

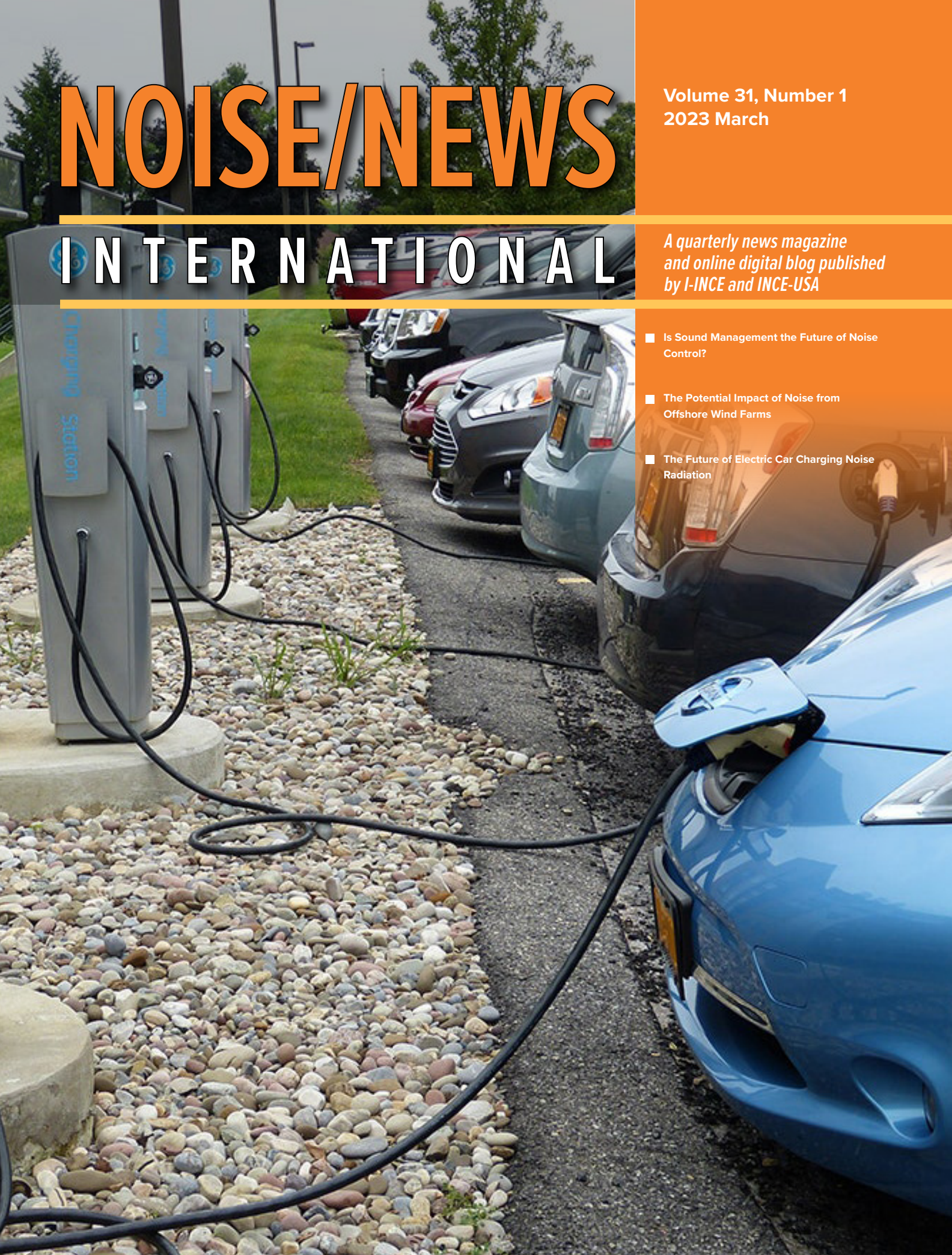
NOISE/NEWS

INTERNATIONAL

Volume 31, Number 1
2023 March

*A quarterly news magazine
and online digital blog published
by I-INCE and INCE-USA*

- Is Sound Management the Future of Noise Control?
- The Potential Impact of Noise from Offshore Wind Farms
- The Future of Electric Car Charging Noise Radiation



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Introduction to this Special Issue

By Gijsjan van Blokland, I-INCE VP, Development & Outreach

The world faces a major challenge in the coming decades to limit global warming and to manage the shift to renewable energy. This shift however is expected to be noisy.

The most known source is on shore wind farming. The repetitive sound of the passing blades is a common source of annoyance, especially at night when the lower atmospheric layers come to rest reducing back ground sound, while the wind speed above the boundary layer, where the modern wind turbines operate, remains high. A successful series of I-INCE Europe conferences have been dedicated to wind turbine noise with the next scheduled in July 2023 in Dublin.

In this special issue of Noise News International it is argued that moving the wind farms off shore will not guarantee silence in the coastal regions and most certainly it will become noisier under water. In another paper the noise impact of heat pumps and domestic wind turbines in urban areas is assessed.

A next paper notices that even the flow and storage of electric energy may cause noise issues around vehicle charging

stations. The shift to electric road vehicles present challenges to the acoustic design inside the vehicle where the speed and acceleration sensation by the internal combustion engine sound has to be replaced by something new. Outside though the vehicle is generally expected to become so silent, so to warn pedestrians artificial sounds have to be added. The study presented in this issue demonstrates that this effect is limited to low speed areas with stop & go traffic, once the vehicle is driving at constant speed no positive effect was observed.

Noise engineers around the globe will contribute directly to the shift to renewable energy by for instance the development of acoustic heat pumps, but most certainly they will work to mitigate the negative noise impacts. I wish them success and I look forward to a future sustainable world with a pleasant acoustic atmosphere.

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The Future of Electric Car Charging Noise Radiation

by

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As the transportation industry transitions into the electrification era, new sources of noise are introduced. Electric cars in operation are typically quieter than internal combustion engine vehicles and can be nearly inaudible at low speeds. However, there are new sources of noise associated with electric vehicles that can have a more significant impact, specifically electric vehicle charging stations. As the demand for electrified equipment increases, the demand for electric energy harvesting, transmission, and storage also increases.

A single electric car will not generate a great deal of noise during normal driving operation. The vehicle batteries and motors are cooled as air passes over the components while the vehicle moves down the roadway. However, when the vehicle is charging, a significant amount of heat is introduced to the batteries and heat dissipation is required using cooling fans to maintain proper battery temperature and reduce degradation of the batteries. When an entire parking lot of electric cars are charging at the same time, a new source of noise is introduced.

In electric vehicle charging stations there are multiple sources of noise. There are the cooling fans on the vehicles themselves that will operate during charging, but there are also noise sources associated with the high-voltage electrical equipment required to get power to the vehicles. The electrical equipment includes transformers to connect the station to the power grid and the power conditioning systems (PCS) associated with the charging equipment. Both the transformer and the PCS can be significant noise sources. The combination of the various noise sources can produce audible noise in the areas surrounding the stations. This proposes a novel issue of electric car charging station noise, especially in residential or noise-sensitive areas.

When one thinks of a gas station, there is generally not a lot of noise associated with the operation of the gas station pumping gas. A new future of electric vehicle charging stations with PCS, transformers, and cooling fans presents new sources of noise not generally associated with transportation. So, how are these emerging noise sources of the electrical era managed? Burns & McDonnell has been heavily involved with the management of noise associated with power generation, transmission, and storage systems throughout the United States. The recent emergence of lithium-ion battery storage systems and electric vehicle charging stations have introduced additional noise sources to communities that must be managed to reduce noise pollution. These forms of technology present similar issues of electrical and fan noise control. So, how are these forms of noise controlled?

The first step is to assess where a potential charging station may be located and if there are noise sensitive areas nearby. Once a potential site is identified, a determination of the noise generated by the station must be determined. This is determined based on vendor-provided and field-measured equipment noise levels. Once initial noise levels are calculated, the transmission to nearby receptors is predicted and potential mitigation strategies are identified. So, what are the options for noise mitigation of an electric vehicle charging station?

A general model of noise mitigation is the source-path-receiver approach. This method determines what is the most effective path of mitigation. Depending on the constraints of the potential project site, this method helps determine whether the source, path, or receiver is the most effective path of mitigation. Once the path of most effective mitigation is established, the types of mitigation available are determined.

