

Eco-design pilot project in China - Monsoon offer 2 upgrade

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Abstract. During COP21, Schneider Electric has committed that 100% of our new products would be eco-designed to tackle climate change. Launched in 2015, this initiative ecoDesign Way™ was tested on some pilot projects. This project covers the first ecoDesign Way™ pilot in China on an overvoltage or under voltage protective device used in both residential and industrial sectors, called Monsoon.

Under the name ecoDesign Way™, a method and a process have been deployed. The 3 main ecoDesign Way™ phases are: phase 1 - Marketing & Technique handshake, Phase 2 - ecoDesign Way™ follow-up and Phase 3 - Marketing communication. During the project, EIME from Bureau Veritas CODDE and ecoDesign Way™ scorecard from EVEA consulting are two core tools for eco-design implementation. They are respectively used for life cycle assessment and eco-design performance comparison.

Thanks to the approach, compared to previous range, pollution emissions and resource depletion along the whole life cycle of product have decreased (reduction of 55% for energy depletion and 85% for water depletion). Global warming potential has dramatically decreased by 98.4% and air pollution by 33%. Meanwhile, the recycling rate has been improved by 18%, and recycled PA is used. The ecoDesign Way™ scorecard is stored as referent document for any customer request. Moreover, customers can access RoHS certificate, REACH declaration, PEP and EoLI in Check a product, an online environmental data repository, available 24/7.

1. Introduction

Company official commitments have been released during COP21. All new products will be eco-designed by end of 2017. Pilot phase started in January 2015 and deployment of the initiative has started in January 2016. Pilots except this one were targeting Western markets. This project is the only local one targeting Chinese market co-developed between French and Chinese R&D teams. All statements and figures are available on Schneider Electric website in the People and Society barometer as part of our Corporate Social Responsibility report.

The Monsoon offer 2 upgrade project is the first eco-design pilot project implemented in China. This project integrates “top-down” and “bottom-up” strategy together, which settles the positive environment target and identify the feasible eco solution. Compared to the old products, this project is required to have improved environmental performance integrating more environmental-friendly technology innovation. Eco often referred to ecological and economic (Karlsson et al., 2006) [1], many advantages can be linked to eco-design: reduction of material, better manufacturing process and etc., with taking into account the economic part as leverage by involving the marketing from the beginning (Platchek et al., 2008, Borchardt et al., 2010, Haned et al., 2015) [2], [3], [4].



The implementation of such approach is restructuring the organization and impacting the R&D processes. Regarding specifically this project, the project team is located in 2 countries France and China. It implied expertise transfers, adaptation to local needs and culture, adoption by all functions: materials, environment, design, purchasing, and marketing.

Under the name ecoDesign Way™, a method and a process have been deployed (see figure1). The three main ecoDesign Way™ phases are:

- Marketing & Technique handshake
- ecoDesign Way™ follow-up
- Marketing communication

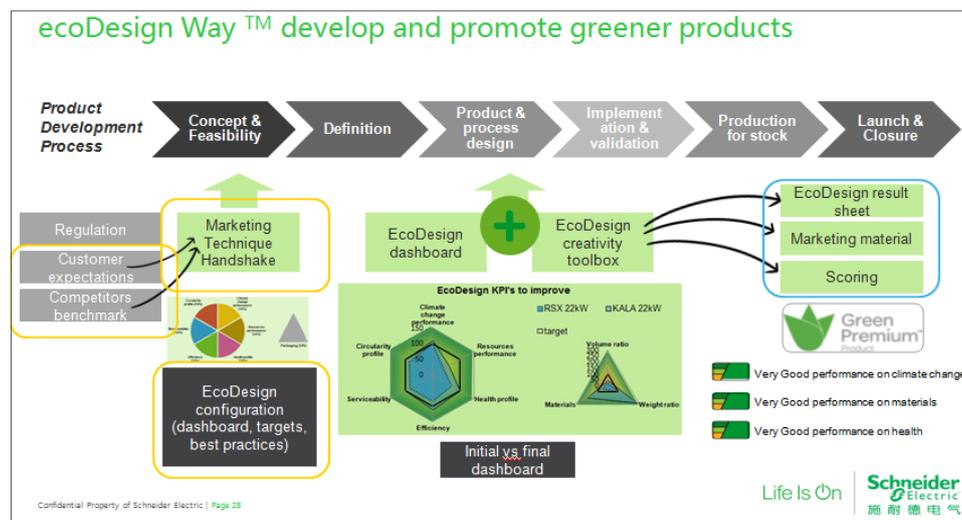


Figure 1. ecoDesign Way™ deployment process

This process is supported by 2 tools used to assess the whole product lifecycle:

- EIME¹ from Bureau Veritas CODDE to provide the Life Cycle Assessment (ISO, 2002) [5]
- An ecoDesign Way™ scorecard² from EVEA consulting for aggregation of environmental indicators.

