

## DJIBOUTI: A LEGACY OF THE SALT TRADE

Presenters: Dan Sutton – CEO Salt Investment S.A., Djibouti.  
Roly Mottershead – Director CGV Pty. Ltd. Perth Western Australia

### Abstract.

*The Djibouti Salt Project will utilise the brine and salt resources of Lake Assal in Djibouti, Africa. Djibouti is strategically located at the southern end of the Red Sea. The level of Lake Assal is 150m below sea level. Total salt reserves in the lake exceed one billion tonnes. Production output can be varied to suit market requirements, both quantitatively and qualitatively. A deep water port will be constructed to accommodate vessels up to 100,00DWT. Marketing of the salt will commence in 2010.*

### Introduction.

The objective of the Djibouti Salt Project is to build and maintain a market position of being a reliable supplier of various grades of solar salt which satisfy customer requirements. The size of the resource and the way in which this resource is replenished ensures that the project will be sustainable over the long term. The owners of the project are utilising experts with many years of experience in designed, constructing and operating world-class solar saltfields.

### Djibouti

The country of Djibouti is a Republic of 23,200 sq km, situated at the mouth of the Red Sea. Population is around 600,000. The climate is very hot all year round and rainfall is low. This is a key requirement for efficient production of solar salt. Djibouti is bordered by Eritrea to the North, Somalia to the South and Ethiopia to the West. As Ethiopia has no coastal access, much of its trade utilises the deep water port facilities of Djibouti. The Government of Djibouti is very supportive of the project as Lake Assal's salt resource represents one of the few resource-based opportunities for the country.

### Lake Assal.

Lake Assal lies 80 km west of the capital, Djibouti. It originally formed an arm of Ghoubet el Kharab, which connects to the Gulf of Tadjura and thence to the Gulf of Aden and the Red Sea.

The lake become isolated from the sea more than 5,000 years ago at the time of successive volcanic eruptions. It is now a vast depression at a mean altitude of around -150 metres. The total area is more than 110 km<sup>2</sup>, of which around 60 km<sup>2</sup> are covered by solid salt up to 80 metres thick and 50 km<sup>2</sup> saturated brine up to 25 metres deep.

The lake is partly supplied by water by intermittent run-off from rainfall over a large catchment area, and by hot springs that gush from the fault system. However, the main input (and therefore dissolved salts) is from seawater coming from Ghoubet el Kharab through faults in the rock barrier between the lake and the Ghoubet.

Thus, the salt resources, both as solid salt and in the lake brine, are vast and constantly being replenished.

The salt deposits have been exploited on a small manual scale for centuries. Equivalent freshwater evaporation at the lake is around 4 metres per year, comparable with 3.5 metres per year at the solar saltfields in the Northwest of Western Australia. Rainfall at the lake is less than 200mm per year. Inflow from the large catchment area can be significant at times. However, unlike the solar saltfields of Western Australia, Lake Assal, is not exposed to cyclonic activity which can result in damage and lost production at the salt fields in that region.

## The Project

Large scale production of solar salt from the reserves at Lake Assal has been considered for many years. A major study undertaken by Salins du Midi of France in 1969 concluded that a project with an ultimate production capability of 3 million tonnes per year was both technically and economically feasible. The project did not proceed at that time due to the rapid development already taking place in Australia and Mexico; aimed at servicing the growth being experienced in the Japan chloralkali industry.

In July 2008, Emerging Capital Partners (ECP), an international private equity firm focused on investing across the African continent, announced a significant initial investment in Salt Investment S.A. (SI). SI is a Djibouti-based company focused on the production and export of salt from the reserves of Lake Assal. Dan Sutton is the CEO of Salt Investment with a long career and experience in the salt industry with Cargill Salt, United Salt Industries, and Virginia Gas. Dan's experience enables him to call upon like experts in the global salt industry, to bring this project successfully into export markets, including Asia.

As the lake brine is close to concentration in sodium chloride, there is no requirement for the construction of a series of large concentration ponds which would normally be required where seawater is used as the salt source. This also eliminates the associated high capital investment in these ponds; and, furthermore, permits the project to proceed to production in a much shorter timescale.

A number of crystallisation ponds (crystallisers) will be constructed on the salt pan close to the lake brine. Brine from the lake will be pumped into these crystallisers where it will quickly reach full concentration and commence depositing a layer of salt. The extreme evaporation levels experienced at the lake will result in a salt layer of more than 50 cm being grown annually.

Harvesting of the salt can be carried out throughout the year if necessary. Conventional harvesting machines will transfer the salt layer into trailers towed by heavy duty prime mover trucks. Each truck will tow at least two trailers for optimum efficiency. The average haulage distance from the crystalliser ponds will be less than 5 km.

