (generator with “Slavyanka” winding)

Duyunov's hub motor on IRBIS scooter

Our hub motors for wheelchairs

The technology application scope is so wide that it can be successfully used for making a screwdriver and icebreaker alike! For the long time of work, we have repeatedly proved that our deeds match words. And the results of the engineering company that is being built will substantially extend the list of new implemented projects.

Hub motor as one of the technology development courses

One of Duyunov's most well-known developments is the hub motor.

It's important to understand that the hub motor is only one of the effective motors made using the combined winding technology “Slavyanka” and the technology itself allows both to create new motors and redesign the current motor fleet that amounts to 10,000 units.

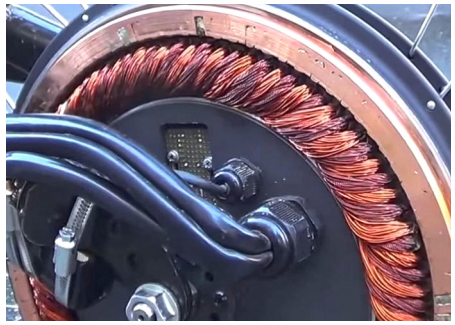
A hub motor is an electric motor installed into the wheel of a bicycle, car, scooter, motorcycle and other vehicles. The motor is put on a shaft which provides the drive without any additional elements, such as a cog wheel or chain.

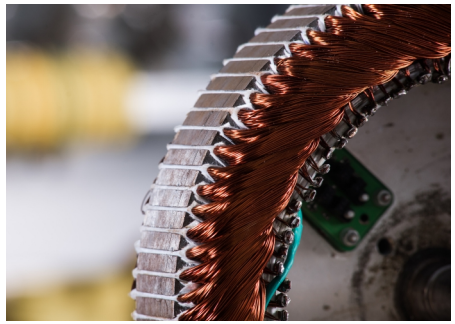
Currently there are the following operating samples of hub motors made using the technology:

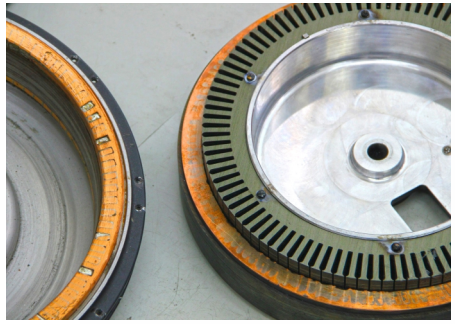
- **10 kW hub motor for wheelchairs and electric bicycles**
- **20 kW hub motor for electric bicycles**
- **27 kW hub motor for electric scooter**
- **Hub motor for electric cars**

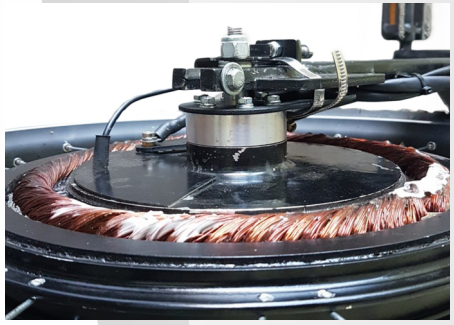
Each of the samples has been tested by hundreds of professionals in the field of electric transport and ordinary people and rated highly.

Dynamics, power and compact size – these are the features of our hub motors.