The first tool is dedicated to environment experts and provides quantitative results. Unfortunately, this tool is not easy to use to talk to other functions and roles involved in the product development process. Many environmental indicators are available. A simplification is needed for project management. A second tool under the form of a scorecard is used for steering along the project. It grouped all environmental indicators into 6 environmental dimensions: climate change performance, resources performance, health profile, efficiency, serviceability, circularity and an additional one for packaging. Those 6 dimensions fit the Life Cycle approach of ErP: Energy related Products eco-design directive and are classified between "Producer responsibility" and "Service for customer".

1.1. Phase 1-- Marketing & Technique handshake

Environmental requirements are reviewed in the project team. Marketing inputs include customer expectations (implicit, explicit, and tacit), competition/market claims and regulations and standards. They all can be reviewed as opportunities. The eco-designers help the translation into environmental expectations and rank them. The discussion must lead to the configuration of the scorecard at earliest of design choices with the weighting of the eco-design dimensions and the selection of relevant criteria.

¹ EIME is dedicated to environment experts and provides quantitative results regarding life cycle assessment

² ecoDesign Way™ scorecard is used for steering along the project. It grouped all environmental indicators into six environmental dimensions: climate change performance, resources performance, health profile, efficiency, serviceability, circularity and an additional one for packaging.

The selection of criteria involves some actions to be integrated to the project management plan and the communication plan. Targets are set for each criterion. Project team defines the strategy of comparison for the scorecard. Several scorecards can be done. Comparisons can be either with a competitor or average generic product from the market or with a previous range. The analysis can also be completed as standalone or in complement for 2 options of development.

1.2. Phase 2—ecoDesign Way™ follow-up

An ecoDesign Way™ creativity toolbox is available to support the project team with best practices and testimonies. Based on previous criteria selection and project management plan, the eco-designers ensure the follow-up of actions before production. Improving some dimensions often can lead to some “rebound effect” effect” (Jevon, 1865) [6]. Project must ensure that all axis have been improved.

1.3. Phase 3—Marketing communication

Based on the results of the scorecard, Marketing and Technique review together the environmental selling points. The scorecard is stored as referent document for any customer request regarding our environmental claims. The eco-designers shall compile all scorecards, define or update a generic scorecard configuration for their ranges of products and ensure the continuous improvement while applicable. The final technical solutions were proposed in accordance with technical feasibility and economic acceptability. With joint effort of whole project team, the final environment impact assessment shows great improvement compared to the old products, and will also draw attention of increasing green market. (See from figure 2)