Adding distance between the source and receiver is a simple way to reduce the noise impacts. There is typically a significant amount of distance loss attenuation in rural areas (e.g., approximately 65 dB (decibels) for 1-mile of distance based on a point source distance loss attenuation, not including ground surface attenuation, etc.). If distance between the source and receiver is limited, for example in high-population density areas, the path or receiver mitigation should be reviewed. Depending on the location and the project site, path attenuation is the next approach to help maintain a balance between the effected community. Depending on the noise source type, attenuation to the source could be applied. The PCS noise can be mitigated the form of a sound attenuator, sound barrier, or similar. The last approach is providing mitigation at the receiver. This typically a last resort and generally not cost effective and can be intrusive to receiver.

As new sources of electrified noise become more prevalent in our day to day lives, management of their noise emissions will become more prevalent. As discussed in this article, there are different approaches to mitigate noise depending on the location of electrified noise emitting site.



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Is Sound Management the Future of Noise Control?

By Jim Thompson

While there are still many cases where noise reduction is needed, there are also many instances where the noise control engineer's challenge is the management of sound in a particular environment. This may be obvious in cases like music performance spaces. However, more and more, the management of noise environments includes home, school, office spaces, automotive interiors, urban spaces, and much more. The role of the noise control engineer is broader in such cases than simply reducing the noise.

When I started in noise control engineering the scope of work was clearly defined as reducing the noise levels in almost every aspect of the field. Now, the scope of work has expanded to include managing the acoustic (sound) environment in a space. There are numerous examples such as the impact of appliances on the home sound environment, the enhancement of the experience of automotive occupants, and the control of privacy in office spaces where the sound levels may be increased to meet the needs of the customer. Clearly objectionable sound must be reduced. However, it may also be necessary to increase or add sound to provide the desired environment.

As electric vehicles are developed there are new challenges for noise control engineers. This was discussed in a recent SAE Update article*, Electrification Forces Fresh Perspectives on Vehicle NVH: <https://www.mobilityengineeringtech.com/component/content/article/ae/stories/news/46208>

The challenge of designing a new sound environment in which some sounds are gone and new sounds appear is discussed at length. A good quote from the article is "We're not trying to kill the sound, we're trying to design the sound."

This is just one example of the broader challenges faced by noise control engineers that go well beyond simply reducing noise. Due to the success in automotive noise control customers have grown accustomed to a characteristic background noise environment in an internal combustion powered vehicle. With the use of electric propulsion, new opportunities have arisen. These new ways to present value to the customer provide new challenges to the noise control engineer. We now have active programs to generate artificial noise in electric vehicles to provide the sensation of speed and acceleration that was familiar with an internal combustion engine. The role of the

noise control engineer is greater than only noise control in such cases.

This does not mean that traditional noise control is not important or is no longer needed. I got an angry reaction recently when I suggested that we might be better to call ourselves sound management engineers instead of noise control engineers. In a room full of noise control engineers, several people told me they were working hard to reduce noise to improve the quality of people's lives, and they saw sound management as something else entirely.

While I am sure many may still feel the challenge of reducing noise is enough, more and more noise control engineers are finding their role growing to include sound management in spaces. These may include urban spaces, homes, businesses, classrooms, performance spaces, transportation vehicles, hospitals, businesses, and even workspaces. This list continues to grow.

By now it is obvious that I believe sound management is the future of noise control. I would like to hear your thoughts. Is sound management part of noise control? Will we see the end of the need just to reduce noise from sources or in environments? Where does this intersection of noise control and sound management go? Will sound management become a routine part of the role of the noise control engineer? Do you agree this is the way noise control is evolving?

*Electrification Forces Fresh Perspectives on Vehicle NVH, June 17, 2022, Bill Visnic, Automotive Engineering, August 2022, p4.



The now-common “skateboard” architectures of EVs create unique NVH challenges; here, the skateboard chassis of a Rivian R1T pickup meets the bodyshell at Rivian’s assembly plant in Normal, IL. (Rivian)*

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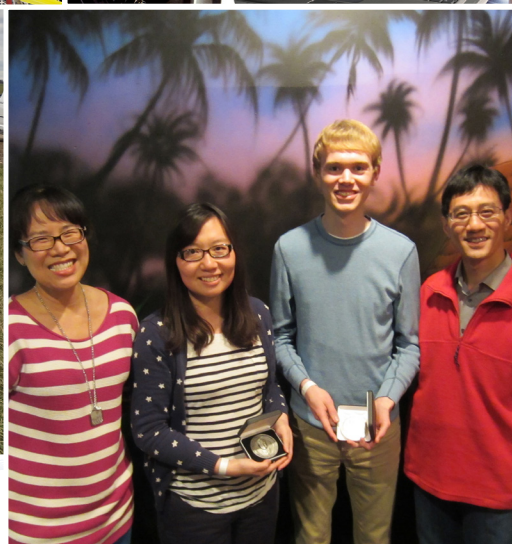


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The Potential Impact of Noise from Offshore Wind Farms

By Eoin King, Ryan Institute, University of Galway

Ireland's position on the edge of the Atlantic places it in an ideal position to harness energy from renewable sources, particularly from offshore wind power. Ireland's National Mitigation Plan (2017) recognises that we have one of the best offshore renewable energy (wind, wave and tidal) resources in the world, and there is very significant potential in utilising these resources to generate carbon-free renewable electricity. This is recognised in the current programme for government, ratified in 2020, setting an ambition of at least 3.5 GW of offshore wind power by 2030, as well as taking advantage of the potential for at least another 30GW of offshore floating wind power in the deeper waters in the Atlantic. There are clear targets for Ireland regarding decarbonized energy systems, and there is a greater understanding of the role that offshore wind energy can play in achieving these targets.

While the potential behind offshore wind energy is massive, there are some concerns over the environmental impact that may arise from widespread adoption, including increased noise levels above and below the sea, disturbances to habitats, and potential pollution from the release of contaminants from seabed sediments. The collection of wind turbines in farms, as opposed to standalone units, will increase noise generation. Further, with the increasing height of the wind turbine towers, and the increasing size of the offshore wind farms, these environmental impacts are becoming significant [1]. This is particularly important in the case of low frequency noise. Larger turbines have significantly more low frequency noise compared to smaller turbines.

While most discussions around noise from Offshore Wind Farms are concerned with the impact (underwater) noise may have on marine life, this article considers the potential for the impact of audible noise on coastal communities. Of course, while underwater noise is a significant concern and will require more research to assess likely impacts, there has been minimal consideration (in the academic literature) of the impacts of audible noise on coastal communities.

As it currently stands there is no reliable method to ascertain the noise impact of offshore wind turbine developments. A standard simply does not exist, so in the relatively few cases

where a noise impact assessment is performed, developers often apply standards that are used for onshore developments. Several EISs for planned developments in Ireland (and the UK) have used ISO 9613 in the assessment of operational noise. This standard is not designed for propagation over water, and its use may significantly under-predict the true impact of a development. Propagation over water usually means that the sound will travel over longer distance, especially at lower frequencies. There is little published research or guidance in Ireland or the UK on the propagation of noise over water. Further, there is currently no recommended calculation method for the assessment of noise from offshore wind farms.

There is some evidence that, when wind turbine noise is propagating over water, there is a 3 dB decrease in sound level for each doubling of distance (cylindrical propagation) instead of the more usual 6 dB (spherical propagation) used for on-shore calculations [2]. This would mean noise over water will be louder over twice the distance compared to propagation over land, and could lead to significant exposure issues related to low frequency noise. Any exposure assessment for offshore wind turbines may significantly under-predict the level of noise, and, as low frequency noise transmits more efficiently through walls, these underpredictions may lead to significant adverse issues in homes.

While the issue of sound propagation over water needs to be further investigated in itself, the interaction between the water surface and the meteorological conditions at sea is another important issue in need of further research. Meteorological conditions, water surface roughness, and the water/land border, are also important to consider, and their effects are not currently well defined. Further, when a sound wave propagating over the sea reaches the shoreline, a variety of changes happen all at once, including changes to the ground impedance and the wind and temperature gradients. This will alter the sound speed profile and will induce some refraction. Only a few studies have been made of the shoreline effect for acoustical propagation [3], but one study suggests a possible attenuation of only 3dB [4]. The current noise prediction tools commonly used to assess the acoustic impact of wind farm developments are only partially taking these parameters into account. A reliable method to

capture the effect of these parameters on noise propagation from offshore is required, as a failure to take these issues into account may result in a significant underprediction of the impact of offshore wind turbines.

