

# The establishment of CORS-LIBYA

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**C**ONTINUOUSLY operating reference stations (CORS), especially those integrated as RTK networks, play a very important role in precise geodetic positioning. Coordinates can be determined quickly and economically without any need for static base stations. Geodetic surveys, including surveys for control, planimetry and cadastral boundaries, can be carried out very efficiently. The main goals of the Libyan project were the establishment of CORS functioning 24/7 and the determination of datum transformation parameters.

CORS-LIBYA consists of a network of multi-functional RTK and DGNSS reference stations providing signals that could be used for geodetic point positioning, land, marine and air navigation. CORS-LIBYA will fulfill all accuracy requirements of geodesy and navigation; centimetre and subcentimetre levels of accuracy in the post-processing mode, and centimetre, decimetre and metre levels of accuracy in real time. The CORS-LIBYA network will consist of 50 reference stations.

Geographic data plays an extremely crucial role in all kinds of spatial design, planning and applications. Mapping and engineering works necessitate the use of up-to-date geographic bases in order to manage and conduct all kinds of spatial works, including structural and

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infrastructural ones. Geographical/land information systems (GIS/LIS) evolved from the ability to evaluate and manipulate graphic and attribute data within the computer environment. Nowadays, GIS/LIS are an inseparable part of our life. Geoinformation has many uses, for instance in the administration of state, forest, environment and city planning, determination of land usage and agricultural policy, engineering, evaluation of infrastructure and natural resources, multi-purpose cadastre, e-government, e-municipality, e-commerce, plus all other activities that depend on spatial information.

The technology of a global navigation satellite system (GNSS) has opened a new era for the determination of positions. Despite the fact that GNSS technology entered developing countries in the 1990s, public and private establishments are still using uneconomical, old-fashion methods and techniques. The CORS-LIBYA project will substitute the old inefficient systems with a single, fast, efficient, economical, reliable and modern service for the northern region of Libya.

Libya has recently started national mapping, requiring significant geodetic positioning. It is required to carry out geodetic positioning and surveys rapidly, economically and precisely. This will be met by using the most recent GNSS techniques, through a network of real-time kinematic (RTK) continuously operating reference stations. As part of the national mapping project, the Surveying Department of Libya (SDL) has established network based Libyan RTK CORS, known as CORS-LIBYA. It will consist of 50 GNSS CORS with one control centre. The system will not only serve national mapping project surveys, but also all types of geodetic positioning, terrestrial surveys and mapping, engineering surveys, vehicle tracking, precise navigation, tectonic studies and the like.

## Objectives

### Goal 1

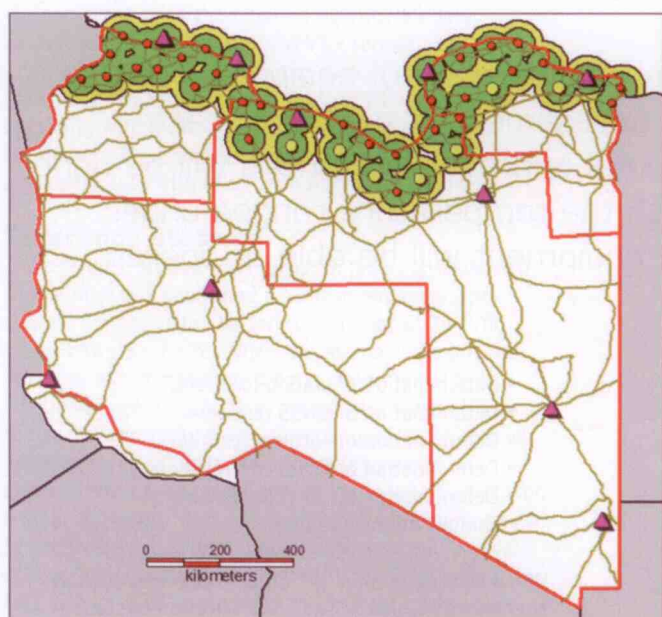
- Providing continuous real-time centimetre level precise geodetic positioning throughout northern Libya for collecting geographic data, including data for national mapping, military, development, engineering surveys and cadastre, by much faster, more economical and reliable means, all in the same format and standards. This system will aid SDL in the production of maps and associated data, such as the establishment of geodetic control points.
- Terrestrial mapping, land surveying and cadastral measurements.
- Other terrestrial measurements for GIS/LIS applications.

### Goal 2

Providing decimetre and metre level positioning for navigation and vehicle tracking in air, land and sea.

### Goal 3

Modelling the atmosphere (troposphere and ionosphere) over northern Libya and contributing to atmospheric studies and weather predictions, as well as studies on signals and communication.



CORS-LIBYA stations and coverage at 40–60km interstation distances.

Leachate is actually an example of 'water always wins'. A substantial proportion of the leachate generated in a closed and active trash decomposing landfill is caused by rainwater and melting snow filtering through it. In the process, the rainwater picks up many of the contaminants (chlorine, sulphur, various metals etc) remaining from the decomposition process. The resulting liquid requires special disposal provisions.