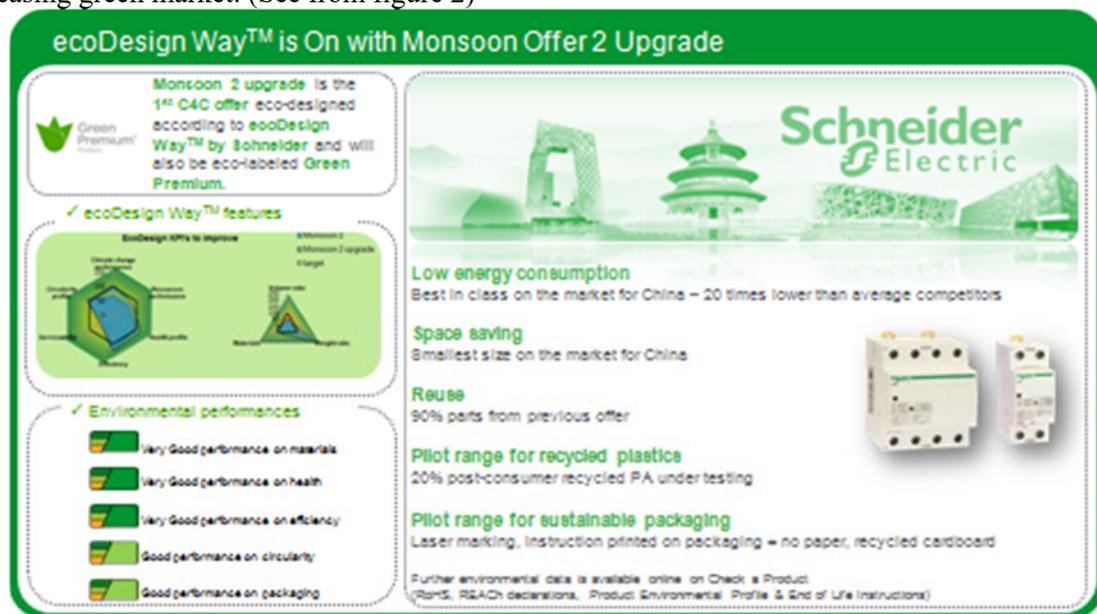


Figure 2. Final eco-design result sheet of Monsoon 2 upgrade project

2. Innovation of pilot project

2.1 Concept innovation

Commonly, environmental declarations including substance and LCA reports are prepared after product design phase and do not provide environmental improvements. Nevertheless, those environmental declarations are a good baseline to develop improvement. In this pilot project, environmental considerations have been integrated at the earliest by involving eco-design engineer to draft the offer specification at design stage. Environmental declarations are no longer simple reports but proof of environmental improvement and used by marketing for environmental promotion. Beyond energy efficiency, the environmental improvements are global and in this project, focus has been done on

resource efficiency, more serviceability, and better health profile. This project is not only for report generation, but also for environmental friendly design.

2.2 Methodology innovation

Besides the EIME (life cycle assessment tool) used for environment impact assessment, eco-design scorecard can identify the points and propose solution for product further improvement based on environment criteria and lifecycle thinking. Environmental considerations are included in the project from beginning of development to the end, under many forms such as partnership with suppliers for more environmental friendly solutions, compliance with stricter regulations and standards beyond China, use of BAT in manufacturing plant certified ISO14001. Specifically, in our project, it also leads to technology innovation for material selection (recycled material usage), product design (cable connection direction), packaging strategy (saving on grouping box) and industrialization (automatic welding).

2.3 Process innovation

Two teams were involved in this pilot project from France and China. For eco-design, French environment experts build the framework and transfer the knowledge and tools to Chinese eco-designer by intensive coaching. For project, eco-designer and environment experts have to work closely with multi-function including material, design, purchasing, market, industrialization, the efficient communication way is built and implemented during the whole life of project. Promotion of environmental consciousness was also externally by involving actors from upstream and downstream supply chain.

3. Overall benefit of pilot project

3.1 Usefulness of the project in social terms

Our global approach of eco-design aims to integrate environmental consciousness at each stage of the lifecycle of our project and of our product. The whole project team has been involved to consider environmental impacts in their decisions. All project team members were also the ambassadors to promote environmental-friendly decisions with all the external actors they are dealing with. For instance, purchasing team has developed partnership with suppliers to provide environmental data and also provide alternative solutions with less environmental impacts. Marketing team is working closely with customers to understand their needs in terms of environment performance. Industrialization team is ensuring the environmental compliance and quality by testing the materials received. Design team and Environment team are working closely in the evaluation of architecture, material selection and in the achievements of environmental compliance documents. By promoting internally recycled materials, we prepare ourselves for more circular economy. By creating demand, we contribute to an overall reduction of waste and development of recycling sector in China.

For external social aspects, this first project of eco-designed product in China targets to promote transparency and easy access to data on the environmental performance of our product. Our customers do not want to struggle to understand how to choose or how to decrease their environmental footprint. They want to buy best-in-class product and not compromising the environment. The environmental performance is part of the technical performance of our product beyond energy efficiency. Our customers can access online 24/7 EU-REACH declaration, EU-RoHS & China-RoHS compliance certificate and a Product Environmental Profile on Check a product, based on an international recognized standard PEP ecopassport. They can also easily retrieve all instructions thanks to the QR Code on the packaging. Secondly, this project aims to promote and provide to China market, higher standards for the environmental performance of products and what Chinese customers can expect.