Comparing hub motor types

+ INDUCTION MOTORS WITH "SLAVYANKA" WINDING	− BLDC MOTORS WITH PERMANENT MAGNETS
THE MAIN	
+ No brake force with the power turned off: • possible to coast • easy to spin pedals + High-efficiency regeneration	− Powerful brake force with the power turned off: • not possible to coast • hard to spin pedals − Regeneration is hindered
PERFORMANCE	
+ Maintaining torque at any revolutions + Controllable overload capacity, depends on currents + Maintaining coercive force throughout the whole lifecycle irrespective of operational conditions	− Significant drop of torque with the revolutions increase − Overload capacity is limited by induction of magnets − Loss of coercive force with time. The loss rate depends on operational conditions − Motor power will decrease with time
RELIABILITY	
+ Almost fully proof to physical effect + Not sensitive to ferromagnetic powder + Not moisture sensitive + Half of hub motor is motionless, good cooling system + Possible to use cable of any width	− Sensitive to physical effect. − On impact they get demagnetized and can crumble (magnets are fragile material) − Sensitive to ferromagnetic powder: − Difficult to repair, can be damaged in operation − Moisture-sensitive, rust and can get unglued − Need in airtightness makes organization of cooling system difficult − Power cable width is limited by diameter
AVAILABILITY	
+ Low cost + Availability of materials and raw material suppliers + Independence from other countries + Easy to produce	− Cost is higher − A small number of raw material suppliers − Everything is patented and monopolized, dependence on China − Shortage of raw materials in the market, these materials are hard to produce and process

Mass production of motors based on Duyunov's technology

Currently the project partners in partnership with Denzel, under the license agreement with OOO “AS and PP” developed, tested and started the mass production of DA-90S electric motor – the motor Y2-90S-6 produced in China, modified using “Slavyanka”-type winding.

The motor has been successfully tested on the motorcycles Rush3 by Denzel and Honda Café Racer, electric cars Denzel Mini and Pickman. In the course of testing, the motor demonstrated the power of 8.5 kW (whereas the power of the original is only 750 W) and high torque from the start (with the current 2-3 times lower than the original).

Today the motor has been put in mass production and is available for purchasing.

Another motor with “Slavyanka” winding - DA-100S is under development.

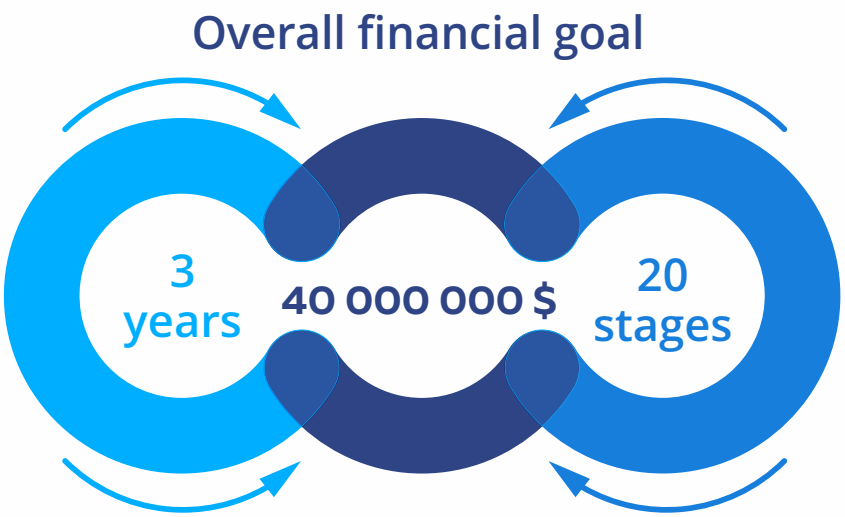
18 patents for Duyunov's developments
were obtained for his technologies for the period from 2011 to 2018

RU 2568672 (20.11.2015)	Low-noise energy efficient electric drive
RU 2569214 (20.11.2015)	The method of cooling a vehicle electric drive
RU 144399 (20.08.2014)	Combined winding of a drive induction motor
RU 107648 (20.08.2011)	Energy saving drive for electric transport
RU 109055 (10.10.2011)	Drive system of a vehicle
RU 117117 (20.06.2012)	Hybrid vehicle drive
RU 132271 (10.09.2013)	Single layer combined winding of an electric machine for Z=24
RU 2538266 (10.01.2015)	Combined winding of an induction machine for 2p=4, Z=36
RU 2528179 (10.09.2014)	Combined winding of an induction machine for 2p=2, Z=18
RU 132272 (10.09.2013)	High-torque induction electric machine
RU 150824 (27.02.2015)	Low-noise induction motor
RU 109934 (27.10.2011)	Rotating induction machine
RU 113090 (27.01.2012)	Rotating induction machine with combined winding
RU 2562795 (10.09.2015)	Winding of bipolar three-phase electric machine for Z=18
RU 2507664 (20.02.2014)	Low-noise induction motor
RU 111724 (20.12.2011)	Electric AC machine winding
RU 111723 (20.12.2011)	Induction motor winding
RU 2568646 (10.09.2014)	Combined winding of an electric machine for 2p=12, Z=36

How the project is funded

5 advantages of owning investment shares

1. Individual asset ownership
2. Getting dividends from the company's profit upon exchange to registered shares
3. Existing legislation
4. Limited number of shares
5. Inheritance and transfer of rights for shares after the end of financing



The project overall financial goal is $40,000,000.

