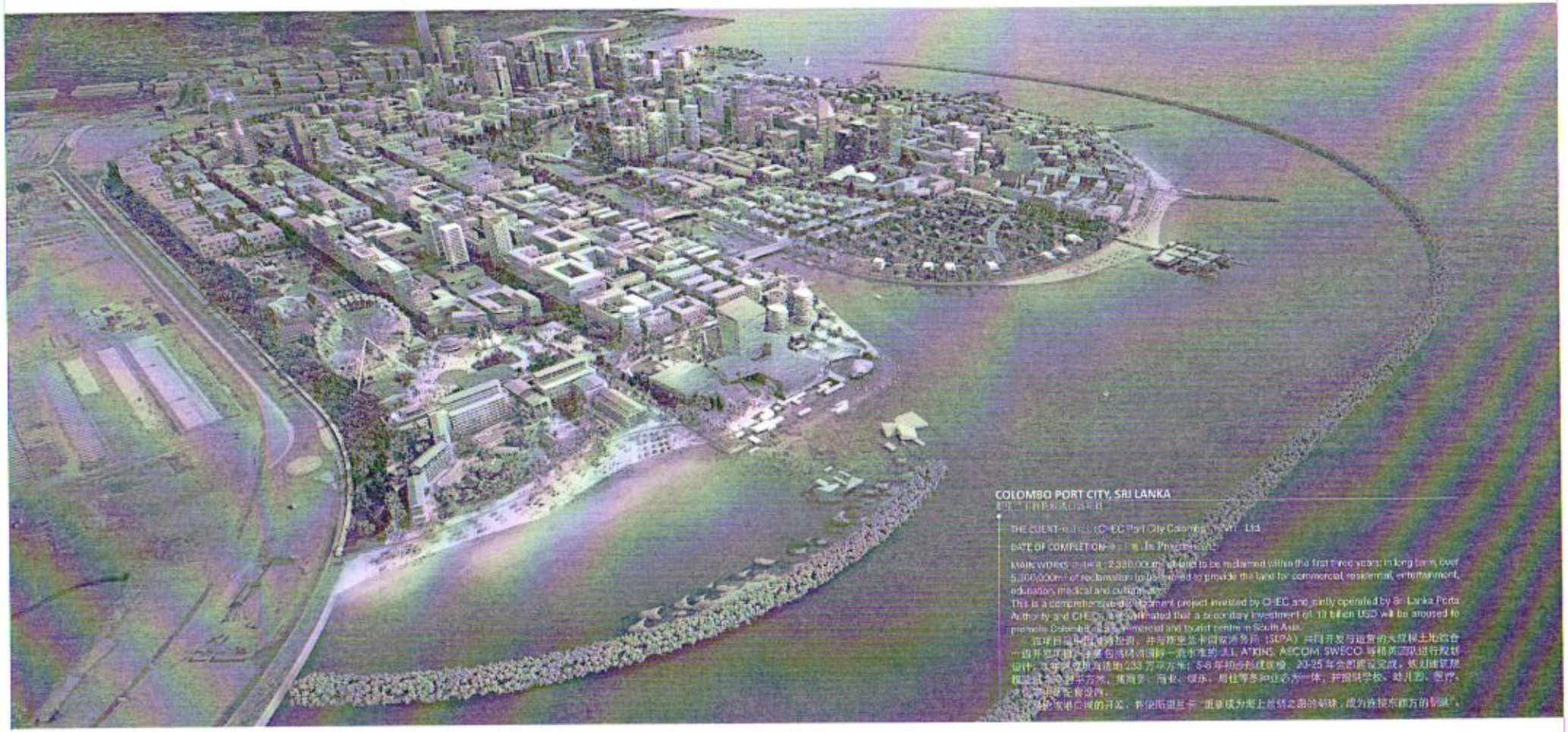


COLOMBO PORT CITY, SRI LANKA

THE CLIENT: CHEC Port City Colombo (Pvt) Ltd.