Politics over here take advantage of the common misconception that there is a lack of land suitable for landfill. In reality, if carried out correctly, landfill represents a usage of land that is not generally suitable for commercial development. Such land is not lost. Although the dome of a landfill facility will not support construction, there have been many instances where the site has been used for facilities such as ski-slopes, baseball and soccer fields, and public parks.

It has been my experience that demand for renewable electricity, under appropriated power purchase agreements, has in fact increased available sites. EPA reports that over the past 20 years the number of landfill sites has increased from 1,654 to 1,854.

There is no doubt that landfill offers flexibility, as well as a source of renewable energy. The site can be hundreds of acres with many cells (or tens of acres) with a few cells. Electricity production from decomposition gases can be from 1 to 100MW. The individual cells are constructed, filled and closed over a period of a few years and, as opposed to an incinerator, are then working unseen for 30 years generating electricity. Thus, the land itself has been recycled; there are no smoke stacks. In summary, trash to cash.

## Regulation

EPA and the associated clean air and water acts of the 1970s are the source of most of the regulations affecting landfill. The *Public Utility Regulatory Policies Act 1978* (PURPA) is the enabling legislation to allow landfills and others to install electric generation to sell electricity to a utility (renewable energy). In essence it created a market for non-utility electric power producers; forcing electric utilities to buy power from these producers at the avoided cost rate, which was the cost the electric utility would incur were it to generate or purchase from another source. The PURPA regulation provides for energy efficiency along with a source of revenue to allow the projects to be economically viable.

The positive side of the EPA regulations responds to the natural desire to treat the environment responsibly. Thus, a significant growth of landfills facilitating electricity generation commenced in the 1990s, with private enterprise matching a need to alleviate a projected shortage of generation capacity. The clean air regulations requiring landfill gas to be collected and burned provided the opportunity for profitable enterprise.

Unfortunately, new regulations specific to some states have actually prevented some projects from being constructed. For example, in California there was an existing landfill with closed cells generating electricity in accordance with the regulations applicable at the time of instigation. There was a need to expand the facility with new cells receiving trash, but despite the clean air regulations requiring all unused gas to be burned, the generation capacity could not be expanded to utilise the additional gas produced because an air permit for the added engine capacity could not be obtained from the applicable agency. The result was a 20% reduction in saleable electricity output of the existing plant which went toward powering gas compressors to transport the

additional landfill gas via a pipeline for usage at another site! Historically all government activities grow and become more ponderous with time.

The landfill industry in the USA is not exempt from bureaucrats. Site permitting (licensing) is simply the implementation of the latest regulations, requiring the services of specialised firms to deal with the complexities of an application process, which, from an engineering viewpoint, bears little resemblance to the actual process.

## Inter-state activity

Based principally upon economic considerations, there is considerable importation and exportation of MSW between states for combustion and landfilling. According to the 38 states reporting this activity, some 35.9 million tonnes were imported and 25.4 million tonnes exported in 2006. Principal importers of MSW from other states were:

|                |                    |
|----------------|--------------------|
| • Pennsylvania | 7.3 million tonnes |
| • Michigan     | 6.3 million tonnes |
| • Ohio         | 3.8 million tonnes |
| • Indiana      | 2.2 million tonnes |
| • New York     | 2.1 million tonnes |

There was an international dimension to the importation of MSW to Michigan. The city of Toronto paid Michigan landfill companies to receive Canadian MSW, which was used to generate electricity into the Michigan grid. The Toronto trash was trucked to Michigan landfill sites via the Bluewater Bridge at Port Huron, a round trip of at least 400 miles!

Principal exporters to other states were:

|              |                    |
|--------------|--------------------|
| • New York   | 4.5 million tonnes |
| • Maryland   | 2.9 million tonnes |
| • New Jersey | 2.6 million tonnes |
| • Missouri   | 2.5 million tonnes |
| • Illinois   | 2.4 million tonnes |

From 2006 to 2008, the average annual tonnage of MSW generated per capita increased nationally from 1.3 tonnes per person to 1.38 tonnes. At the low end of the spectrum were:

|                  |             |
|------------------|-------------|
| • Idaho          | 0.85 tonnes |
| • North Carolina | 0.93 tonnes |
| • Connecticut    | 0.96 tonnes |
| • New Hampshire  | 0.97 tonnes |

Top of the spectrum were:

|             |             |
|-------------|-------------|
| • Indiana   | 2.50 tonnes |
| • Illinois  | 2.07 tonnes |
| • Tennessee | 2.01 tonnes |

Perhaps one of our UK members in the field of waste management could inform us how the US figures compare with those of the UK?

There is no doubt that trash to cash is now big business in the USA. Despite patchiness of regulations and related activity across states and cities, public awareness of, and responsibility for, recycling is generally high and there is a lot of development activity in the field of renewable energy.

Next time we will be getting down to the specifics of some of the landfill gas renewable energy plants over here.

*Barry Hiscox FCIInstCES with Frank Woodbridge BSEE MSE PE Frank Woodbridge spent 18 years of his career as a self-employed consulting engineer for the design and project management of industrial co-generation systems in respect of both electrical power generation and mechanical process heat recovery, specialising in the landfill industry.*

