

TRADING DECIBELS: OVERVIEW OF A CAP AND TRADE REGULATORY FRAMEWORK FOR NOISE EMISSIONS

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1 Current regulatory framework and its shortcomings

Noise for energy-related facilities in Alberta is regulated through the Alberta Energy Regulator (AER) Directive 038: Noise Control (the Directive) [1]. The goal of the Directive is to reduce the impact of noise received in the environment to a reasonable amount. In its simplest case, the Directive sound level limit is 40 dBA, as measured at the nearest or most impacted residence within 1500 m of a facility. If no residences exist in that zone, then the limit is set at a 1500 m distance. If the facility sound levels are below the limit, then the facility is in compliance, and if above the limit, then the facility is out of compliance. While this approach meets the goal of reducing the noise impact at the receiver to a reasonable level, it still has some shortcomings:

- i. No incentives to maximize margin of compliance beyond the Directive criteria: In some cases, additional margin of compliance is easily achieved with minimal efforts/expense incurred by the facility owners, and a reasonable investment of noise control can often yield significant benefits in further reducing noise impacts.
- ii. Inefficiency in Retrofit Noise Control: With a facility operating at the regulatory limit for noise emissions, facility expansions (and/or new proximate facilities) creating additional sound power will often require exceptional noise control (for new equipment), retrofit noise control (for existing equipment), or both. Many industry operators report that retrofit noise control costs can easily exceed ten times the initial capital cost for the same noise control included at the design stage.
- iii. Little incentive to advance noise control technology: As technologies employed in equipment operation advance and mature over time, it is expected that low noise-emitting equipment becomes more easily available and at a lower cost. However, since the Directive sound level limit is static, there often exists an incentive to deploy equipment that simply meets the limit, rather than installing the latest low-noise-emitting equipment that would optimize the margin of compliance.

2 The principle of cap-and-trade, and its potential use in noise emissions

Cap-and-Trade programs impose a limit on emissions (e.g. noise) within a given area. Emitters within the area are given allowances (e.g. sound power) to emit within a given

timeframe.

Over time, a governing authority may choose to reduce allowances: this reduces overall emissions (e.g. cumulative noise) within the area. To remain compliant, an emitter must either reduce emissions (e.g. install noise control) or purchase additional allowances in open-market trading in order to continue operating at the same emission rate. However, if an operator emits below their allowance limit, this generates an emission credit that could be sold to others. The supply/demand balance of available allowances and credits dictates market value, which ultimately guides the timing, choice of source, and noise control technology best suited for noise reductions.

3 How a cap-and-trade program can overcome the shortcomings

- i. No incentives to go above and beyond the Directive criteria: The Cap-and-Trade program creates both a positive incentive for achieving high margins of compliance and a negative incentive for deferred adoption of reasonably noise-controlled equipment. The positive incentive is created by the facility owners generating credits, if they operate equipment with noise emissions below its reasonable PWL value. This credit could be sold or transferred to other facilities with equipment noise emissions that do not meet the reasonable PWL. The negative incentive is created by the facility owner's requirement to purchase credits if they operate equipment with noise emissions exceeding its reasonable PWL value. It is therefore in the company's interest to evaluate if it is more cost-effective to obtain facility equipment which meets the reasonable PWL, or else purchase credits from other companies. This offers facility operators more alternatives to optimize compliance for minimal cost.
- ii. Inefficiency in Retrofit Noise Control: As the Cap-and-Trade assessment will occur during the facility design stage, it will help to avoid the problem of costly retrofit noise control, because there now exists an incentive to install equipment that is below the reasonable PWL at the design stage. As such, the facility sound levels received in the environment around the facility will not approach the Directive's regulatory limits as quickly. This will leave acoustic room for further facility expansions in the same area, rather than incentivizing facilities to disperse to other green field areas.
- iii. Little incentive to advance noise control technology: The "reasonable PWL" criteria of a given type of equipment are determined by taking population

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measurements of that same type of equipment currently operating at existing facilities. As technology improves and more low-noise equipment is installed and operated over time, the criteria value will naturally decrease proportionally. A particular facility owner can lead the trend by being proactive, or else follow the trend that other companies establish. This creates a continuous improvement mechanism where, as the facility owners adopt available technologies for low-noise equipment, their actions will in turn further advance the technology and lower costs.