This is further complicated in a marine environment. The marine boundary layer (MABL), the part of the atmosphere in contact with the ocean, is directly influenced by the ocean, and is shallower than the atmospheric boundary layer. Further the MABL is where the ocean and atmosphere exchange large amounts of heat, moisture, and momentum, primarily via turbulent transport. Consequently, wind speeds on sea for a given height are higher, and turbulence intensities are lower, than on land. It is further complicated by the potential presence of low-level jets, which are winds of high speed occurring at a relatively low height and are usually formed by diurnal changes in the thermal stratification of the surface layer.

As sound is propagating from source to receiver, the manner in which it interacts with the ground surface also plays an important role. Some sound energy hits the ground surface and is absorbed or reflected. The spreading of the reflected sound is dependent on the surface roughness of the ground. It is generally assumed that a flat water surface will totally reflect sound. However, under real conditions on sea, water waves, with different amplitudes and wavelengths, will be present. The effect that water waves have on sound propagation is not fully understood.

In discussions on the noise impact of offshore developments, many point to that fact the wind farms installation are located increasingly further offshore, typical several 10s of km offshore, which may make their acoustic emissions negligible onshore. However, there is always a certain degree of uncertainty, for reasons outlined above. Quite simply, it is not possible to make an assertion on impact one way or the other using today's tools, as no validated model currently exists. Further, in the case of Ireland, of the six Phase One offshore Wind Farms under development, four are actually within approximately 10km of the shore at their closest point. It is not unreasonable to suggest that any of these proposed developments, as well as those further offshore, could be audible in coastal communities, and certainly warrants further investigation.

Should noise from offshore wind turbines be audible on the coast, it is highly likely they will be audible above the background noise sources. This could lead to complaints resulting in a lack of social acceptance for developments. The time has come to perform a detailed assessment of the acoustic impact of offshore developments, in order to avoid unnecessary noise-induced barriers to development in the future, and ensure we can harness the full potential of offshore wind energy. Research is being conducted in the area, both at the University of Galway, and across Europe through the work of IEA Wind TCP Task 39.

SOUND PROPAGATING OVER WATER – SOME PERSONAL EXPERIENCE.

Last summer, along with two close friends, I decided to take up sea swimming in the early morning hours. I started in June and continued until mid-November, at which time the water in the Atlantic Ocean was simply too cold for me to brave any longer. One particularly cold and calm morning, my friends and I were not feeling particularly brave, and instead of jumping into the sea, we chose to slowly descent at some steps a little distance from the main diving board area (to save ourselves from embarrassing ourselves in front of the seasoned swimmers). The water was so cold we uttered some choice words (along with the occasional shriek). But thankfully, as we were a little bit away from the experienced swimmers, we felt that no-one could hear us. That was until someone came upon us and started to poke some fun at us - he had been walking along the promenade probably a couple of hundred metres away, and heard every word we said, and much to our embarrassment repeated those words back to us. He told us that everyone along the prom could hear us, and we had brightened up everyone's morning. It turns out that our voices carried over the calm water that morning, and anyone out for a walk heard us as we 'acclimatised' to the cold water

Sound can travel very efficiently over water, sometimes much more efficiently than you might expect!

References

- [1] Dai K., Bergot A., Liang C., Xiang W., Huang Z., *Environmental issues associated with wind energy – A review*, Renewable Energy (75), 911-921, 2015.
- [2] Keith, S.E., Daigle, G.A., Stinson, M.R., *Wind turbine low frequency and infrasound propagation and sound pressure level calculations at dwellings*. J. Acoust. Soc. Am., 144, 981–996, 2018.
- [3] Boué, M., *Final report for the Swedish Energy Agency project 21597-3 (TRANS), Long-range sound propagation over the sea with application to wind turbine noise*, KTH, Stockholm, 2007.
- [4] L. Johansson *Sound Propagation around off-shore Wind Turbines -Long-Range Parabolic Equation Calculations for Baltic Sea Conditions*, Licentiate Thesis, KTH, Stockholm 2003.

Will EVs make our cities quieter?

By: Erik Bühlmann, Daniel Schweizer and Felix Schlatter, G+P Ingenieure

An initial assessment based on a limited comparative study and tyre statistics.

Introduction

E-mobility is gaining in importance worldwide. The European Parliament and the European Commission earlier this year formally approved a law to ban the sale of new gasoline and diesel vehicles in the European Union from 2035 [1], [2]. Legislation such as this will further accelerate the shift to electric vehicles (EVs). While EVs are known to have numerous positive effects on the environment, little is known on the impact of EVs on road traffic noise emissions. EVs are generally considered to be quieter than vehicles with combustion engines, as they produce virtually no engine noise [3]. However, the total noise emissions of vehicles are not only due to the engine noise: Several studies show that for passenger cars, tyre/road noise dominates already at a speed of 15 to 30 km/h [4], [5] & [6]. The question arises among noise abatement officials and noise plagued residents regarding the expected impact of EVs on noise emissions from urban roads. Systematic comparisons between electric vehicles and combustion vehicles are hardly available to date. Therefore, we attempt here to make an initial assessment of the noise impact of EVs on urban roads based on a limited comparative study and tyre statistics.

1. Noise emissions of EVs and combustion vehicles in direct comparison

To obtain an initial assessment about the impact of EVs on noise emissions in cities, we conducted a series of road tests with seven EVs and seven combustion vehicles (CVs). The vehicles were subjected to three different driving scenarios commonly encountered on urban roads.

1.1 The pairing of vehicles

To compare EVs with CVs, seven electric vehicles of different categories, ranging from small cars to delivery vans, were selected. Based on this selection, the corresponding vehicle counterparts with internal combustion engines were then searched for (see Figure 1). When selecting the vehicles, the pairing was chosen as best as possible, however, there were limitations in selection and availability. For example, a VW E-Golf would have been preferable as a counterpart to the VW Golf, instead of the VW ID.3. However, this vehicle was not available for the road tests.

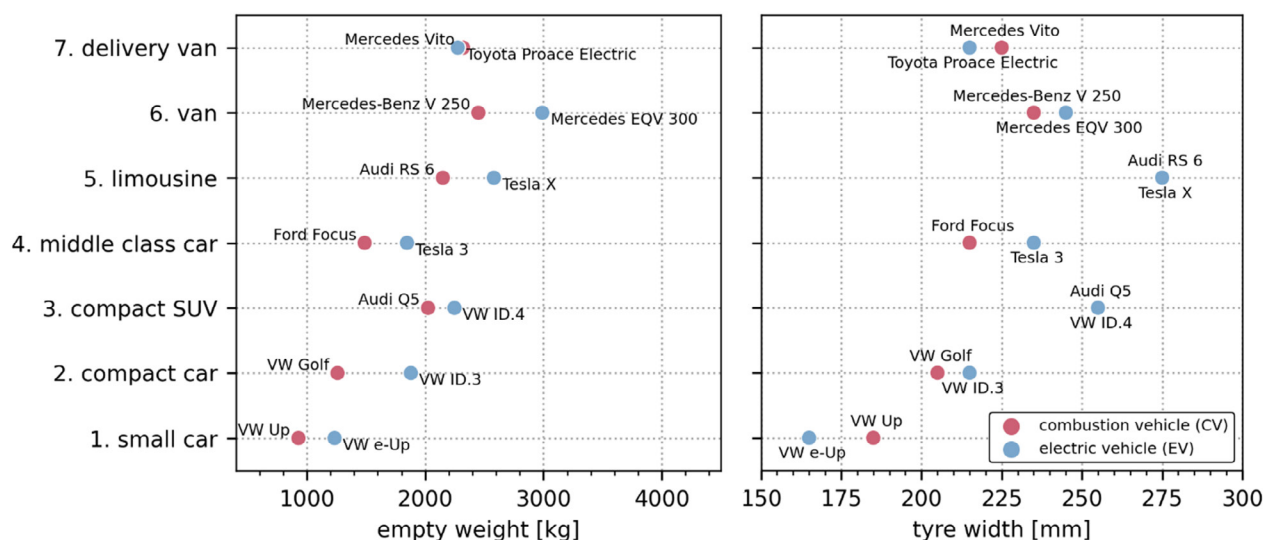


Figure 1: Empty weight and tyre width of the selected electric vehicles and their counterparts with combustion engines by category.

