

JOURNAL

PROJECT

AirQon - Air Quality through EV Battery Connectivity

📍 Breda, The Netherlands

TOPIC

Air quality

EDIT 26 JUNE 2023

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# AirQon Final Journal

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## Executive Summary

The demonstration phase of the AirQon Project is coming to an end. Every day, there is a growing commitment to reducing the carbon footprint of events, which paves the way for innovative solutions like AirQon. This crowd-powered solution not only eliminates the need for diesel generators but also allows for their smarter usage, with smaller sizes, improved performance, and shorter operating times. Moreover, the potential for integrating AirQon with other eco-friendly energy solutions, such as fixed-grid power supply points and battery packs, has been extensively demonstrated.

Throughout the project's development, the AirQon solution has evolved from being solely designed for indoor use and protected from atmospheric conditions to becoming capable of operating outdoors. It can now function independently or be combined with battery buffers. Additionally, it has been successfully integrated with other technologies like solar photovoltaic generation, storage, and electric vehicle chargers, even leading to the development of all-in-one solutions. As of today, the AirQon solution remains fully available and can be reserved through the Project's website.

AirQon has contributed to a shift in the mindset of the population in Breda, including event organizers and festival attendees. This aspect of dissemination and promotion of more sustainable solutions is crucial. It has played a significant role in creating a long-term vision by fostering a collective understanding and commitment to sustainable practices. The influence of the project goes beyond its implementation and continues to inspire positive change in Breda.

The construction industry has positioned itself as an enthusiastic early adopter of AirQon and other innovative energy solutions. Construction companies have the capacity to invest in these technologies, making them a promising opportunity for scaling up the AirQon solution. While originally considered in the project's definition and work plan, the impact of the COVID-19 pandemic, which led to a significant decrease in events in 2020, accelerated the application of AirQon in construction works. Similar to event organizers, construction sites may face challenges in accessing the electricity network or meeting technical requirements. AirQon provides a green, sustainable, and customized solution for such clients, offering an alternative to conventional diesel or hybrid generators.

Additionally, the Municipality of Breda demonstrates a strong willingness to promote the existence of fixed-grid power supply points throughout the city. These points offer a safe, easy-to-implement, and zero-direct-emission method of providing electricity for events. The municipality's approach aligns with a legislate-by-doing spirit, focusing on encouraging sustainable practices rather than simply limiting or banning less eco-friendly alternatives, although this should be a final way to shift to zero emission events and construction sites. This long-term approach acknowledges that while prohibition could be an option, it may not be the most effective solution in the broader context.

At the same time, this initiates a captivating discussion regarding the potential competition between the electric grid and solutions like AirQon. While both systems offer clean power in diverse areas across the city, the grid ensures supply security, while AirQon stands out for its modular, adaptable, and portable nature. By leveraging the strengths of both solutions, this project demonstrated a comprehensive approach to enhancing air quality.

While the future of the AirQon device itself cannot be definitively determined, it undoubtedly represents an important part of the energy evolution leading us towards a new paradigm. AirQon has been at the forefront, successfully achieving the project's objectives of acquiring knowledge and practical understanding. It has demonstrated that greener, more sustainable, and decarbonized events in cities are indeed possible. This project stands out because it has effectively materialized a new energy paradigm, which, at first glance, may seem simple: extracting energy from vehicle batteries and redirecting it for other purposes beyond transportation. Lastly, it is worth noting that AirQon contributes to materializing this new energy paradigm by being fully compatible with other clean solutions, such as accessing fixed-grid power supply points.