3.2 Usefulness of the project in economic terms

Within the eco-design approach, ecological and economic considerations are considered and balanced. Energy efficiency and resource efficiency are the drivers in the development of our project. The

ecological aspect of them can be easily seen but behind the economic aspects are also relevant. From our customers' perspective, the energy efficiency can be monetized as they will reduce their bills and reduce their carbon footprint. From our internal perspective, beyond meeting the needs of our customers, we help the energy transition. On the resource efficiency side, our project contributes to the development of recycling sector. Recycled materials in this particular project were cheaper than the actual primary virgin grades. More compactness, more serviceability and longer life time contribute to the development of virtuous loops in the circular economy.

The application of eco-design actions on the product also brings real cost down:

- 20% Recycled PA will reduce cost per each PA part
- Delete individual box and paper instruction will reduce cost per each product
- Auto welding instead of manual welding can save cost per labour
- Substitution of capacitors containing hazardous substances reduce cost as well

3.3 Usefulness of the project in industry terms

Along this project, some R&D partnerships with different material suppliers have been developed to:

- understand each other needs – common environmental language
- understand each other impacts on production and Offer/Demand
- develop more environmental-friendly solutions
- test, verify and validate together industrial processes
- understand each other investments implied

All these aspects concur and contribute together in symbiosis to a better environmental performance for the whole industry. This project as success story will lead to replicates in our R&D centres both in France and China.

Regarding resource efficiency studies developed with our partners during this project, they will help to raise the consciousness and responsibility on Chinese producers and markets to improve overall environmental footprint. This action will also push upstream and downstream sectors towards greener considerations by creating the demand and involving them in the global reflection from the beginning. This is mutual benefits for the whole supply chains and of course the customers.

3.4 Usefulness of the project in environment terms

Before eco-design strategy implemented, the GHG emission is 60 times more than the eco one. With carbon trade market gains more and more maturity and integrity, both residential building and industrial sector must join in the trade. Therefore, 60 times emission abatement equals to 60 times cost saving. Take China as an example, 20 RMB/ton CO₂-equ is estimated by some trade institute and 1200 RMB/ton is saved by new products applicable with the eco-designed solution.

1. Technological term

Material substitution: 20% recycled PA integrated to raw plastic has been tested by material engineers and this solution has been accepted by factory as the option for material selection for various project later on. Compared to PC, recycled PA has some difficulty in application. But with joint effort of material engineer and environment expert, as well as test engineer, this eco solution has been finally realized and it can also be regarded as the material innovation. Nevertheless, purchaser played also a role for working with different suppliers to push the availability of these sources for test.

2. Non technological term

QR code instead of paper instruction: it is the first applicable of QR on product. In the beginning, the eco suggestion is only for raw material (paper) saving, printing on packaging is proposed by most of people. But after assessment of ink printing, QR is decided as the most environmental friendly solution.

As a global energy specialist, energy efficiency is at the core of our product development. R&D teams are always targeting the best. This new project was part of a process of continuous improvement. Project team was very open-minded to consider our approach. We brought to them lifecycle thinking and showed them from the results of a LCA on their previous range, areas of improvements. A Product Environmental Profile – based on PEP ecopassport rules and compliant with ISO14025:2006 provides

a good basis for analysis and identification of significant and relevant aspects to focus on. Other aspects for health profile have been taken into account as they are not part of the LCA. For simplification of communication with non-environmental experts, environmental indicators are classified into 6 axis (Climate Change with the CO₂ footprint, Health profile, Resource efficiency, Energy efficiency, Circularity profile and Serviceability). Packaging improvement is also considered on its own. Based on marketing inputs and the application of the most constraining upcoming regulations and standards from Europe, we have set requirements on the new development to target overall improvement and specifically on the Energy & Resource efficiency, health and packaging optimization.