4 Example: hydraulic drivers

An engine skid hydraulic driver (driver) is a unit composed of a gas engine and hydraulic pump, which drives a screw pump located in an oil well. Although these units are available in a wide horsepower range, for a given horsepower, the unit comes as a typical package, and as such, is a good candidate to classify as a distinct type of equipment that can have a “reasonable PWL” criterion.

The first step is to determine the “reasonable PWL” criterion. This is achieved by measuring several units of that type, from different packagers, and purchased by different facility owners. Once sufficient data points are gathered, then the average PWL values (or other statistically-validated limit) become the value for the “reasonable PWL” criterion.

Over time, as a facility owner plans to install additional equipment at a facility, the procured equipment PWL will be evaluated against the “reasonable PWL” criteria. If an equipment PWL exceeds its individual criterion, then the facility owners would be required to purchase noise credits in order to install higher-than-average noise-emitting equipment. If an equipment item is below its criterion, however, then the facility owners will generate noise credits as a reward for installing lower-than-average noise emitting equipment.

Facility Owner A plans to install 75 hp drivers at a facility, and decides to spend a bit more money to obtain lower-than-average noise-emitting equipment. Consequently, they generate cap-and-trade credits. They can then transfer these credits to one of their other facilities, if needed, or else sell them to another facility operator. Facility Owner B plans to install 75 hp drivers at a facility and decides to reuse old models they have in stock. As these models are old, they have higher-than-average noise emissions and exceed the current “reasonable PWL” criteria. Consequently, Facility Owner B would be required to obtain cap-and-trade credits, either through transfer from another facility, or through purchase in an openly-traded market (from someone such as Facility Owner A).

As a result, Facility Owner A has achieved a high margin of compliance, below the Directive criteria, instead of simply meeting the regulated limits at the receivers. By purchasing lower-than-average noise emitting equipment, they help to advance the adoption of emerging technologies, and they also obtain noise credit revenues to help offset incremental costs for quieter equipment.

5 Limitations to the cap-and-trade program for noise emissions

Before the program can be implemented, a critical milestone will be determining the values of the “reasonable PWL” criteria for different types of equipment. This could be obtained by calculating the average PWL value of all the existing equipment PWL measured in the field, or using another statistically-validated limit. A sufficient quantity of field measurements must be gathered to reach an adequate level of confidence that the resulting average is representative of the current equipment population operating in the field.

Each particular type of equipment’s “reasonable PWL” criteria must be thoughtfully defined with sound engineering judgment (e.g. normalized to a relevant metric, such as driver horsepower), in order to fairly determine the correct criteria against which proposed equipment will be compared. For example, a proposed 75 hp driver should be compared against the 75 hp driver criteria, not against the 40 hp driver criteria.

6 Conclusion

Historically, Cap-and-Trade programs have been most effective for reducing regulated emissions when there exists adequate market liquidity to ensure fair and reasonable market pricing. In other words, there must exist a sufficient numbers of buyers and sellers of allowances and credits. In the case of noise, this requires an adequate number of noise sources – which is certainly present in an urban environment, but could also be present in a congested rural environment (i.e. several proximate facilities). The authors emphasize that they are not suggesting that more regulation is a solution; rather, they offer that Cap-and-Trade programs for noise emissions could provide a means, in certain regions, to reward operators with a high social license, helping them to monetize some of their noise control investments that achieve high margins of compliance below regulated limits for noise.

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References

[1] Alberta Energy Regulator Directive 038: Noise Control, February 16, 2007.