## Project's progress



AirQon can deliver power to events by means of cars, providing energy directly, and vans, acting as energy buffers  
(Source: facebook.com/airqon)

### What has happened with the project since its end date?

Since the project was officially completed in October 2022, this new way of powering events has continued to thrive in the city of Breda. Along the project it has been witnessed an increase in fossil-free events. Indeed, the way of working and thinking of AirQon has been spreading more and more. However, this cannot be solely attributed to the AirQon project itself. The reality is that combining cars, battery storage systems, and the electricity grid creates a clean and financially sound solution. Indeed, according to expert sources from AirQon, if there are no restrictions imposed by municipalities, approximately 20% of events may continue to rely on diesel

generators, while 80% will opt for cleaner solutions.

Firstly, any potential user can access the project's website and book the AirQon solution for usage. Therefore, AirQon remains fully available, although it should be noted that there is now a cost associated with its utilization, which was not the case during the project's development. However, it is important to highlight that, for now, working with AirQon in combination with power grid and storage systems is proven to be financially better than diesel generators. However, this should be understood as a necessary step, part of the natural process through which events must transition from using conventional, polluting solutions to these innovative, decarbonized ones that are now a reality.

Secondly, there is a strong willingness from Breda Municipality to disseminate the existence of different sites in the city where electricity for events can be provided through fixed-grid power supply points, in a safe, easy-to-implement and, overall, zero-direct-emission manner. Breda Municipality is actively seeking options to facilitate the best possible match between energy demands and power delivery options. For instance, by promoting the use of digital tools such as apps and websites to face the challenge of scaling up utilization, accessibility, and utilization of these temporary set of fixed-grid power supply points. Nevertheless, current questions being addressed are: How can we make them easier to use? What should be the price for the service? Should we pass on this cost to event organizers, or should they be financially helped in some way? And especially, if something goes wrong, how can the resulting impact be managed? Who would be responsible in case of a failure? And how can those potential incidents be resolved quickly?

Finally, it is worth noticing that the entire community of Breda desires to be more sustainable, but hosting events and contributing to economic development is a first-level priority. In other words, the focus is on facilitating the development of events of all types and nature, although being sustainable is not currently a mandatory condition. However, construction branches have positioned themselves as enthusiastic first movers, since they are entities capable of firmly investing in AirQon and other innovative energy solutions.

### What is the project's plan for long-term sustainability?

The AirQon solution has evolved throughout the project's development, transitioning from being an indoor-only device protected from atmospheric conditions to an outdoor-capable device. It can now operate independently or be associated with battery buffers. Furthermore, it has been integrated with other technologies such as solar PV generation, storage, and electric vehicle chargers, even leading to all-in-one solutions.

While we cannot definitively state whether the AirQon device itself has a promising long-term future, at least as it has been developed within this project, we can confidently affirm that it is an important part of an energy evolution leading us to a new paradigm. AirQon has been a front runner, successfully achieving the project's objectives of gaining knowledge and understanding how it can be done in practice, demonstrating that greener, more sustainable, and decarbonized events in cities are indeed possible.

A crucial aspect to remark for the long-term vision is the mindset shift that this project introduces among event organizers, participants, and the general public. This change in thinking remains impactful and beneficial, as it fosters a collective understanding and commitment. The project's influence extends beyond its implementation and continues to inspire positive change in Breda.

## Generated Knowledge



One of the first prototypes of AirQon device delivering power from a car (Source: facebook.com/airqon)

## Lessons learned

The project's development yielded valuable lessons and generated significant knowledge. Collaboration and interdisciplinary approaches proved crucial, enabling the project to tackle complex challenges effectively. A comprehensive summary of lessons learnt are here presented:

- The AirQon solution is fundamentally based on community participation. It is a crowdsourced powering solution for events. Essentially, end users of electric vehicles become [facilitators as eventual providers of a service](#) demanded by the organizer of the event to power it. Therefore, engagement is the key concept for success, so both event attendees and organizers must be on board.
- AirQon's appealing and ease of use can help overcome initial barriers that may arise in electric mobility early adoption since it allows anyone, not an expert or familiar with sustainable mobility and energy concepts, to understand how to utilize the car's energy as a rolling battery to power electrical demands, such as sound systems or refrigerators. This demonstration and normalization of vehicle-to-load applications not only brings AirQon itself closer to the public, but also facilitates their approach to more sophisticated applications like vehicle-to-home or vehicle-to-building.
- Event organizers are needed to have a change in their mindset on the way they approach their energy planning to rely on such a greener, alternative technology available today like AirQon, and not to oversize and tend to choose conventional, inefficient, fossil-based solutions. Organizers strongly depend on the criteria of their power suppliers, so it is needed to focus on them as well to reach further impact.
- [Participants must be considered with all their heterogeneity](#). In a country like Netherlands, the minority of them are owners of the cars, so additional applications like vehicle-to-event may depend on the conditions set by the corporation if it is a company car, or the conditions of the service contracted if it is a carpooling or a lease-plan car, to cite various examples.
- AirQon struggles with an incipient, but promising, expansion of electric mobility. [This makes difficult to rely only on AirQon for powering big events](#), in spite of being perfectly prepared to be combined with other energy sources or to power small and medium-sized events by itself.
- Flexibility perceived by electric vehicle users may be a barrier. The state of charge of the battery may be not enough to provide part of its energy. It may be an issue to have an unforeseen eventuality, or simply just go and prefer to leave the event, because their cars may be in use by AirQon, which means they might not be immediately available to their owners. Or their present state of charge prevents them from returning home, unless having a fast charge along the way back.
- Nominal capacity of the battery is a fundamental factor when deciding to participate. The limited energy storage capacity of batteries could pose a challenge in meeting the energy demands of a sustainable event from start to finish, naturally, unless there is a wide community of users ready to participate through a solution like AirQon. This may lead event organizers to better make use of existing fixed-grid power supply points along the city, since they result to be more reliable and steadier, or at least to complement both options. Nevertheless,

continuous technology development foresees higher battery ranges, which means higher possibilities for electric cars involvement, in addition to the expected increase of electric mobility adoption within the population in coming years.

- Standards may condition large-scale implementation of AirQon-type solutions. AirQon has been developed for using CHAdeMO connectors to plug-in the car and use the energy of its battery, but this is not compatible with any car brand. Furthermore, different connectors are in use in the market and there is ongoing debate about which one should be universally adopted to ensure compatibility for electric vehicle users. Moreover, numerous brands do not provide yet the feature to enable utilization of stored energy in the electric vehicle for external purposes.
- The weight of individual personal experience cannot be ignored. Creating the AirQon community does not only depend on technical aspects. In this sense, there are people who have never tried electric car driving, or even who have not ever tried any means of electric mobility in general, like an electric bike or scooter. Otherwise, there are people who have tried electric driving. These people have broken that barrier, although there may be some resistance to change, but they know what it feels like to drive electric, and, consequently, are more likely to be part of the AirQon community.
- The positioning of construction branch as an interesting opportunity for scaling up the AirQon solution. It was already considered in the early steps of the definition of the project and later included in the work plan. But the significant decrease in the number of events in 2020 due to the COVID-19 pandemic led to boost the [application of AirQon on construction works](#). As in the case of event organizers, sometimes the electricity network may not be accessible, or the technical requirements makes it unfeasible. Contrary to conventional diesel generators or hybrid generators, AirQon enables a green, sustainable, tailor-made solution for those clients.

## Recommendations to urban authorities willing to implement similar innovative projects

Based on the insights gained from this project, a set of recommendations can be provided to guide other urban authorities interested in implementing similar innovative projects. These recommendations are derived from the experiences and lessons learned throughout the project's development. By following these guidelines, main urban authorities may enhance their chances of success and maximize the positive impact of their sustainable initiatives.