As can be seen in Figure 1, all EVs (except for category 7 “delivery van”) have an empty weight 220 to 620 kg higher than the corresponding CVs due to their heavy batteries. In terms of tyre width, there is no systematic difference between the two vehicle types in the present sample.

1.2 The driving tests

To collect the noise emission data, pass-by measurements according to ISO 11819-1 [7] were performed at three microphone positions (A, B and C) placed at 25 m from each other on two different pavements – a conventional pavement and a low-noise pavement. In 7.5 m distance from the centre of the lane, the maximum sound level ($L_{A,F,max}$) as well as the equivalent sound level ($L_{A,eq}$) were recorded. The following three urban driving scenarios were simulated with all vehicles: 1) Constant velocity, the vehicles passed the three microphones at a constant driving speed of 20, 30, 40, 50 and 60 km/h; 2) Acceleration, the vehicles drove at 20 km/h to the first microphone “A” and then accelerated to 40 km/h and 60 km/h to microphones “B” and

“C” respectively; and 3) Stop & Go, the vehicles drove past the first microphone “A” with 30 km/h, then slowed down, came to a complete stop at the second microphone “B” and then accelerated again and passed microphone “C” at a speed of about 40 km/h. The vehicles were driven by different drivers. Despite precise instructions, minor differences in personal driving behaviour were observed.

1.3 Noise emissions from EVs compared to CVs

To provide an overview, only the aggregated results across measurement positions (A, B and C) and vehicle categories (1 to 7) are presented in Figure 2. A detailed description of the measurements and the results can be found in the study [8].

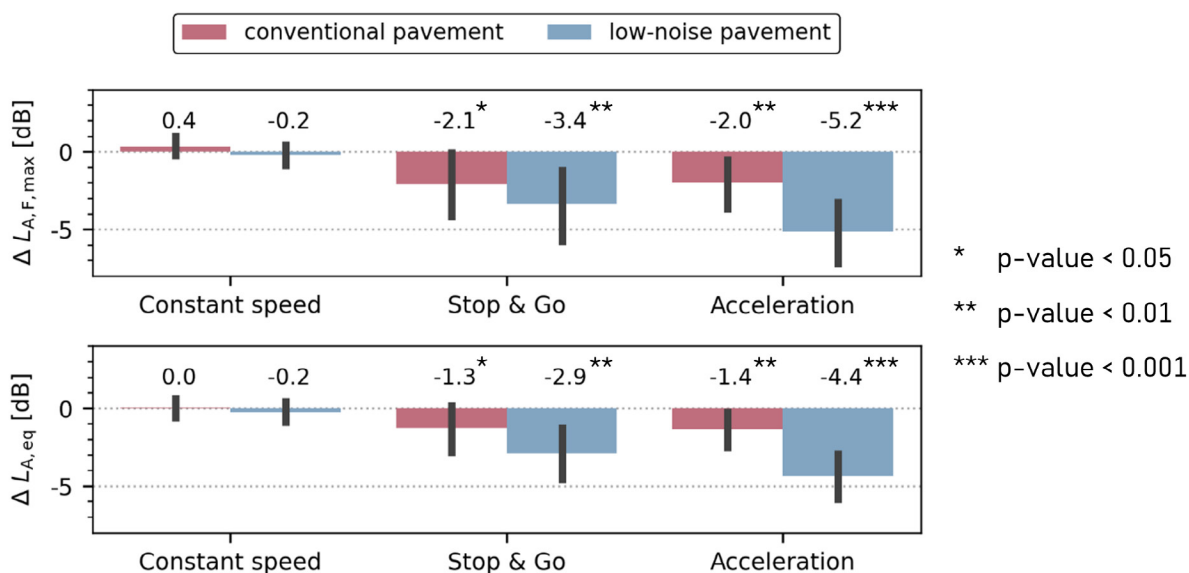


Figure 2: Mean difference values (EV - CV) and the corresponding 95 % confidence interval of $L_{A,F,max}$ and $L_{A,eq}$ for the three driving scenarios. All seven car categories are averaged without weighting.

Our limited vehicle comparison showed that the EVs used in this study are significantly quieter than their CV counterparts for the typical urban driving scenarios “acceleration” and “stop & go”. Interestingly, the study shows that the effect of EV’s is greater on low-noise pavements than on conventional ones. This can be explained by the reduced tyre/road noise on low-noise pavements which leads to a bigger influence of the propulsion noise component, causing the main difference in noise emissions between EVs and CVs.

At constant speed, however, the EVs used in this study did not show systematic differences in noise emissions compared to the corresponding CVs: At all tested speeds of 20, 30, 40, 50 and 60 km/h, no significant difference between EVs and CVs with regard to the noise emission was found, regardless of the road surface.

2.What happens when EV's higher weight and torque require wider tyres?

In the limited comparison study, no significant differences in noise emissions were found between EVs and CVs at constant speed between 20 and 60 km/h. It must be emphasised that due to the small vehicle sample, the available data basis is rather small. Therefore, no clear conclusions about the differences in noise emissions between EVs and CVs can yet be derived from the measurement data. However, it appears that at constant driving speeds, other factors such as unladen weight or tyre specifications play a greater role than the propulsion type.

Because the electric battery of EVs is quite heavy, other studies have found EVs to be about 200 to 300 kg heavier than their corresponding CV counterpart [9]. The increased weight and higher maximum torque of EV's and the resulting use of wider

tyres with a higher load index may have a negative influence on the noise emission of an electric vehicle [10].

To find out how noise emissions may statistically change with increasing electrification of vehicles, we further analysed a database of all (C1) passenger car tyre products sold in Switzerland. On the one hand, we are interested in how the noise label statistically changes as a function of tyre width. On the other hand, we would like to know how the tyre load index affects the noise label. The tyre load index is a value ranging from 62 (=265 kg load per tyre) to 126 (=1700 kg load per tyre) and relates to the maximum carrying capacity of the vehicle. Understanding these trends may help us further assess the impact of the rapidly advancing electrification of vehicles on noise emissions.

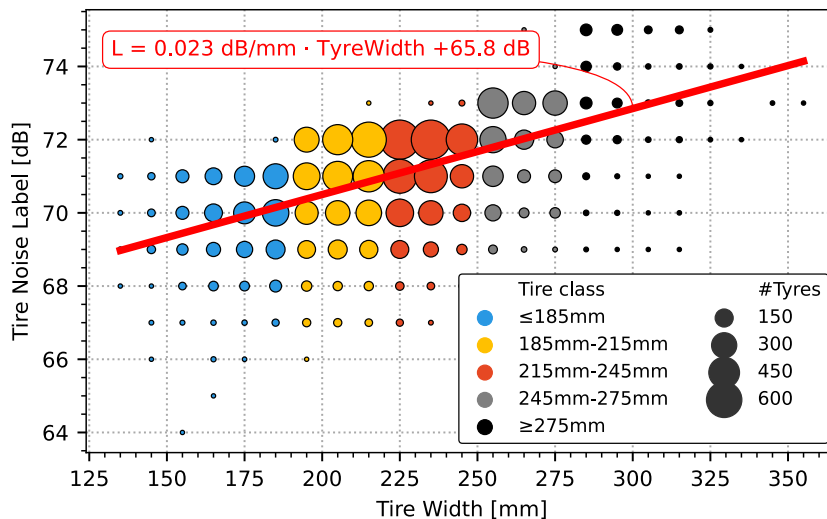


Figure 3: Relationship between tyre width and the tyre noise label based on the Swiss tyre product database.

Figure 3 shows that noise levels (noise labels) increase with tyre width by about 1 dB per 43 mm. So if EVs had to be fitted with slightly wider tyres than CVs due to their weight and torque, a slight increase in noise would have to be expected. A multivariate model between tyre width, load index and noise label, confirms the positive relationship between tyre width and noise while the load index again contributes to a noise increase of 0.05 dB per 10 units of load Index.