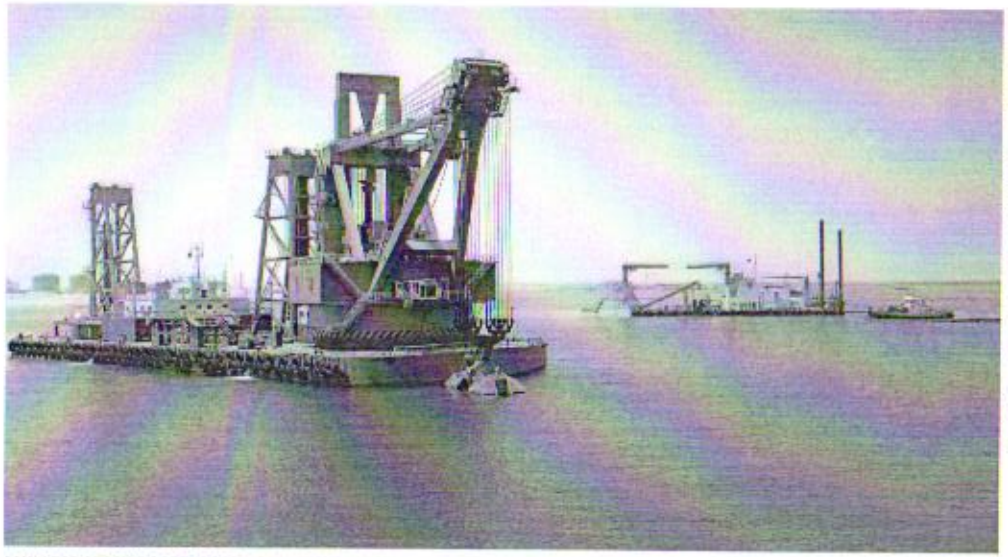
DATE OF COMPLETION: In Progress

MAIN WORKS: 合计吹填2,330,000m² planned to be reclaimed within the first three years; in long term, over 5,300,000m² of reclamation to be carried to provide the land for commercial, residential, entertainment, education, medical and cultural use.

This is a comprehensive development project invested by CHEC and partly operated by Sri Lanka Ports Authority and CHEC. It is estimated that a secondary investment of 13 billion USD will be aroused to promote Colombo as a commercial and tourist centre in South Asia.

该项目由中国港湾投资，并与斯里兰卡国家港务局（SLPA）共同开发与运营的大规模土地综合一级开发项目。主要包括填海造地一次水准的 AECOM, SWECO 等精英团队进行规划设计，三年内吹填填海造地 233 万平方米；5-6 年初步形成规模，20-25 年会初步实现。规划建筑规模达 530 万平方米，集商业、商务、娱乐、居住等多种业态为一体，并配套学校、幼儿园、医疗、文化等设施设备。

科伦坡港口城的开发，将使斯里兰卡一重要成为南亚经济增长的引擎，成为连接东西方的枢纽。

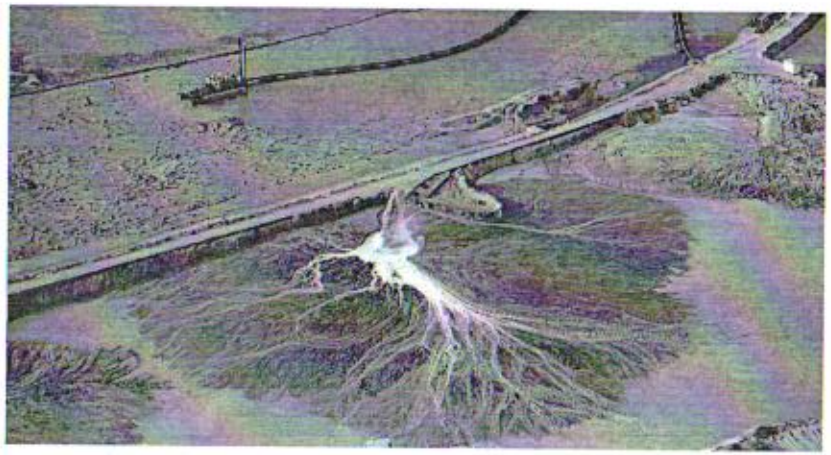


SAUDI RAS AZ ZAWR PORT EPC PROJECT IN SAUDI ARABIA

- THE CLIENT-业主单位: Saudi Ports Authority
- DATE OF COMPLETION-竣工日期: 31 Oct., 2012

MAIN WORKS-工程概况: a 24km dredging line of navigation channel with a quantity of approximately 46,700,000m³, and reclamation of 6,100,000 m². The Project specification is in line with American standard, British standard, Saudi standards and relevant international conventions.