- Stimulate awareness of the population. Not only in terms of going there and connect your EV – indeed still there is not such a big community of electric vehicle users. AirQon aims to engage people and foster a change in the city's mindset, not only focusing on long-term goals like replacing diesel generators or improving air quality but also emphasizing the electrification of demand, electric mobility, responsible use of private vehicles, and other related actions that contribute to a more sustainable city. Perhaps there might be brand restrictions in vehicle-to-grid applications, or physical limits in the battery range, but a positive change in the mindset remains and helps.
- Act as a first mover. As in this case, where Breda Municipality has acted as the leader of a technological project, but with the goal of being an enabler, supported by a series of expert partners.
- Legislate by doing. It could be easier to opt for restrictions and prohibitions in order to enforce the use of greener solutions. Prohibition can be an option, but for the long term.
- Promote the use of fixed-grid power supply points to have greener events. It has been demonstrated over the years that they are a good solution for events, markets, construction works, etc.
- Boost cross-department working. The change in the mindset also has to take place in the municipality. A more sustainable city implies the involvement of a series of departments, such as environment, urban planning, energy, mobility, and of course events in this case, but all of them with the same strategy.
- Be an example in public procurement. Not only third-party event organizers or construction companies are implied in this transition. Events promoted by the Municipality may be suitable for using green powering solutions, as well as public-promoted construction works.
- Widen the approach. Developing a device like AirQon requires financial resources and time, just like any future evolution, such as enabling a new type of connector. However, it is important to recognize that not all event organizers have the ability to invest a significant amount of money in more sustainable equipment for their events. But active promotion from Breda Municipality led to interesting opportunities in this project for construction branches. They get added value in using this solution: AirQon lets them use their electric car fleet for much more than just mobility purposes and they can also improve the perception of their customers by developing a more sustainable business model.
- Make it easy. Within the AirQon project, it has been developed a [web-based calculator](#) that can be used both by event organizers and whoever in charge of energy planning. It collects step by step, in a very intuitive way, all the necessary input data, helps to determine the energetic needs, so the tool not only serves to make the energy plan of the event as a whole, directly, but it can also help organizers to gather the different needs of their partners and collaborators, assess them and optimize them. Once energy needs are determined, thanks to the tool, it can be easily estimated the maximum power consumption and total energy demanded, considering as well certain simultaneities to avoid oversizing. Having this information set, and by comparing it with the capacity of suitable electric cars, the AirQon calculator then gives the number of electric cars required to appropriately power the event.



Electric van adapted to environmental and civil works at Breda

## Conclusion



Electric car providing power to charge mobile phones by means of an outdoor, advanced AirQon device (Source: facebook.com/airqon)

### The expert's final reflection and evaluation of the project

Overall, AirQon project has been conceived as an energy solution. It must be evaluated as something that facilitates a transition, not under a manufacturing point of view as a simple device. AirQon acts as a trigger to enable greener, more sustainable events and also construction works. The project has to be considered a success.

In this sense, the role of first mover and leader of Breda Municipality has to be remarked and recognized. Despite of being a very technological project, the public administration engaged the necessary group of expert partners and led it successfully. Therefore, Breda Municipality is not just writing policy to restrict, but they are testing firsthand these innovative approaches.

In addition to this, unless environmental legislation pushes firmly, it will be difficult to have a firm, solid evolution towards zero-emission technologies. In other words, if European or national regulations are not clear, it will be challenging for municipalities to effectively enforce the transition, especially regarding the prohibition of diesel generators. For instance, it is paradoxical that cars cannot come inside the so-declared zero emission areas in cities, but conventional diesel generators can be placed there without restrictions. Also, emission levels are roughly established for these generators, and it makes difficult to control their effective performance and impact.

Nevertheless, important progress is done. For instance, some large events that take place in neighborhoods or nature must calculate how much nitrogen emissions they produce. For example, the event [‘Down the Rabbit Hole’](#) in Rijntakken, Gelderland, the Netherlands, bought emission rights from a farm to be able to place the event. This will be a matter of time to be extended to medium and small events. This strategy is comparable to those applied to industrial activities that, at the end, have a similar impact in the environment.