The harvested salt will be despatched into hoppers feeding a salt washing plant, now under construction at the edge of the salt pan. The design of the washplant will allow effective upgrading of the harvested salt so as to achieve customer quality requirements. A large stockpile adjacent to the washplant will permit the salt to achieve low moisture content prior to its transfer to the port stockpile area.

Having achieved optimum moisture content, the dry salt will be transferred by haulage trucks to the port stockpile. The haulage distance to the port will be around 25 km.

The port stockpile will have a capacity exceeding 100,000 tonnes. A short land-based conveyor will transfer the salt from the stockpile to the loading jetty and shiploader. The jetty and shiploader will be built in the lee of Devil's Island to provide maximum protection from the prevailing winds. The available depth at the wharf head will be adequate to enable vessels up to 100,000 DWT capacity to berth and load on all tides. Construction of the port facilities has commenced.

Shipments should commence in the first six months of 2010. Production levels will increase to match markets. The strategic location of the port, close to the mouth of the Red Sea and the Gulf of Aden is such that freight costs to Asia, Europe and North America will be competitive. Opportunities will also occur to settle spot cargoes for vessels normally by-passing Djibouti in ballast due to lack of return cargoes.

The planned target production is 4 million tonnes per year. Market studies indicate that this volume will not be dominant in the overall increase in global and regional demand for salt during the next decade.

## **Products**

The principal focus of the project will be to supply chemical grade product to chloralkali and soda ash producers in Asia, the Middle East and possibly Europe; and deicing salt to North America and Europe. Should markets emerge for food-grade salt, then supplies of this product will be considered. Note has been taken of the critical need of many African countries for iodised salt to combat Iodine Deficiency Disorders (IDD).

In targeting the Asian markets for chemical-grade salt, it is accepted that quality expectations are high, particularly for those customers utilising the ion exchange membrane technology to produce chloralkali products. The level of impurities in the final product, including calcium, magnesium, sulphate and potassium are critical for these plants. High quality solar salt from Mexico and Australia, together with vacuum salt produced from Chinese rock salt deposits, dominate current supply to these chloralkali plants. The Djibouti Salt Project will focus on matching and improving upon these supplies.

In regard to deicing salt, conforming physical analysis is recognized as being the dominant requirement.

## **Conclusion**

Commercialisation of the vast reserves of salt at Lake Assal is finally being realised. The Djibouti Salt Project will effectively and efficiently utilise these reserves in a sustainable way. Low cost use of solar energy will assist in reducing greenhouse gas emissions. Availability of labour is high in Djibouti and world-class training programs will ensure effective use of this labour. Safety, health and environmental responsible practices will also be world-class.

Potential customers are now encouraged to discuss their future salt requirements with Salt Investment. The presenters are available for questions now or for meetings during the conference.

We thank you for this opportunity to present this key project to you.

# DJIBOUTI: LEGACY OF THE SALT TRADE

## NEW SOLAR SALT PROJECT

SPEAKERS: DAN SUTTON - CEO SALT INVESTMENTS DJIBOUTI  
ROLY MOTTERSHEAD – DIRECTOR CGV PTY LTD PERTH  
WESTERN AUSTRALIA

13th Asian Chlor-Alkali  
Conference - 24-25 June 2009

1

## Djibouti Salt Project

- Utilise naturally replenishing salt resource of Lake Assal
- Produce quality salt to meet export customer requirements
- Build port to accommodate 100,000DWT vessels
- Sustainable project with capacity up to 4MTPA.

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2

## Djibouti Salt Project

- Salt Investments S.A. a Djibouti-based company responsible for the project.
- Utilising solar salt expertise from USA and Australia

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3



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4

## DJIBOUTI

- REPUBLIC WITH SUPPORTIVE GOVERNMENT
- 23,200 SQ KM
- POPULATION 600,000
- CLIMATE HOT ALL YEAR ROUND
- EXCELLENT FOR SOLAR SALT PRODUCTION

