MONT-MÉGANTIC ASTROLAB LIGHT POLLUTION ABATEMENT PROJECT
How to create a Dark Sky Reserve in an inhabited area and preserve astronomical research

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Mount Megantic is located within the Mont-Mégantic National Park (PQ, Canada) which also includes an Educational Center in Astronomy (ASTROLab) and a Professional Observatory that belongs to Montréal, Laval and McGill Universities.

The Mont-Megantic Observatory (OMM) is one of the best-instrumented University Research Centres in the World. It houses a 1.6-meter telescope, which is the third largest in Canada. The Observatory has the darkest sky of all research Observatories in Canada, which makes it one of the best facilities in the country.

Because of the treat created by light pollution on the research capabilities and scientific effectiveness of the Mont-Mégantic Observatory, the "Light Pollution Abatement Project" was initiated in 2003 by the Mont-Mégantic ASTROLab.

Figure 1: Mont-Mégantic Observatory

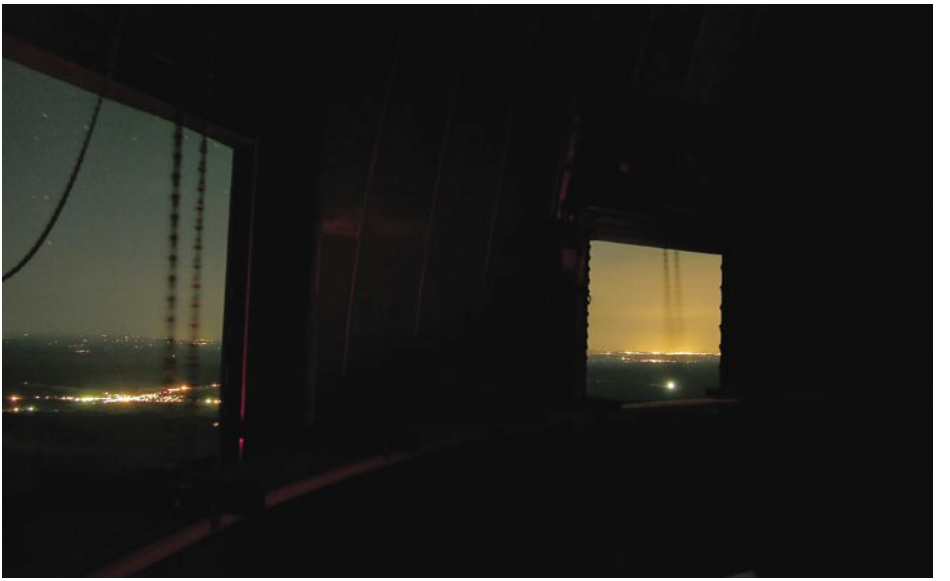

Figure 2: Light Pollution around Mont-Mégantic. From the inside of the observatory, we can se light pollution from La Patrie (15 km away) on the left side and from the right window, the glow from Sherbrooke city (60km away). By Sébastien Giguère.

The Action Plan

As part of the light pollution abatement project, the action plan is being implemented in three components, which are awareness, regulations and lighting fixture conversion, in order to create one of the greatest reserves of dark sky within a habited area and to ensure the sustainability of astronomy research in Quebec and Canada. This project has always been managed so as to reconcile a maximum number of objectives, thereby creating strong regional – and even national – cohesion. Light pollution abatement is a sustainable development project and a way to achieve energy efficiency.

Actions lead by the ASTROLab had many positive repercussions such as :

- Impressive media attention has been accorded to this project creating great awareness and interest across Québec province and Canada ;
- Regulation has been adopted by the municipalities of the Granit and Haut-Saint-François regional county municipalities (32 municipalities total – 50 km radius) and by the City of Sherbrooke (60 km away, pop. 175 000), the first of its kind across Canada (see the Map of the three Intervention Zones);
- A technical and regulatory guide have been written intended for a wide range of stakeholders to help them develop their lighting knowledge and understanding of the standards adopted;
- Education and technical support have been offered municipalities, electricians, engineers, urban planner, architects, hardware stores, etc.;

- Collaboration has been developed with a research center dedicated to the light pollution measurement and modeling called GRAPHYCS (www.graphycs.qc.ca). An intelligent dome will be installed at the top of the mountain in order to measure every night the light pollution. Also, this collaboration brought us broadening the research topics (human health, ecology, ...) by encouraging new researchers from various universities and college to collaborate with us to create a "Light Pollution research center". This center should be operational in 2008-2009, and by 2010 between 5 and 8 researchers will actively work in this center;
- Because of the expertise developed and the credibility gained, great attention has been accorded from Governments and different groups such as, Natural Resources of Canada, Energy Agency of Quebec, Hydro-Quebec, Quebec Transport ministry, etc., this will translate, in the next few years, into National politics and regulations.

