



Environmental

**BEST Friend**

Transformers





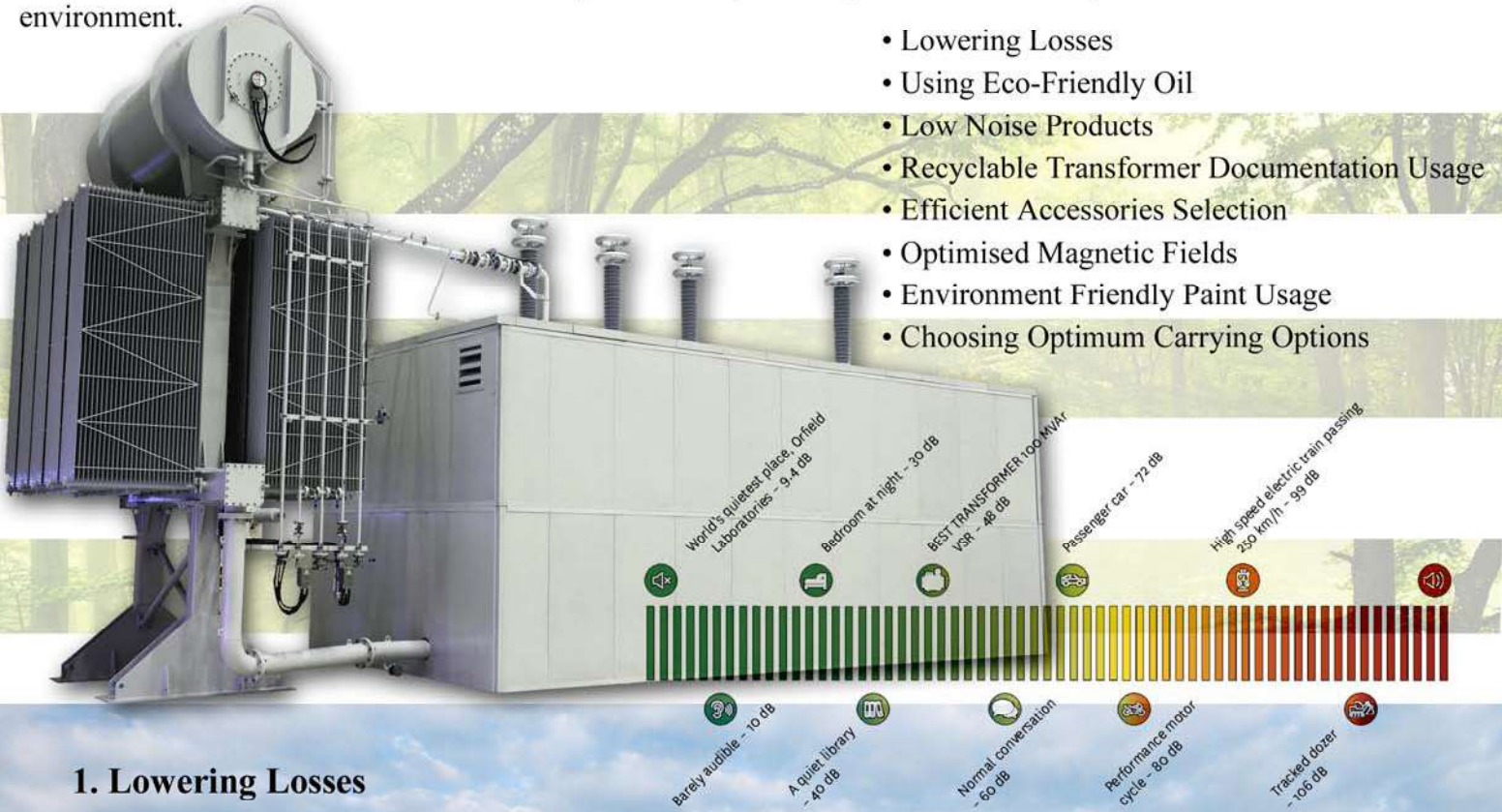
Environmental "Best Friend"

## TRANSFORMER

As Best A.Ş., we aim to reduce the negative impact on the environment by making improvements to reduce carbon footprint. For this purpose; we developed "Best Friend" concept for transformers, which you can prefer when making transformer investment and do better things for earth.