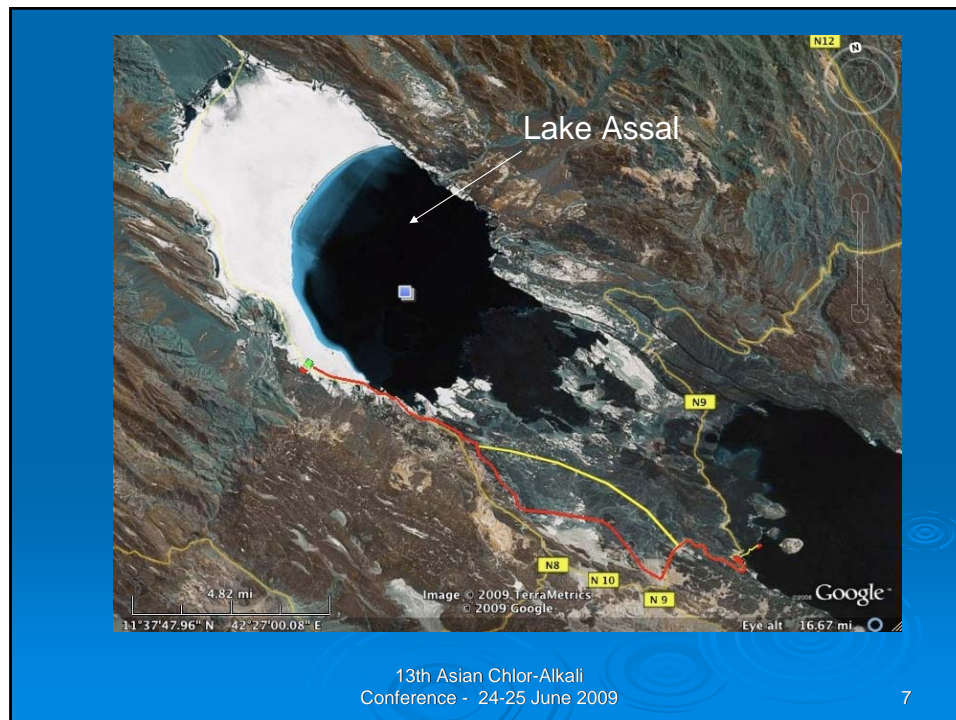
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5

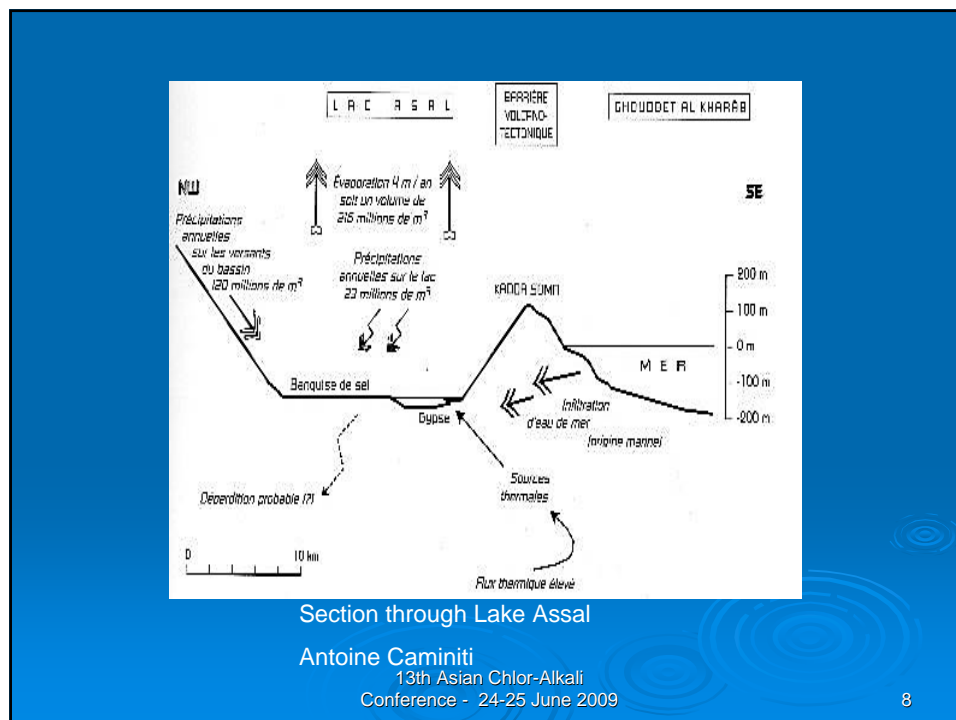


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6



7



8



## LAKE ASSAL

- FORMED 5,000+ YEARS AGO
- TOTAL AREA MORE THAN 110 SQ KM
- SALT BEDS UP TO 80m DEEP
- SATURATED BRINE UP TO 25m DEEP

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9



Lake Assal Salt used for Centuries

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## LAKE ASSAL WEATHER

- UP TO 4000 mm EVAPORATION PER YEAR
- LESS THAN 200 mm RAINFALL
- EXCELLENT CONDITIONS FOR SOLAR SALT PRODUCTION

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11

## SALINS DU MIDI STUDY 1969

- 3MTPA PRODUCTION TECHNICALLY AND ECONOMICALLY VIABLE
- COMPETITION AT THAT TIME FROM AUSTRALIA AND MEXICO IN ASIAN MARKET