The sum is planned to raise in 20 project stages taking 3 years to complete.

The project financing is carried out by means of selling investment shares to the participants. The investment shares are grouped into packages from $500 to $50,000 with an opportunity of purchasing the package via either a single payment or instalment plan. The shares are sold with a discount (venture bonus) that decreases with every new project stage. With every stage, the price of the company shares will increase since the possible investor risks are reduced to a minimum.

By purchasing the investment package, every investor becomes the company co-owner.

After the project implementation, these investment shares will be exchanged to securities in the form of registered shares of the future enterprise under the investment agreement signed by the investor and in accordance with the legislation.

Upon the project implementation and the company's making profit, the shares provide the investors with the opportunity to get profit in dividends. The investor will also have the opportunity to sell their shares on the stock market after the company's IPO.

Investment agreement – legal protection of investors

Investment agreement is the legal platform of the relations between the project of “Duyunov’s induction motors” and the investor.
The document consists of the main part and schedules placed in 12 pages.

Solar Group Limited
https://solargroup.pro

INVESTMENT AGREEMENT
№2448 dated as 01.07.2017

Ivan Ivanov, hereafter named the Investor acting as a natural person as the party of the first part, and company **SOLAR GROUP LIMITED**, hereafter named Investment Recipient or Company represented by Sergey Semenov acting under the Charter as the party of the second part, together named Parties and individually – the Party, have entered into the current Investment Agreement (Agreement hereafter) as

ДОГОВОР ИНВЕСТИРОВАНИЯ
№2448 от 01.07.2017

Иванов Иван Иванович, именуемый(ая) в дальнейшем Инвестор, действующий(ая) как физическое лицо, с одной стороны, и компания **SOLAR GROUP LIMITED**, именуемая в дальнейшем Получатель инвестиций или Компания, в лице Сергея Семенова, действующего на основании Устава, с другой стороны, вместе именуемые Стороны, а

The agreement is signed electronically once only and is the indispensable condition for the project participation.

Project road-map

2017

1

2

3

46 200 participants
4 500 investors
200 million roubles in investments
915 partners around the world

2018

4

65 263 participants
5 083 investors
300 million roubles in investments
1964 partners around the world

PROJECT START

Project financing stage 1 (May 2017)

- *Backoffice startup*
- *Attracting the first investments*

Project financing stage 2 (September 2017)

- *Specifying the list of required equipment*
- *Selecting the suppliers and placing the orders for the equipment supply*

Project financing stage 3 (December 2017)

- *The construction lot in SEZ "Technopolis Moscow ("Alabushevo site") is coordinated*
- *New premises for the production areas are leased, repair works are started*
- *The testing laboratory is implemented, the test bench equipment is put into action*
- *Motor testing in the new "SovElMash" laboratory is started*
- *The second live meeting with the investors is held in Moscow*
- *Duyunov's technology gets the support of Weihai Department for developing motor modernization under the license of "AS and PP" in China*
- *The reference guide on combined windings authored by Duyunov is published*

Project financing stage 4 (02.04.2018)

- *The repair works and mounting of the main equipment is completed in all company premises*
- *The testing of motors and hub motors is started*
- *The investment agreement as the legal platform of the relations between the investor and company is launched*
- *The commitment letter from a major partner concerning additional funding of the project if necessary is received*
- *Documents for obtaining Alabushevo resident status are revised in accordance with the comments and re-submitted*
- *A new application is filed to Rospatent*
- *Part of the edition of the reference guide on combined windings passes into the ownership of "SovElMash"*
- *The agreement with a major investor about building a plant producing combined winding motors in SEZ Chaplygino, Lipetsk is formalized*