AirQon has faced some technical constrains as well. The project has adapted successfully to the availability of vehicle-to-grid in certain car brands or connectors, like CHAdeMO, able to make it possible. But it is a matter of time that new car brands and connectors will allow all this.

Indeed, when people know about the idea of taking out energy of the car to power an event or their houses, they are enthusiastic: they rapidly ask how it works and how they can do it. But they get disappointed if their car brands or the conditions of their lease-plan cars do not allow it. All this may turn into a negative message to people and should provoke a high-level rulemaking debate. Legislation must promote people to use their cars as a battery on wheels.

Undoubtedly, this project has broken mental barriers in people to take part in events. This is decisive for the creation of the crowd-powered community of AirQon. Up to now, battery capacity has led to not consider other purpose apart from mobility for electric cars. If part of the battery is used for powering events, range anxiety phenomena may aggravate. But nowadays, fortunately, battery capacity normally surpasses around 40 kWh, hence, this paves the path to feel ready to collaborate with the AirQon solution and get benefits such as free tickets, beverages, or VIP access, to cite some examples proposed by event organizers in this project and successfully validated in practice by beneficiaries.

It must be highlighted that event attendees significantly notice the impact of sustainable actions undertaken at local level. Hence, people going to an event perceive the externalities and negative effects that AirQon intends to mitigate or even avoid such as dust, soot and smoke. This also reinforce the spirit of events to [make it more sustainable](#). And if they do not know how to do it, expert companies are ready to help and convinced them.

Commitment with greener solutions has been also a leverage for boosting the use of existing fixed-grid power supply points. They represent a reliable, easy-to-use solution that can significantly reinforce the strategy of cities towards zero emission event, markets, and construction works. And digital tools such as web portals and apps facilitate users to select suitable locations or manage permissions and payments, shorten timings to be ready to use them. Moreover, AirQon and fixed-grid power supply points may be seen as complementary solutions, able to work together and maximize possibilities.

AirQon project also demonstrated how construction branches are suitable users. They fit well in the solution since they need to use power equipment for a longer time. The construction sector is changing the mindset as well, replacing old equipment still in use and investing in more sustainable technologies, materials, processes, etc. like front runners do. And focusing on construction while events dramatically decreased due to COVID-19 restrictions let the project keep developing the AirQon solution and minimize impact in overall progress planned.

## Main legacy of the project

This project stands out because it has successfully materialized a new energy paradigm on its own. The idea seems simple: extracting energy from vehicle batteries and redirecting it to other use than transportation. While it is expected that the market will evolve in this direction in the coming years, offering a variety of devices, connectors, standards, etc., it is clear that this project has taken a decisive step ahead of others.

AirQon has been able to provide a reliable alternative to conventional diesel generators in the event industry, which has traditionally relied on oversized equipment to ensure proper energy planning. Sustainable solutions already exist, such as on-site renewable energy generation or energy storage using batteries. AirQon has contributed by bridging the gap for event organizers, facilitating their transition and offering them a zero-emission solution that is easy to use and applicable to events of all kinds.

In addition to solving technical issues, which are by no means simple, it is admirable how this group of partners has achieved it. The project also addresses the social factor, making it a pioneer in targeting an emerging community of users within the growing electric vehicle market. Just as electric cars are said to serve as a distributed and disaggregated battery capable of providing service to an entire country's electrical system, AirQon relies on a community of users with the same objectives.

Lastly, it is worth highlighting in this section that AirQon contributes to materializing a new energy paradigm because it is fully compatible with other clean solutions, such as accessing fixed-grid power supply points. They are not mutually exclusive competitors but rather companions on the journey. This becomes even more important for large events, covering extensive areas and lasting for extended periods. The electric grid can provide supply security, while AirQon remains modular, adaptable, and portable. Together, they maximize the variety of solutions to improve air quality in cities, as demonstrated in this project through exhaustive monitoring and evaluation.

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Air quality

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