Table 1: OLS Regression Results of the model to predict the "Tyre Noise Label [dB]" based on variables "Tyre Width [mm]" and "Load Index [-]"

	Coefficient	Std. error	t-value	P > t-value
Intercept	65.57	0.108	608.88	0.000
Tyre Width	0.022	0.001	40.03	0.000
Load Index	0.005	0.002	2.75	0.006

As the above model shows, the load index seems to be significantly less decisive than the tyre width with regard to noise emissions. So, the mere increase in weight of EVs compared to CVs would not have to result in major increases in noise levels, unless wider tyres are fitted. It should be noted, however, that the above correlations were not determined directly based on measurements but were established indirectly via the tyre noise label. Given the relatively high uncertainties determined for the EU tyre noise label [12], the correlations between tyre width, weight index and acoustics may even be stronger in reality

3. Conclusions

In this article, based on a limited comparative study, an attempt was made to estimate the influence of the rapidly advancing electrification of vehicles on noise emissions in urban areas. The good news for residents is that significantly lower noise emissions can be expected for the driving scenarios “acceleration” and “stop & go”, which are common on urban roads. Depending on the dominant driving behaviour on a road section and the road surface, noise reductions of 0 to a maximum of 5 dB can be expected. The more unsteady driving behaviour there is on a road section and the quieter the road surface, the greater the noise-reducing effect of electrification. The bad news, on the other hand, is that at constant driving speeds, no significant reduction in noise emissions was found for EVs at speeds between 20 and 60 km/h. If we assume that EVs tend to be equipped with wider tyres and higher load indexes due to their higher weight and torque, we even have to expect a slight increase in noise pollution on roads with constant driving speeds. It should be stated that only a very small sample of pairs of EVs and CVs could be studied. Further research is needed to reliably predict the change in noise emissions as a result of vehicle electrification. Moreover, in future studies, other vehicle types e.g. heavy trucks, the impact of AVAS, as well as the effect of EVs at the high speed road network should be investigated.

4. Acknowledgments

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5. References

1. K. Abnett, ‘EU countries approve 2035 phaseout of CO₂-emitting cars’, Reuters, Mar. 29, 2023. Accessed: Apr. 03, 2023. [Online]. Available: <https://www.reuters.com/business/autos-transportation/eu-countries-poised-approve-2035-phaseout-co2-emitting-cars-2023-03-28/>
2. Council of the European Union, ‘Fit for 55’, Fit for 55. <https://www.consilium.europa.eu/en/policies/green-deal/fit-for-55-the-eu-plan-for-a-green-transition/> (accessed Mar. 22, 2023).
3. H. Campello-Vicente, R. Peral-Orts, N. Campillo-Davo, and E. Velasco-Sanchez, ‘The effect of electric vehicles on urban noise maps’, *Appl. Acoust.*, vol. 116, pp. 59–64, Jan. 2017, doi: 10.1016/j.apacoust.2016.09.018.
4. E. Hammer, S. Egger, T. Saurer, and E. Bühlmann, ‘Traffic noise emission modelling at lower speeds’, in *ICSV23*, Athens, 2016.
5. K. Heutschi, E. Bühlmann, and J. Oertli, ‘Options for reducing noise from roads and railway lines’, *Transp. Res. Part Policy Pract.*, vol. 94, pp. 308–322, Dec. 2016, doi: 10.1016/j.tran.2016.09.019.
6. S. Kephelopoulou, M. Paviotti, and F. Anfosso-Lédée, ‘Common Noise Assessment Methods in Europe (CNOSSOS-EU)’, *JRC Publications Repository*, Sep. 12, 2012. <https://publications.jrc.ec.europa.eu/repository/handle/JRC72550> (accessed Apr. 04, 2023).
7. EN ISO 11819-1:2022, ‘Acoustics—Measurement of the Influence of Road Surfaces on Traffic Noise—Part 1: Statistical Pass-By Method.’, Geneva, Switzerland, 2022.
8. D. Schweizer et al., ‘(in press), Noise Emissions: What to expect from electric vehicles compared to combustion vehicles?’, in *ICSV29*, Prague, 2023.
9. V. R. J. H. Timmers and P. A. J. Achten, ‘Non-exhaust PM emissions from electric vehicles’, *Atmos. Environ.*, vol. 134, pp. 10–17, Jun. 2016, doi: 10.1016/j.atmosenv.2016.03.017.
10. ATEEL S.à r.l., ‘Study on future sound limit values for type approval for vehicles of category M & N, ACEA – Association des Constructeurs Européens d’Automobiles’, Luxembourg, Final Report V01.00. Accessed: Apr. 05, 2023. [Online]. Available: https://www.ateel.com/app/uploads/2022/03/2022-01-27_Final-Report_V01.pdf
11. Regulation (EU) 2020/740 of the European Parliament and of the Council of 25 May 2020 on the labelling of tyres with respect to fuel efficiency and other parameters, amending Regulation (EU) 2017/1369 and repealing Regulation (EC) No 1222/2009, vol. 177. 2020. [Online]. Available: <http://data.europa.eu/eli/reg/2020/740/oj/eng>
12. F. Schlatter, U. Sandberg, E. Bühlmann, and T. Berge, ‘Project STEER: Improving the EU Tyre Noise Label’, presented at the *Internoise*, 2022.

The Noise Impact of Future Sustainable Homes in Ireland

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Introduction

Noise mitigation is a key environmental challenge that faces sustainable development. New approaches in energy production and distribution will change urban acoustic landscapes. The current carbon and global warming crises highlight the need to provide sustainable housing that utilises renewable energy technologies. Residential areas will be affected by noise produced in sustainable homes which will include small scale energy production. Noise pollution has a negative effect on human health and so it is crucial that the noise impact of potential sustainable energy technologies going into future homes is evaluated.

According to the European Environment Agency, over 13 million adults are estimated to suffer sleep disturbances from environmental noise in Europe. (1) Member states of the European Union have an obligation to assess noise levels on strategic noise maps and report where threshold values of 55 dB for L_{den} and 50 dB for L_{night} have been surpassed. These threshold values represent a physical scale to describe environmental noise at values that are linked to the harmful effects of noise. (2)(3)

Irish homes use 7% more energy than the EU average and emit approximately 60% more CO_2 than the average EU home. This is because the floor area of the average Irish dwelling is amongst the largest in the EU, due to Ireland's low share of apartments. (4) In 2018, Irish buildings were 70% reliant on fossil fuels. The Irish Climate Action Plan 2021 states that the government will reduce greenhouse gas emissions by 51% by 2030 and by 2050 they will phase out all fossil fuels in the building sector in order to reach net zero targets. Electricity is the sector with the largest proposed emissions reductions by 2030. (5) Therefore, sustainable renewable energy technologies are the only option to provide energy to a future home in Ireland. There are different energy needs in a home – heat for comfort and for domestic hot water and electricity for plug-ins such as white goods, lighting and for devices. The Irish Climate Action Bill 2021 commits to installing 600,000 heat pumps in residential buildings by

2030 as one of the steps to meet the required level of emissions reduction.

In this research, the noise footprint is calculated for a future home including a heat pump for heat and domestic hot water, and photovoltaic panels and residential wind turbines to supply electricity and reduce demand on the national grid. The aim is to understand the noise effects of different scenarios of these small-scale renewable energy technologies installed in future sustainable homes.

Methodology

Future Home Model

Passivhaus is a popular building standard that the construction industry are considering for future home construction. It was first developed in Germany and focuses on the concept that houses should be built to use less energy. The standard is acclaimed for being energy efficient, environmentally friendly as well as comfortable and affordable – all key aspects that a model of a future home must consider. (6) There are five core concepts of the Passive House build: (1) Air-tight construction, (2) thermal insulation, (3) heat recovery ventilation, (4) high-performance windows, and (5) thermal bridge-free detailing. (7) There are a number of Passive House certified homes already built in Ireland.

Standard

Calculations were made according to ISO 9613, a standard that deals with the acoustic attenuation of sound during propagation outdoors. iNoise is commercial implementation of the calculation methods set out in ISO 9613 and was used to model the equivalent continuous A-weighted sound pressure levels predicted with different installations of renewable energy technologies.

Sound Power Levels

Heat pumps and wind turbines were modelled in iNoise to investigate the noise effects of these technologies on the surrounding residential areas.