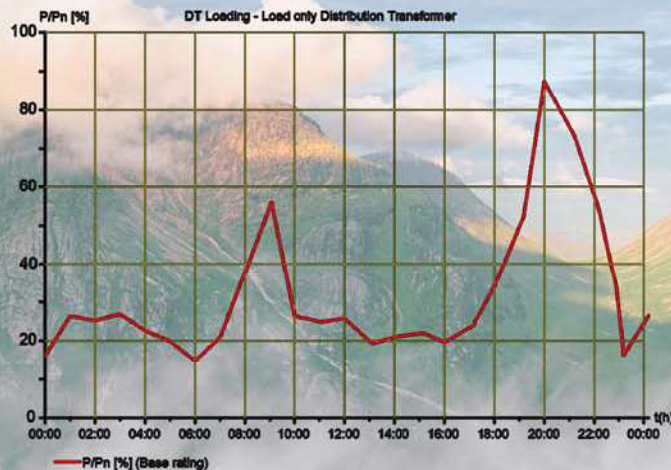
"Best Friend" transformers have optional improvements that could be chosen from list below. It will help you choose the best product that most eco-friendly and fits to your budget. You could compare the effect of each item to environment.

- Lowering Losses
- Using Eco-Friendly Oil
- Low Noise Products
- Recyclable Transformer Documentation Usage
- Efficient Accessories Selection
- Optimised Magnetic Fields
- Environment Friendly Paint Usage
- Choosing Optimum Carrying Options



### 1. Lowering Losses

BEST is working to fulfill its responsibilities towards nature with your help. One of these studies is about the losses of the transformer. These losses vary as each transformer is different, but BEST can provide solutions in any case. This losses means; more energy is wasted and more price is paid for these losses (Picture 1 and 2).



PIC 1 - Normal Load Load Graphic [1]



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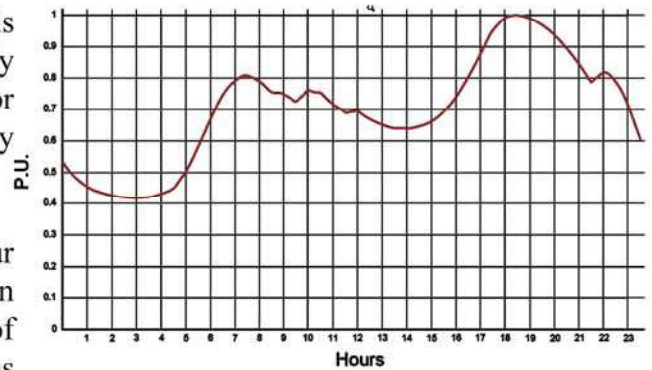
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The connection between Turkey's electricity emissions factor and energy consumption is help us to reduce carbon footprint of transformers. Because when we multiply energy consumption of the transformer with the emission factor, we find CO2 emissions. The difference between high loss and low loss transformer could be seen in Picture 3, which additional carbon emission is more than 584 tonnes and spent energy is more than 1150kWh per year.

The low loss of the transformer does not only reduce the effect on the environment, at the same time, it reduce its temperature rises and increase system efficiency. This advantage will prolong the life of your product. The average amount of CO2 that our staff working in the production of transformers gives to the nature is 4 tons a year (0.456kg CO2 per hour). We take care this constant and manpower effort at calculation.

In addition, a tree consumes (average) 6.5 tons of CO2 per year. Planting trees that equivalent CO2 release of transformer is reduces the carbon footprint of product. Transformers are already working with high efficiency i.e. low losses., planting trees for losses means that our transformers carbon footprint will be very low.

With Best Friend concept transformers; according to your loading conditions, optimum losses and low carbon emission product could be decided. You could ask for carbon report of product to our sales team. As per this concept, you could help us to plant more trees and fight with global warming and carbon emissions.



PIC 2 - Heavy Load Load Graphic [2]

## 2. Using Eco-Friendly Oil

Most of the main materials that used in transformers could be recycled. As a result; a product with high efficiency with high recycle ratio is very environmentally friendly. Beside that; one of the most critical material that used in transformer is oil and the effect of oil to environment is could not be underestimated. If not managed well, standard petroleum based transformer oils could cause environmental crisis, but you can change that with vegetable- based oils.

With considering effect of transformer oil to environment; natural oils have no less advantage than standard oils as electrical and mechanical characteristics. Beside that; they could be easily biodegradable and have higher fire performance. As our customer, if you choose to go with vegetable-based oil; it will be manufactured with recycled material and this will result as low carbon emission [4]. Additionally; in case of a leakage in transformer, additional to oil pit solution, your oil's 98% will be dissolved in nature, in less than 1 month time. Vegetable-based oil also have great fire performance, which acts as extinguisher. By choosing Best Transformer with natural oil, you will protect the environment, together with your equipment.