A way to achieve energy efficency

Altough the Mont-Mégantic project contribute significantly to saving the dark sky in the Mont-Mégantic region, it also serve as a reference initiative that will contribute to the development of responsible and efficient management of outdoor lighting across Quebec and Canada.

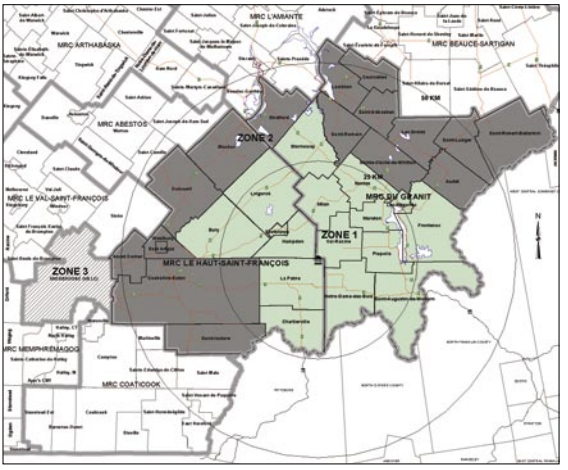

Figure 3: Map of the three intervention zones around Mont-Mégantic Observatory

Zone1*:* 50% of light pollution. Zone 2: 25% of light pollution

Zone 3 (Sherbrooke city): 25% of light pollution

From the satellite images of light pollution and different calculation made, it was possible to estimate the amount of energy used to light the sky in Québec province. These studies show that Quebec is one of the most illuminated areas in the world per capita. By applying some basic principles – efficient lamps and lighting fixtures, adequate lighting levels and controlled operating hours – it is estimated that the potential energy savings would amount to several hundreds of GWh annually in Quebec. These studies were presented at different governmental public consultations and made a clear difference towards the attention given to the project leaded by the ASTROLab.

The Lighting Fixture Conversion

Now that awareness, education and regulation have known great success, the lighting fixtures conversion project has begun in fall 2006. The project includes the replacement of 2500 lighting fixtures within the 16 municipalities closest to the Observatory. About 500 sites are planned to be converted in all sectors (industries, roadway, individuals, farms,...). Many efforts have been made since 2003 to do so and the ASTROLab

have found 1.3 millions $CD. Financial support is offered by Hydro-Québec, Natural Resources of Canada, Municipal Affairs of Québec, Eastern Township Council, Montréal, McGill and Laval Universities, Mont-Mégantic National Park and Mont-Mégantic Observatory.

By achieving this, a reduction of 25% the total light pollution measured at the Mount Megantic is anticipated by mid-2008. Preliminary results of this conversion project are pretty conclusive:

- Local population is greatly participative;
- 40% energy efficiency in roadway lighting;
- 75% energy efficiency in private lighting;
- At the end of March 2007, 0.45 GWh/yr were already saved;
- Light pollution measures will be made by the end of 2007.

These pictures taken by Guillaume Poulin are from La Patrie Municipality before the roadway conversion and after the roadway conversion

Outside this “priority conversion zone”, Sherbrooke city and Quebec Ministery of Transport has also started to replace their lighting fixtures and reduce the actual illumination levels. In Sherbrooke City, no more 400 watts will be installed and many of them are replaced by 100 and 150 watts. Quebec Ministery of Transport will also replace all their roadway lighting fixtures near the Mount Megantic and Sherbrooke city.

Figures 4 and 5: Before and after.

Notes and References

1. DUTIL, Y., 2001. *Light Pollution in Quebec*, in the proceedings of Symposium No. 196 of the International Astronomical Union: Preserving the Astronomical Sky, R. J. Cohen & W. T. Sullivan, Eds., p. 134.
2. LEGRIS, C., 2005. *L’efficacité énergétique en éclairage comme moyen de réduire la pollution lumineuse*, a study made for the Energy efficiency Agency of Québec : http://www.aee.gouv.qc.ca/pdf/municipalites/efficacite_eclairage.pdf, 16p.
3. LEGRIS, C., 2005. T*echincal and Regularory Guide for outdoor lighting*, a publication made for the Ministry of Natural Resources of Canada: http://cetc-varennes.nrcan.gc.ca/en/eb_o/pg_gp/p_p.html, 61p.