The heat pump investigated in the models is the Daikin Altherma ERQ. It is a monobloc outdoor unit with a COP of 3.94. (8) Sound pressure levels were determined from technical datasheets and these were then converted to A-weighted sound power levels for iNoise.

$$L_w = SPL_A + 20 \log(r) + 11 + D$$

where L_w is the sound power level, SPL_A is the A-weighted sound pressure level, r is the distance from the source to the receiver and D is a correction factor referring to the number of reflecting planes.

Two different scales of wind turbine were modelled. A small wind turbine, with output 5kW and a micro wind turbine with output 0.6kW, were both used in different scenarios. (8) Sound pressure levels were determined from a previous publication and converted to sound power levels.

$$L_w = L_p + |10 \log \frac{Q}{4\pi r^2}|$$

where L_w is the sound power level, L_p is the sound pressure level, Q is the directivity of the source which correlates to a +3 dB increase for ground reflection and r is the distance from the source to the receiver.

Table 1: Sound power levels for the renewable energy technologies modelled

	<i>f</i> (Hz)	63	125	250	500	1000	2000	4000	8000
Heat pump	L_w (dB)	52.5	54.5	61	64	64	59	53	46
Micro Wind Turbine	L_w	73.2	74.2	74.8	76.7	79.3	83.8	79.6	66.7
Small Wind Turbine	L_w	78.2	85.9	88.9	92.4	93.1	92.2	88.9	83

Results

Multiple scenarios were investigated to assess the noise footprint for different combinations of the renewable energy technologies. A middle house in a row of seven terraced houses with semi-detached houses on each side were chosen as the focus for the simulation. Receivers were placed at the centre house (R2), and at both end of terrace houses (R1, R3) to investigate the noise at different bedroom locations in the row of houses, see Table 2. The building layout was chosen as representative of suburban housing developments in Ireland. The building heights were 6m, which is representative of a two-storey house in Ireland. (9)

It is estimated by the Sustainable Energy Authority of Ireland (SEAI) that 61% of all energy used in a household is for space heating, 20% for hot water heating, 16% for lighting and appliances and 2% for cooking, based on BER estimates. In 2021,

the average Irish home used 20,424 kWh of energy (weather corrected). (10) This correlates to approximately 55.96 kWh per day. From these figures an approximation of the average energy provision to a home of the scenarios was created and an estimate of the reduction of grid reliance determined. The results of these estimations are included in Table 3.

The Daikin Altherma ERQ heat pump has a COP of 3.94. This means that although it provides 81% of the energy requirements of the home, approximately 45.3 kWh, it used 11.5 kWh per day.

The micro wind turbine is an Ampair A600, which provides 1300 kWh of energy annually for a 5m/s wind speed. This correlates to approximately 3.56 kWh per day. (11)

The small wind turbine is an Evance Iskra R9000 which provides 9018 kWh of energy annually for a 5 m/s wind speed. This correlates to approximately 24.7 kWh. (12)

According to the SEAI, an at home solar photovoltaic system of approximately 20m² generates around 2600 kWh of electricity annually. This correlates to approximately 7.1 kW per day.

Planning permission is required where these panels cover more than 50% of the area of the roof of the home. In these scenarios it was estimated that each house had 10m² of solar photovoltaic panels approximating to 3.55 kWh per day.

Heat Pump

The first scenario modelled was the impact of heat pumps alone on the houses. Reflections from the surrounding buildings produced the highest noise level not in the centre of the row of houses but at one end. L_{den} for this scenario was calculated to be 43.1 dB at R1, 32.9 dB at R2 and 45 dB at R3.

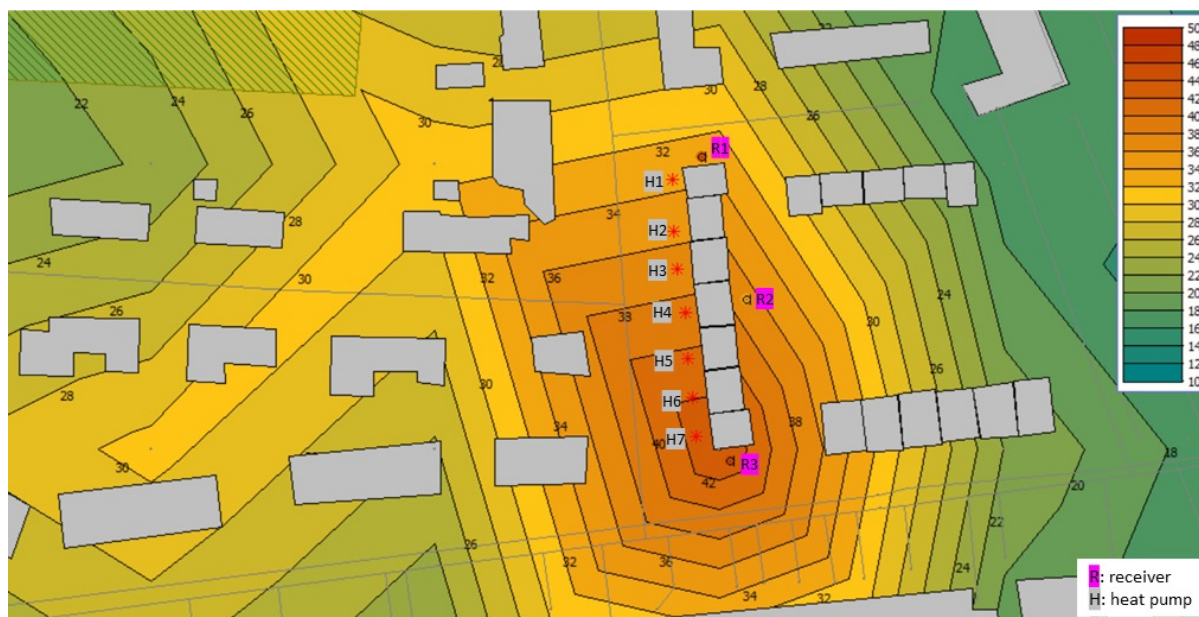


Figure 1: Noise map of heat pumps in Irish suburban development

Micro Wind Turbine

The micro wind turbines were simulated alone. One could be placed in each garden as the rotor diameter of the micro wind turbine was 1.7m. To avoid interference from other wind turbines, they must be placed five times the rotor diameter apart. L_{den} for this scenario was calculated to be 63.3 dB at R1, 51 dB at R2 and 62.4 dB at R3.

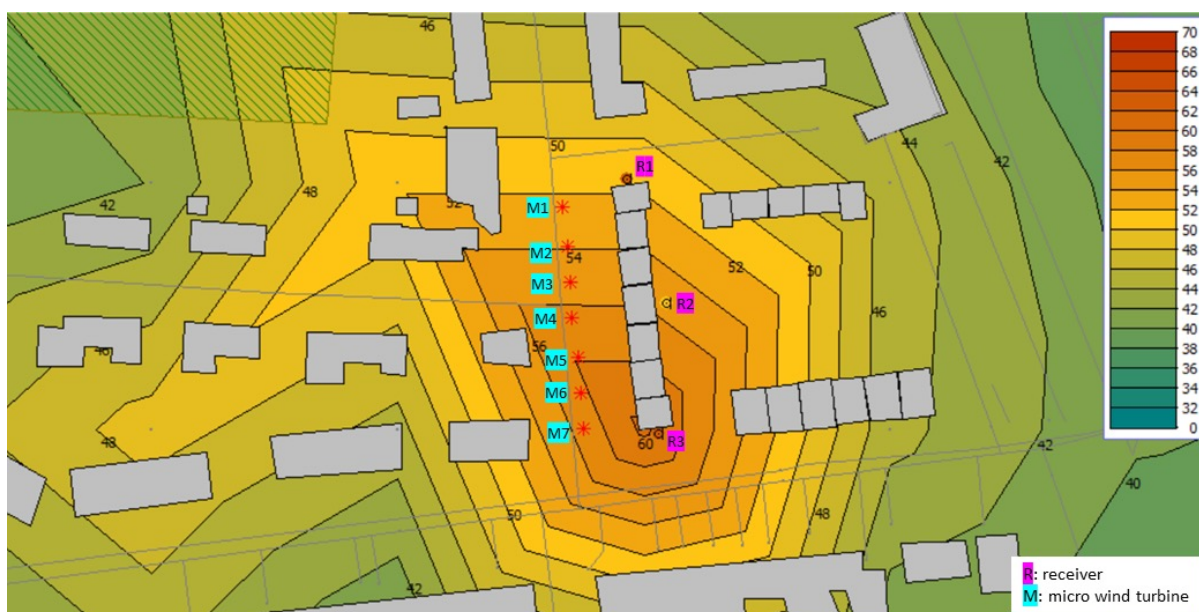


Figure 2: Noise map of micro wind turbines in Irish suburban development

Small Wind Turbine

The small wind turbines have a rotor diameter of 5.4m, which means they must be at least 27m apart. They are not suitable for installation at each house on the terrace because of this. L_{den} for this scenario was calculated to be 65.3 dB at R1, 56.1 dB at R2 and 73.1 dB at R3.