Power transformers have approximately 30 tons of oil in tank.



Pic 3 - Difference of yearly energy and carbon-dioxide emission between high loss and low loss 100MVA transformers (\* under normal loading conditions)



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### 3. Low Noise Products

With increasing population and distributed energy systems; substations and transformers are getting closer to cities. This shows the importance of transformer effects to environment. For that reason, Best developed low noise transformers to protect human health.

There are more than one solution to reduce noise in Best Transformers. According to NEMA standards or even lower noise levels as per customer requirement, could be satisfied. Best manufactured "World's most silent 100MVAR reactor" in 2017, which is as silent as a library. With reduced noise levels, environmental and human health will be protected.



PIC 4 - Best Transformer with noise enclosure



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### 4. Recyclable Transformer Documentation Usage

As BEST A.Ş., we care about nature and we are working to provide a greener world for future generations. You can suppose our IBT files that made from recycled paper like a small example. However, we do not only help to protect the forests, but we also prevent water pollution as the amount of waste that is generated decreases accordingly. Because 17 tons of wood, 26 tons of water and 2 barrels of oil are being saved in the production of one ton of recycled paper. Our IBT files consist 1200 pages (average) and its weight is 6. This saves 42 gallons of water and 1.92 liters of oil. In addition, the use of recycled paper in recycling can reduce air pollution by 74%, water pollution by 35% and water use by 45%. For this reason, BEST A.Ş. pay great attention to these small steps. If you want, we can also provide you with the most environmentally friendly method, just digitally sending iBT.



PIC 5 - 7000 gallons of water, 17 trees and 2 barrels of oil are recovered for 1 ton of recycled paper application. [6]

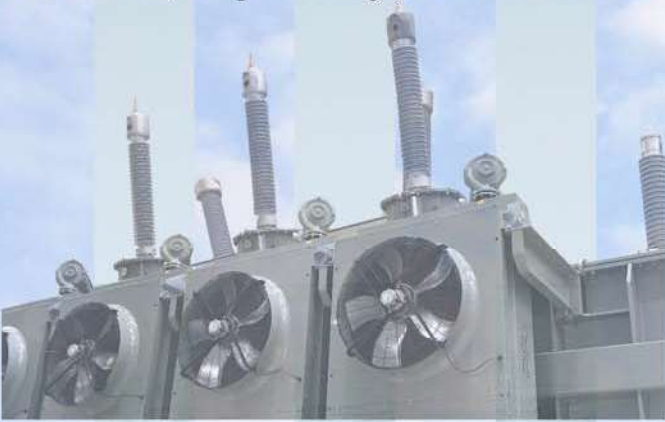


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### 5. Efficient Accessories Selection

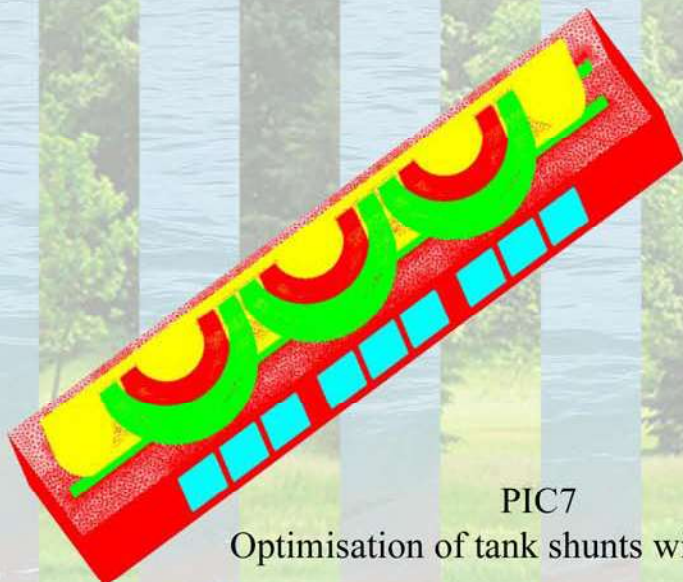
Fans and pumps that cause high energy consumption in transformers; new generation, nature friendly, are cared to be more efficient. In this way more energy is saved and less carbon emission is created. When compared with fans that AC motors according to ErP 2015 standards, Green-Tech EC motors provide efficiency in excess up to 90%. In the pumps, which are planned to be used, design and easy installation has a big importance too. Besides, considering the lifetime cost; leakproof design, low noise and low vibration levels are obtained.