5

100 000 participants
7 500 investors
450 million roubles in investments
2500 partners around the world

7

PLANNED ACTIVITIES

2019
2020

Project financing stage 5 (July 2018)

- *Our own laser equipment is installed and put into operation, the first parts of the future electric motors are produced*
- *The testing area and casting floor are put into operation*
- *Preliminary agreements with the potential customers are signed*
- *We start testing our own controller*
- *Our partners in China in cooperation with Denzel start mass production of DA-90S motors (developed using Duyunov's technology), the production of DA-100S motors is being prepared*
- *The first patents with "SovElMash" as their rightholder are obtained*
- *The front office in Khimki is opened*
- *As part of the laboratory qualification, "SovElMash" is assigned the developer company decimal number*

Stage 6 is skipped due to going ahead of the plan
Project financing stage 7 (October 2018)

Planned activities

- *Opening the front office in Moscow*
- *Developing the work of regional representatives*
- *Obtaining the permit for building a plant in SEZ Alabushevo*
- *The start of building a design engineering department in SEZ Technolopis Moscow ("Alabushevo" site)*
- *Establishing the design engineering department and engineering center*
- *Defining the methodology and "SovElMash" laboratory qualification*
- *Signing partnership agreements with new customers*
- *Producing the first pilot batches of the motors for demonstrating the technology and measuring the performance*
- *The start of building a design engineering department in SEZ Technolopis Moscow ("Alabushevo" site)*
- *Re-designing motors used by a customer applying the combined winding technology "Slavyanka"*
- *Beginning the development and designing of new electric motors for the customers using the unique combined winding technology "Slavyanka"*
- *Setup of the electric motor production on the customer premises (introducing the technology, making the tooling, choosing the equipment, training the employees, etc).*

Project financing stage 20: Accomplishing all project tasks and goals

THE BEST TIME FOR FINANCING IS NOW!

SOLARGROUP

There are the following reasons for that:

- World transport modernization, acute need in finding environmentally friendly and efficient electric substitutes
- The market tendency to improve the product along with reducing the production cost due to the market saturation and competition
- Need in more up-to-date passenger transportation solutions
- The efficiency of the products produced using our technology, readiness to mass production
- Unique financing conditions granting the right to become the company co-owner
- Unique opportunity to become the co-owner of the asset that will keep on growing for many years

The main goal that requires financing for its implementation:

Establishing the design and engineering department and engineering center capable of developing the following activity lines:

- development and design of new customized electric motors using the unique combined winding technology “Slavyanka”
- producing our own motors in pilot batches

After the design and engineering department is built and put into operation, the company will make money on:

- developing customized electric motors
- selling license for the right to produce motors using our technology
- selling production equipment and tooling
- selling the end product (electric motors, hub motors)

International partners

For the moment, the company has entered into preliminary agreements for the developments with over 10 companies worldwide.

Denzel/OOO “AS and PP”

The project partners headed by Victor Arestov are cooperating with the company Denzel in China (Weihai province).

Duyunov’s technology got the support of Weihai Department and was included into the program of Weihai Innovation Center.

Currently the project partners under the license agreement with OOO “AS and PP” developed, tested and started the mass production of DA-90S electric motor – the motor Y2-90S-6 produced in China, modified using “Slavyanka”-type winding. The motor is available for purchasing.

Another motor with “Slavyanka” winding - DA-100S is under development.

The technology is in the focus of attention in China, the achievements of our partners are made public at various conferences and symposiums and in Chinese mass media, which contributes to active popularization of the technology worldwide.

International partners

Marussia motors

Nikolay Fomenko – one of the company's founders – has a high esteem of the technology as being very promising for using within the framework of implementing the sports car developed by Marussia Motors. The engagement agreement has been signed.

Nikolay Fomenko's review (the head of Marussia Motors):

"I have never tried anything like that before, trust my experience! This work is unique!", - he said after a test drive of a bicycle with our hub motor.