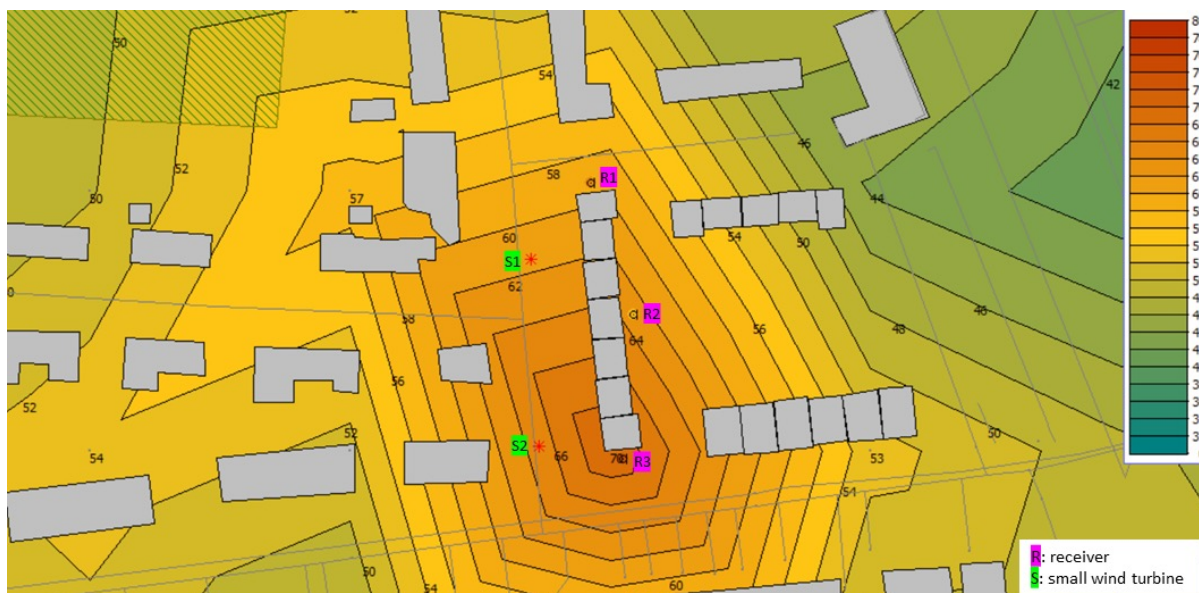


Figure 3: Noise map of small wind turbines in Irish suburban development

Scenario 1

The combination of micro wind turbines and heat pumps were investigated together. The heat pumps were located close to the houses and the wind turbines located further from the houses. Each home was modelled with a heat pump and micro wind turbine. L_{den} for this scenario was calculated to be 63.3 dB at R1, 51.1 dB at R2 and 62.4 dB at R3.

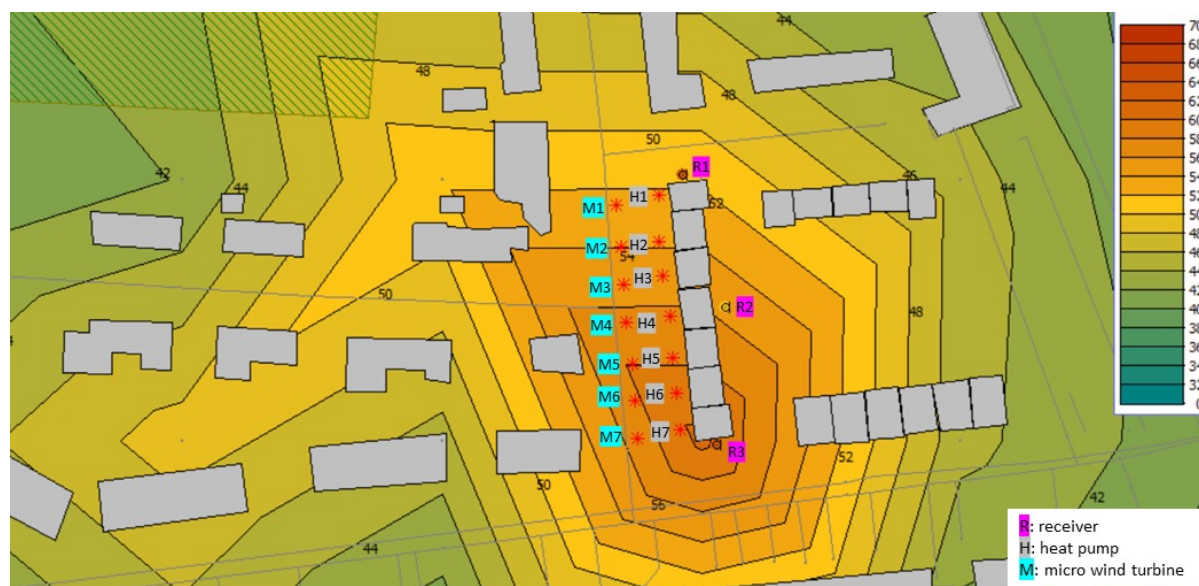


Figure 4: Noise map of heat pumps and micro wind turbines in Irish suburban development

Scenario 2

The combination of small wind turbines and heat pumps were investigated together. Each home was modelled with a heat pump and small wind turbine was shared between five homes. L_{den} for this scenario was calculated to be 56.7 dB at R1, 54.9 dB at R2 and 56.8 dB at R3.

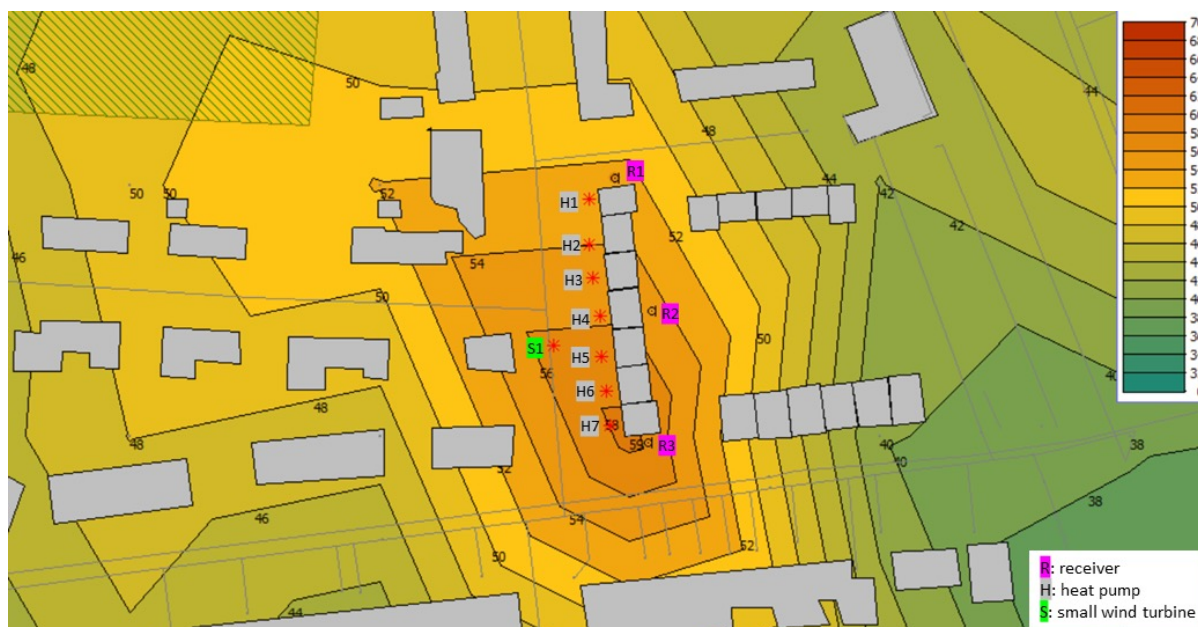


Figure 4: Noise map of heat pumps and micro wind turbines in Irish suburban development

The noise levels at each receiver location is shown in Table 2. A comparison of estimations of energy savings is calculated in Table 3.