PIC 6 - Fans and pumps could be chosen with higher efficiency values.

### 6. Optimised Magnetic Field

Transformer is an electromagnetic energy converter device and magnetic field is used effectively in it. With that way; efficiency values rise more than 99%. Even with this high of efficiency, stray losses inside the transformer could create additional loss and heat on tank walls. Tank shunts are the best way to solve that problem, not just the stray losses; ElectroMagnetic Compatibility (EMC) values could be reduced with optimum shunt design too. This will result as protecting the all living creatures near the transformers.



To protect the environment and creatures, extra effort is performed during design. Magnetic field analysis are made with precision. This will lead to optimum shield placement and optimum material usage. Distance between, height and depth of shields are calculated with consideration of material and production limitations. At last; with BEST experience, best and most environment friendly solution is provided to customers.

PIC7

Optimisation of tank shunts with FEM



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### 7. Environment Friendly Paint Usage

With "Best Friend" program, we are using water based paints instead of solvent based paints we used before.

While paints are drying, they spread vapour which includes carbon, as named VOCs (Volatile Organic Compounds). Addition of the harm of these substances to the nature, they are also dangerous for human health. While typical solvent based paint can contain 30-50 percent VOCs, water based paints we used in ECO-Best program, contains 8-15 percent VOCs. This means: When we think that average 450 kg paint is used for a 100 MVA transformer; we reduced the consumption of organic compounds about 150kg per transformer. By choosing this new paint, you can reduce the effect of transformer on nature to the minimum levels by facilitating the recycling of the transformer.



PIC 8 - You could ask for environment friendly paint.



PIC 9 - Carbon emission values of a 200tonnes load which will be transported to 600km distance.[12]

### 8. Choosing Optimum Carrying Options

As company, we want to follow the carbon effect of transformers from material supply to transformer transport. As you can see from picture 11; sea route is the most friendly transport method. The most critical point in determining the transport method is that we cannot always choose the method that we want. In scenarios where the route is diverse, we can offer you the greenest method in the most optimal way. In addition, "Best Friend" can give you information of your product's carbon emission and we can plant trees to compensate for the emission to minimize environmental impact.

With all these options, Best would be more than happy to increase your positive effect to environment. During your enquiry, please mention that you request "Best Friend" transformer and select the options you want, our team will prepare your special design. Beside above topics, vacuum interrupter tap changers could be preferred, which increase maintenance period and reduce your total cost. Beside that, vacuum interrupters have less carbon emission values.



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#### Ürünlerin Doğa Etki Katsayısı (DEK) ve Maliyet Olarak Karşılaştırılması

|                          |                                                                                                |        |     |
|--------------------------|------------------------------------------------------------------------------------------------|--------|-----|
| <input type="checkbox"/> | 1. Kayıpların Düşürülmesi<br>Lowering Losses                                                   | \$\$\$ | 🌳🌳🌳 |
| <input type="checkbox"/> | 2. Bitkisel Bazlı Yağların Kullanılması<br>Using Eco-Friendly Oil                              | \$\$   | 🌳🌳🌳 |
| <input type="checkbox"/> | 3. Düşük Gürültülü Ürünlerin Tercihi<br>Low Noise Products                                     | \$\$   | 🌳   |
| <input type="checkbox"/> | 4. Geri Dönüşümlü Trafo Dökümanlarının Kullanımı<br>Recyclable Transformer Documentation Usage |        | 🌳   |
| <input type="checkbox"/> | 5. Aksesuar Kullanımında Verimin Arttırılması<br>Efficient Accessories Selection               | \$     | 🌳   |
| <input type="checkbox"/> | 6. Optimize Edilmiş Manyetik Alan<br>Optimised Magnetic Field                                  | \$     | 🌳   |
| <input type="checkbox"/> | 7. Çevre Dostu Boya Kullanılması<br>Environment Friendly Paint Usage                           | \$     | 🌳   |
| <input type="checkbox"/> | 8. Optimum Taşıma Yöntemi Tercihi<br>Choosing Optimum Carrying Options                         |        | 🌳   |



#### Referanslar

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- a) IEA - World Energy Statistics 2016 (2014 data, section 3, pp.47-52)
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Katkılarından Dolayı ; Stajyerlerimiz

Melih BACAĞOĞLU, Necmettin TOPRAK, Furkan Kürşat SÜMELİ, Furkan KESKİN, Mustafa DURAK' a TEŞEKKÜR ederiz.