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12

## DJIBOUTI SALT PROJECT

- NO CONCENTRATION PONDS REQUIRED
- LARGE CRYSTALLISER PONDS
- CONVENTIONAL HARVESTING
- FLEXIBLE WASHPLANT
- LARGE STOCKPILES
- DEEP WATER PORT

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13

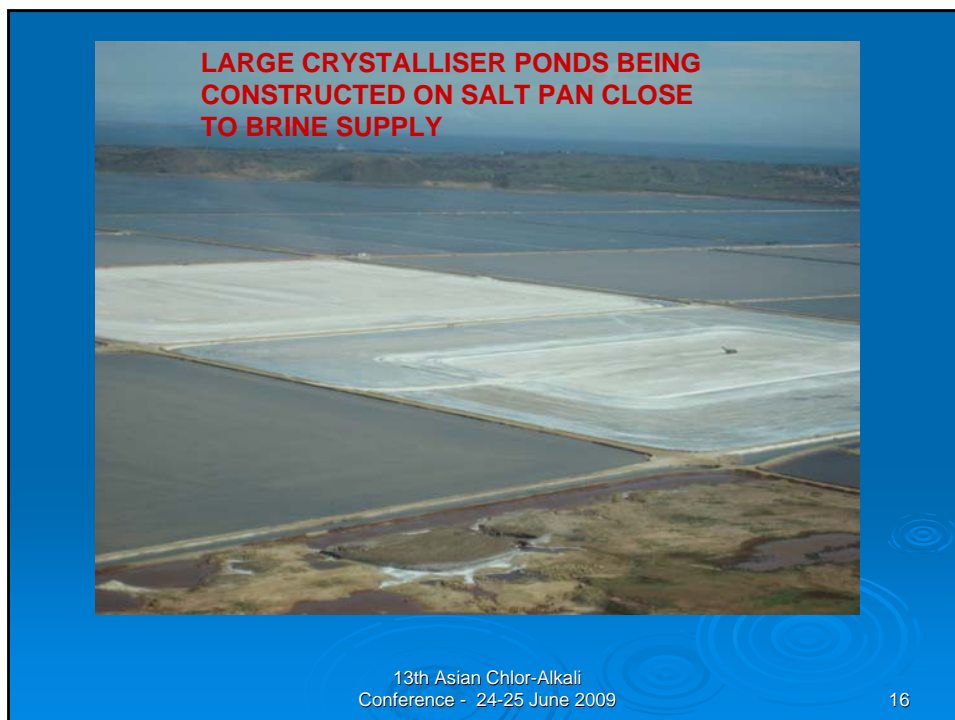
LAKE ASSAL BRINE SG 1.210

NORMAL SEAWATER SG 1.0247

NORMAL SATURATED  
SEAWATER BRINE SG 1.2185

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14





SALT BED GROWTH UP TO  
50 cm PER ANNUM

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17



HARVESTING BY  
CUSTOM-BUILT  
HEAVY DUTY  
MACHINES

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18

HEAVY DUTY PRIME  
MOVERS AND TRAILERS  
USED FOR SALT HAULAGE



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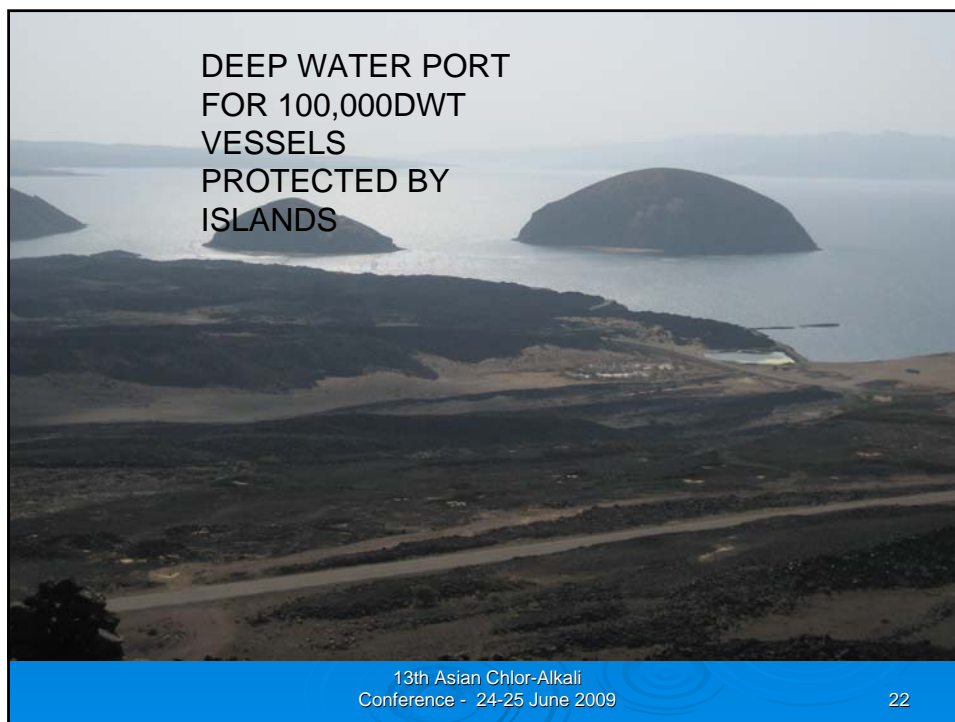
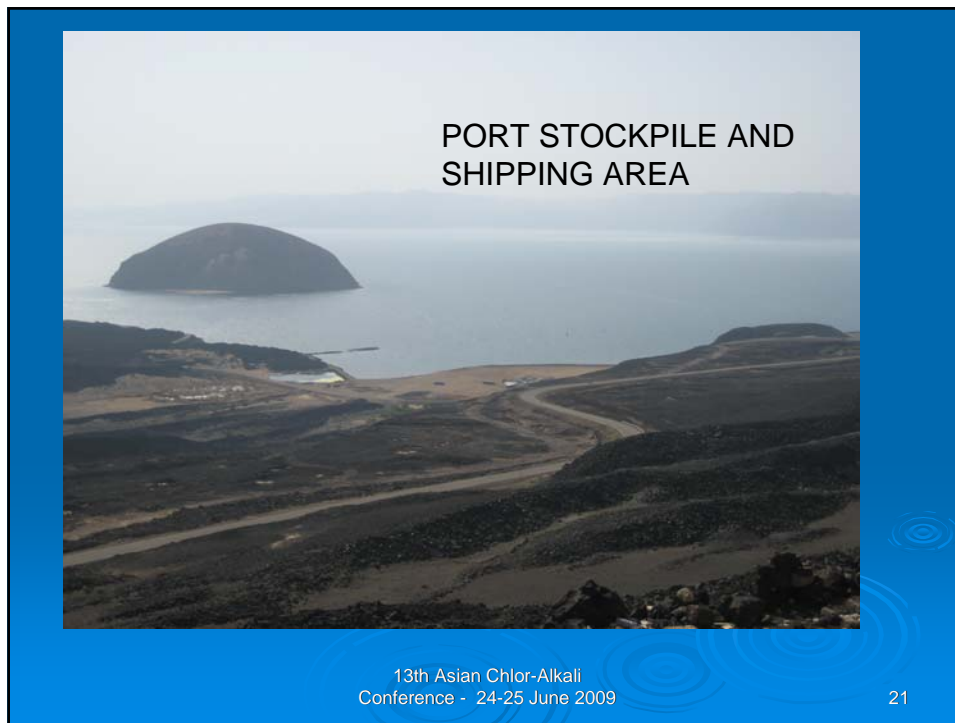
19

WASHPLANT AND STOCKPILE  
AREA AT EDGE OF SALT PAN.




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20







SHIPLOADING RATE  
>2000 TPH

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23

## EXPORT MARKETS

- INITIAL TARGET MARKETS CHEMICAL AND DEICING
- ASIA, EUROPE, NORTH AMERICA AND MIDDLE EAST
- CHLORALKALI MEMBRANE PLANTS REQUIRE CHEMICALLY PURE SALT
- DEICING MARKET REQUIRES CORRECT GRAIN SIZING

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24



## QUALITY

- CUSTOMER QUALITY REQUIREMENTS  
WILL BE MET

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## 4 MILLION TONNES PER YEAR

- TARGET IS TO EXPORT 4 MTPY
- RESERVES ARE HUGE
- COSTS ARE COMPETITIVE
- TRAINING, SAFETY, HEALTH, AND  
ENVIRONMENTAL RESPONSIBILITY  
PRINCIPAL OBJECTIVES

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26

## CLOSING

- THANK YOU FOR OPPORTUNITY TO PRESENT THIS EXCITING NEW PROJECT.
- PLEASE ASK QUESTIONS NOW OR MEET WITH DAN DURING THE CONFERENCE.

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27