Nikolay said that Marussia Motors was planning to make an electric car based on the sports car developed by the company. And he views Duyunov's technology as being the most promising from everything presented on the world market for cooperation in this area.

On November 13, 2017 Nikolay Fomenko visited Dmitriy Duyunov's showroom for the second time. This time Fomenko came together with the representatives of a foreign company interested in this development. "The technology is interesting due to its application versatility and ability to cope with a whole range of tasks not only in mechanical engineering, but industry on the whole ", - the guests summed up in the course of the talks.

The visit resulted in signing the non-disclosure agreement and engagement agreement. The talks will continue.

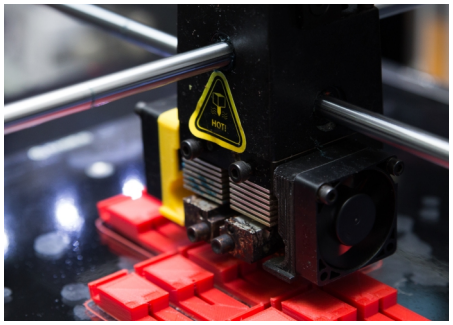
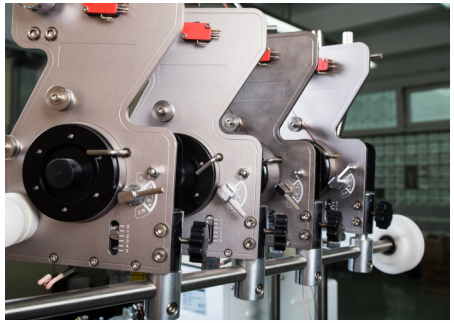
A thousand of winding specialists

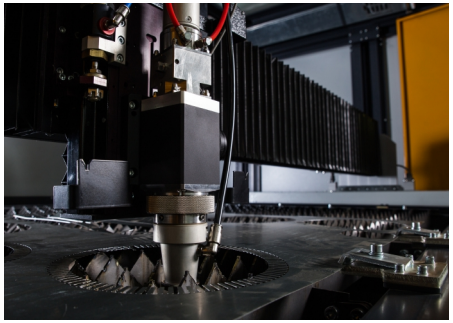
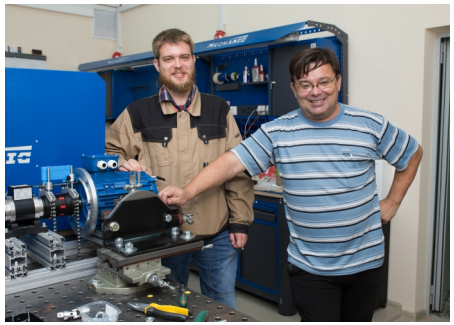
Nowadays over one thousand specialists in electric motor rewinding use Duyunov's technology for modernizing the existing motors under the license agreement with the company.

SOLARGROUP

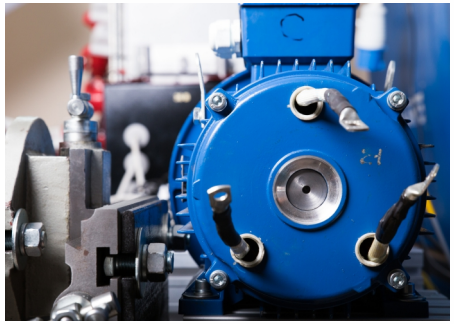
What has been done using the first investments?

Today most of the planned activities have been accomplished: the required equipment has been purchased and the testing laboratory and testing area are equipped. The test bench is used for testing daily, the casting and laser equipment as well as the winding machine are put into operation. The 3d printing machine is used for making prototypes.




OUR TEAM

SOLARGROUP

Concept, business implementation and technology

Dmitriy Duyunov
Development engineer,
patent holder

Evgeniy Duyunov
Engineer, technologist

Igor Korkhov
Engineer, technologist

Engineering team includes more than
10 development engineers
and keeps on growing

Investment founders

Sergey Semenov
Speaker, head of the financial
department

Ivan Saltanov
IT implementation
of the financial platform

Pavel Philippov
Speaker, the head
of financial planning

IT team of project support
and technical analytics