Table 2: Noise levels calculated at receiver locations

Model	R1 (dB)	R2 (dB)	R3 (dB)
Heat pumps only	43.1	32.9	45
Micro wind turbine only	63.3	51	62.4
Small wind turbine only	65.3	56.1	73.1
Scenario 1	63.3	51.1	62.4
Scenario 2	56.7	54.9	56.8

Table 3: Estimation of reduction of energy per home in Scenario 1 and 2

Scenario	1		2	
Heat pumps	1 per house	Providing 45.3 kWh Using 11.5 kWh	1 per house	Providing 45.3 kWh Using 11.5 kWh
Micro wind turbine	1 per house	Providing 3.56 kWh	none	
Small wind turbine	none		1 shared with 5 houses	Providing 4.94 kWh to each house
Solar photovoltaic panels	10 m ² per house	Providing 3.55 kWh	10 m ² per house	Providing 3.55 kWh
Grid requirements	15.02 kWh		13.47 kWh	
Reduction in reliance on grid	73%		76%	

Conclusions

L_{den} ranged from 51.1 dB to 63.3 across both scenario models. Table 2 shows that Scenario 1 had the most variation in noise at the receivers. Across all models R2, the receiver at the house at the centre of the terrace row, calculated the lowest value of the three receivers. In Table 3, Scenario 2 reported lower noise levels than Scenario 2 and reduced the reliance of the houses on the grid by a 3% more than Scenario 1. Community energy resources may be more efficient than individual resources. The European Noise Directive requires European Union member states to report where threshold values of $L_{den} = 55$ dB have been exceeded. Irish Building Regulations Part E requires that the sound insulation in walls be a minimum of 53 dB. The adverse human health impacts of noise and these threshold values must be considered when installing renewable energy technologies in residential areas.

There is a wide range of potential scenarios including a variety of residential small-scale energy production technologies. Many technical data sheets for heat pumps and wind turbines do not include full spectra sound pressure levels which are required to map these technologies according to ISO 9613. It was difficult to find a selection of sources which had this information and so the choices for technologies were limited. Manufacturers should be required to provide full spectra sound pressure levels so that the noise impact of these technologies can be properly assessed for suitability before installation.

References

1. European Environment Agency. Environmental Noise. 2019.
2. European Environment Agency. Managing exposure to noise in Europe. 2021.
3. European Commission. Directive 2002/49/EC. Environmental Noise Directive. 2002.
4. Sustainable Energy Authority Of Ireland. Energy in the Residential Sector [Internet]. 2018. Available from: <https://www.seai.ie/data-and-insights/seai-statistics/key-publications/energy-in-residential-sector/>
5. Irish Department of the Environment, Climate and Communications. Climate Action Plan 2021. Department of the Taoiseach, 2021.
6. Williams F. Passivhaus: the future of architecture? [Internet]. RMJM. 2022. Available from: <https://rmjm.com/passivhaus-the-future/>
7. International Passive House Association. Passive House Brochure. 2018.
8. Taylor J, Eastwick C, Lawrence C, Wilson R. Noise levels and noise perception from small and micro wind turbines. Renewable Energy. 2013 Jul 1;55:120-7.
9. Dublin City Council. 16.7.2 Height Limits and Areas for Low-Rise, MidRise and Taller Development* (See Building Height in Dublin). 2020. Available from: <https://www.dublincity.ie/dublin-city-development-plan-2016-2022/16-development-standards/167-building-height-sustainable-city/1672-height-limits-and-areas-low-rise-midrise>
10. Sustainable Energy Authority Of Ireland. Ireland's Energy Statistics Residential [Internet]. 2021. Available from: <https://www.seai.ie/data-and-insights/seai-statistics/key-statistics/residential/>
11. Ampair 600 230V Wind Turbine Brochure | Manualzz [Internet]. manualzz.com. [cited 2023 Mar 20]. Available from: <https://manualzz.com/doc/11532935/ampair-600-230v-wind-turbine-brochure>
12. Evance R9000 Wind Turbine [Internet]. Eco Evolution Blog. 2009 [cited 2023 Mar 9]. Available from: <http://ecoevolution.ie/blog/evance-iskra-r9000/>

NOISE/NOTES

Eoin A. King, NNI Editor

NNI is on Facebook and Twitter - we try to keep our readers informed with noise news from all across the globe by highlighting interesting research and projects. Here is a roundup of some of the stories that have been making headlines. Follow @NNIEditor to stay up to date with all noise related news.

What to do – a noisy Heat Pump is keeping us up at night

This one is from a little while back, but is in keeping with the theme of this special issue. A concerned resident writes to [the Irish Times property](#) section complaining that a heat pump is keeping them awake at night. The reader is referred to the requirement for noise protection recognised by all local authorities; Irish building regulations stipulate the standards to which new buildings and extensions should be designed and constructed.

Similarly the Institute of Acoustics (UK), [responded to a recent consultation](#) from the Department for Business, Industry and Industrial Strategy in the UK. The consultations ask whether a heat pump first approach should be taken to replacing fossil fuel heating for homes and businesses off the gas grid. IOA answer no because we are not convinced potential noise issues have been properly addressed.

Noise Pollution is Killing Us

A recent opinion piece in the [Guardian \(UK\)](#) covers the problems of noise pollution in detail. It notes that noise disproportionately affects lower-income families, as well as the fact that London has not updated its noise pollution strategy in almost 20 years. This article is certainly worth a read.

Recent Developments in Airport Noise in Europe

[Euronoise](#) reports that Amsterdam's Schiphol airport is aiming to eliminate overnight flights by the end of 2025. It is part of a push to reduce noise pollution and lower CO2 emissions. However, some airlines are opposing the proposals, and are preparing to mount a legal challenge to the night-time ban.

Elsewhere, in Ireland, there has been significant discontent over the opening of a new runway in Dublin airport. [The Irish Times](#) reports that residents claim a change in flight paths by the airport's operator, DAA, since February 23rd have led to several new communities being "significantly affected by unexpected

aircraft noise" and have increased air traffic and noise in some areas.

Plants are not silent – they make noise!

[A new study](#) suggest that plants actually emit ultrasonic airborne sounds when stressed! This research shows that stressed plants emit airborne sounds that can be recorded from a distance and classified. The researchers recorded ultrasonic sounds emitted by tomato and tobacco plants inside an acoustic chamber, and in a greenhouse, while monitoring the plant's physiological parameters, and notes that these sounds may also be detectable by other organisms

Noise in the Workplace may impact your well-being

A new study suggests that noise in the workplace may affect your physiological well-being. For the research, 231 federal office employees were recruited and each study participant wore various devices that analyzed how noises within an indoor setting impacted individual well-being. The study showed that physiological well-being is achieved when workplace sound levels are about 50 dB(A).

Noise Pollution and Scallops

Elsewhere in this issue we have an article describing the potential impact of offshore wind turbines on coastal communities. It notes that developments may also have a significant effect on marine life. A recent study [published in the Journal of the Acoustical Society of America](#) supports this assertion. The study, from researchers at the Woods Hole Oceanographic Institute (USA), quantified auditory thresholds (in particle acceleration levels) and bandwidth of the giant scallop. It notes that behavioral responses were obtained for low frequencies below 500 Hz, with best sensitivity at 100 Hz. The study concludes that results demonstrate clear sound sensitivity and underscore that the potential impacts of anthropogenic sound in valuable ecological resources, such as scallops, may be dependent on sound characteristics

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■ MAY 15–18, 2023

NOISE-CON 2023, A joining conference with SAE and TRB
Grand Rapids, MI, USA

■ AUGUST 20–23, 2023

INTER-NOISE 2023
Chiba, Greater Tokyo

■ SEPTEMBER 11–15, 2023

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