3.4.1 Environment impact indicators. The major indicators imply pollution production and resource depletion through the whole life cycle of product. The energy depletion is saved almost 55% and water depletion is 85% reduction compared to the old products. For pollution perspective, global warming potential has dramatically decreased 98.4% than before, and air pollution is 33% of the old one, but the water toxicity has increased 67% due to electroplate process of some electronic components. But the hazardous waste production reduced 65% by narrowing PCBA size and substitute the plastic with flame brominated retardant. (See figure 3)

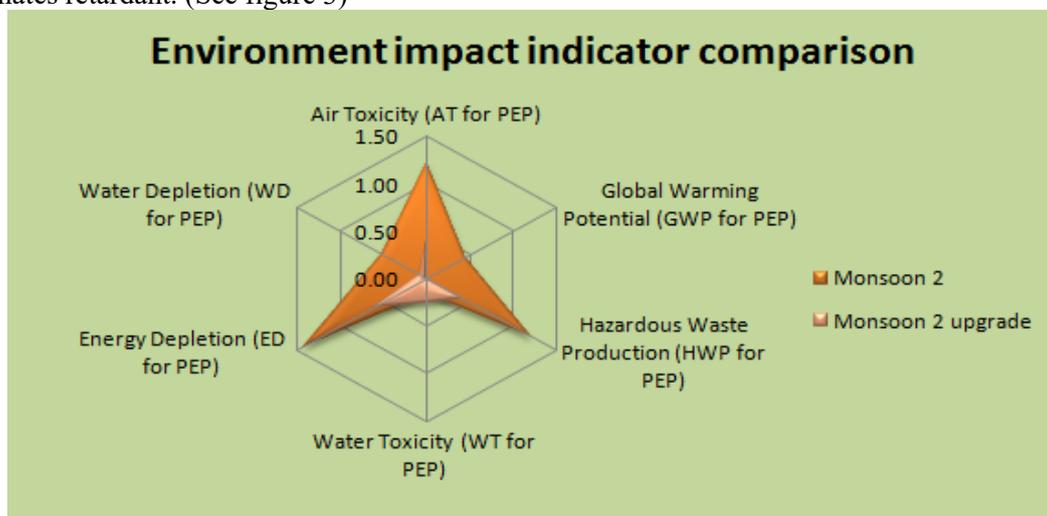


Figure 3. Environment impact indicator comparison between Monsoon 2 and Monsoon 2 upgrade

Furthermore, LCA indicators, a focus on toxicity has been done. From the analysis on the substances from the previous range, some substitutions of materials have been done to ensure that the product is fully EU & China ROHS-compliant. REACH declaration with the up-to-date SVHC list has been completed as additional proof of improvement.

3.4.2 Eco-design indicators. From consumer's expectation, energy efficiency, health (hazardous substance) and packaging get more attention, which are also the eco best practice contributes the most. Based on our internal scale, the performance for health and efficiency are 117 and 125 compared to 94 and 122 for old products, through implementation of BAT and saving on energy consumption. What's more the performance of packaging has grown to 65 by packaging strategy improvement. For climate change and resources performance, the environmental performance has increased, by the integration of recycled materials. (See figure 4)

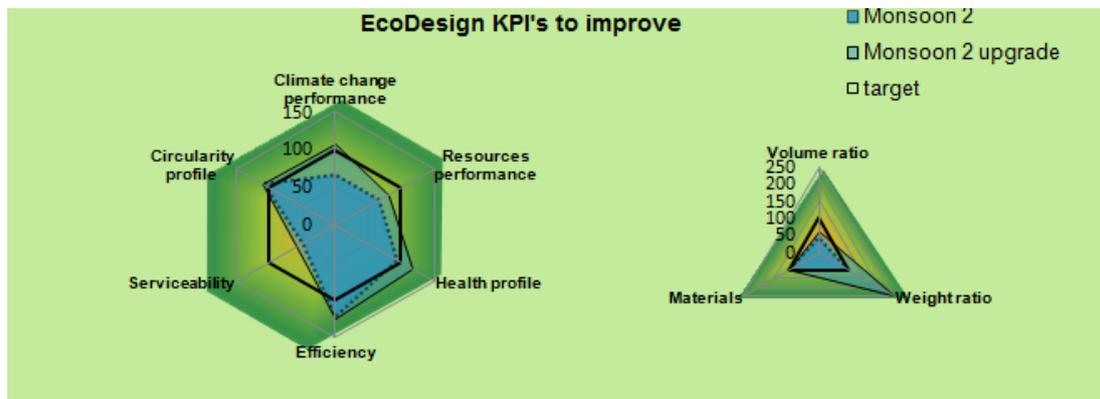


Figure 4. Eco-design indicators of Monsoon 2 and Monsoon 2 upgrade

From the research partnership with our suppliers and Chinese recyclers, we have been able to reach the integration of 48% of reused materials, 20% recycled PA and at the end-of-life with current technologies the 49% of recyclability rate. Respectively, they represent 18% improvement for reused materials, 20% recycled PA and 1 % improvement of recyclability rate on our new product. What's more, 39g weight of packaging is saving in new one. Reaching those targets will improve globally the climate change indicators, as CO₂ footprint is intimately linked to Energy & Resource efficiency.

