

# Energy Efficiency Days 2009 ALSTOM

## Hybrid shunter locomotive

Hervé GIRARD

Alstom Transport, Paris, France

### Abstract:

Shunter locomotive may be defined as locomotives operating in a limited distance range, such as stations, railway operator depots, harbours or heavy industry plants. Operation speed is low, typically around 25/30 kph. Generally, this shunting activity is generating a lot of "stand-by time" between two shunting tasks. In most cases, this type of locomotive is using diesel-hydraulic or diesel-electric propulsion, developing a power between 500 kW and 1 MW. During stand-by time, the diesel engine is idling, in order to ensure immediate availability of the locomotive for the next task to come, and also to supply the energy required by the auxiliary systems of the locomotive.

The drawbacks of this technology are:

- High proportion of idle time between tasks, that could reach an average of 75% (measured in operation), during which the diesel engine consumes significant quantities of fuel.
- As a consequence, the average pollution is high, as well as the noise level of the engine, which may be a significant issue in urban environment.

An alternate technical solution for the propulsion system is Hybrid combination of electrical accumulator batteries and diesel engine power, both feeding in parallel an electrical power bus. Traction electrical converter and auxiliary systems are supplied by this power bus. In that way, the main power may come from the electrical batteries, and the diesel engine is used as charger for batteries and, when necessary, provides an additional power on the top of the one coming from batteries.

In order to fully support this development and ensure its validation, this solution has been implemented by ALSTOM on a renovated BR 203 (originally a diesel-hydraulic shunter locomotive). This demonstrator locomotive, BR 203H, has a total power of 550kW and a max speed of 60 kph.

The above-mentioned drawbacks are mitigated as follows:

- No fuel consumption during idle time, leading to an average of 40% saving in fuel.
- Reduced emissions: 50% in gases and particles, and 15dB in noise
- Return of extra investment within about 5 years (obviously depending from oil price).

This solution is using classical and design proven NiCad batteries technology. It may be adapted to any renovation configuration, as well as any new build requirements.

The demonstrator BR 203H has been extensively tested, allowing Alstom to fine tune the technology. It is currently used for "full scale" shunting operations by rail operators. This brings further validations "on the operations stage" and is confirming the savings and thus the business case.

By using batteries as the main reserve of traction power, hybrid solution efficiently improves both operating costs and "green" characteristics of shunter locomotives in industrial plan, with a reasonable investment effort, making it affordable even for small private operators.