4. Competitive advantage and benchmark of pilot project

4.1 Competitive advantage

This project was a pilot for the integration of an eco-design approach with Chinese specificities and having some close collaboration between France and China as the team was located in 4 different places over France and China. Methodology was adapted to have high flexibility between the different project team members. Part of the project was to empower our Chinese colleagues by bringing them knowledge on how to deal with environmental aspects and having them to identify their advantages for the Chinese market.

Regarding the local market, main driver for decision is cost and customers are not asking yet for environmental performance. However, trends are moving towards similar requests as European customers with more transparency, safety, efficiency and reliability. As Chinese government and standard agencies are also pushing more, this pilot project has been seen as an advantage over competition by anticipating business needs, implementing new economic and ecological technologies, setting up partnership with upstream and downstream stakeholders, promoting transparency and providing our Chinese customers environmental-friendly added value products at their affordable price. By starting at the earliest the investigation and investment, we expect to duplicate this approach on all projects and saving up on resource usage consequently cost reduction by scaling up.

Although the basic drive force for this product upgrade is due to the standard evolution, the eco solution also brings technology innovation rather than only environment improvement. For instance, under the energy efficiency target, designers have proposed several solutions and this effort leads to remarkable advantage on energy consumption saving compared to other major competitors in market. As designer's introduction, the energy consumption for normal usage is 0.2 KWh per month, which is only 3%-5% of the competitors'. Moreover, with increasing strict environment regulation implemented, such as China ROHS, EU ROHS, REACH and WEEE, more consumers are concerned whether the hazardous substance contained in products. Compared to competitors, our environment information can be easily checked via website and catalogue.

4.2 Competitive benchmark

During this project, we have set up some constraining targets regarding the Chinese market. We used international standards and directives. From the analysis of previous range, we were able also to set

ourselves targets to improve the new range on all environmental aspects along its lifecycle. This approach is beyond Chinese standard so far.

A benchmark on the Chinese competition showed the difficulty for our customers to understand what is at stake regarding environment, moreover the multiplicity of environmental claims and labels can mislead them.

Our communication has clear criteria based on international standards. Above all, we ensure that the assessment is done considering all types of environmental impacts and over the lifecycle not only a specific phase which might not be relevant or significant. Documentation is fully disclosed online 24/7 freely not upon requests or as a paid service. So far no competitors on Chinese market provide that free service.

In most of Chinese local companies, environment action always relies on policy rather than self-demand. China ROHS 2.0 for instance is a mandatory environment regulation requiring all EE products used by final consumers, to have a logo for the content of hazardous substances. Although the UV/OV devices in project as components are not required to have logo, from our consumer side, it is very convenient to find the ROHS information on website, which can help them to control the risk. In addition, Chinese market will unify various environment/energy efficiency labels as one, and this will provide stricter requirements to all producers with environment information transparency and accuracy.

5. Conclusion

Implementing a restructuring process of eco-design in a product development process implies to monetize properly the environmental benefits. Involving Marketing team and whole project to value environmental and economically viability is important. Most of all, relevant and significant improvement must be selected properly and retranslated to customers. Anticipating changes in regulations and standards in order to be compliant for a longer lifetime help our customers.

This initiative enables to develop different approaches such as Design for a longer lifetime, design for recycling, etc. This helps to go beyond simple eco-label and towards more circular economy.

Different levels of data and messages must be adapted to the audience (environmental experts, project teams, customers) along the product development lifecycle. ecoDesign Way™ allows that different levels by integrating several tools to aggregate data for decisions. At the end, all environmental information must be clear for the customers. On top of that, it was important to be transparent in order to not mislead our customers.

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