本项目为设计、采购、施工总承包项目，主要包括 24 公里航道疏浚，疏浚总填量 4670 万立方米，造地回填 610 万平方米。本工程控制标准为美标、英标、沙特标准及相关国际公约。



CIVIL, MARINE AND INFRASTRUCTURE WORKS FOR PHASE 1 OF WHITE BAY DEVELOPMENT, UMM AL QAIWAIN, UAE

- THE CLIENT-业主单位: Al Murshin Real Estate/emirates Sunland Group
- DATE OF COMPLETION-竣工日期: 09 Nov., 2010

MAIN WORKS-工程概况: dredging for port basin and channel, reclamation for an artificial island, marine works, roads and bridges, ground base works, and hydropower plants.

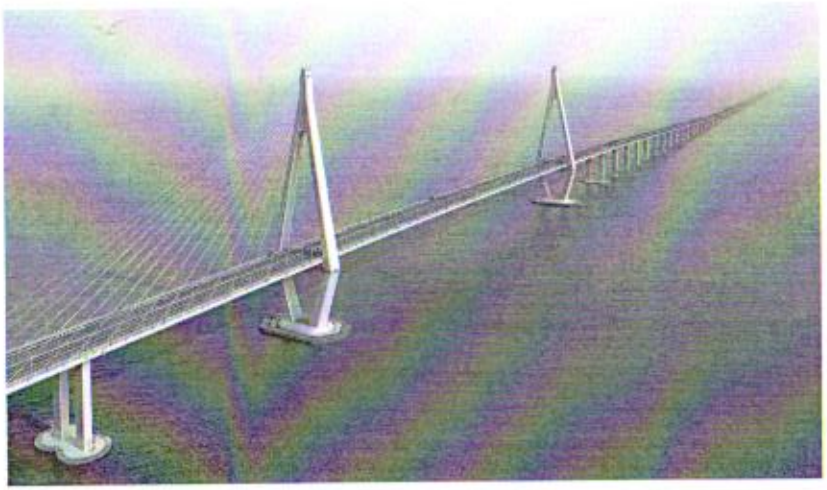
主要包括港池航道挖泥、吹填沙形成人工岛、以及水工工程、道路、桥梁、地基处理、水电通信等。

SONAREF REFINERY PROJECT, DREDGING FOR MARINE FACILITIES, ANGOLA

- THE CLIENT-业主单位: Sonangol EP
- DATE OF COMPLETION-竣工日期: 31 Aug., 2012

MAIN WORKS-工程概况: dredging of 10,340,000m³, temporary revetment of 1014m, permanent revetment of 1129m and other accessory facilities.

主要包括吹填工程量 1,034 万立方米，临时护岸长 1014 米，永久护岸长 1129 米，以及其它附属配套工程。



HANGZHOU BAY CAUSEWAY BRIDGE, CHINA

- DATE OF COMPLETION-竣工日期: 2th Jan., 2007
- MAIN WORKS-项目概述: a bridge of 36km long with offshore portion of 32.7km, using large diameter steel tubular pile as the foundation, designed in S-shape over Hangzhou Bay and adopting precast concrete technology to tackle the tide up to 7.5m.
The construction team has spent tremendous effort to overcome the adverse tidal condition, making it the longest sea crossing bridge in the world.

杭州湾大桥全长 36 公里，其中海上桥全长 32.7 公里。由于杭州湾海域复杂的自然条件，大量采用预制、最长的构件为长 84 米、重达 1.6 米的混凝土钢筒桩。杭州湾大桥在其中非通航孔位置设有一个 1 万平方米的海上平台，它是通过“桥上架桥”的方式与大桥相连。

杭州湾——全球两大涌潮区之一，世界著名钱塘潮的发生地，海上建筑的“禁点”，多方专家论证此处不能从事海事工程，杭州湾大桥就在这个被断定为不可能的地方，创造奇迹。

RUNYANG YANGTZE RIVER BRIDGE, CHINA

- DATE OF COMPLETION-竣工日期: 01 May., 2005
- MAIN WORKS-项目概述: a bridge with the total length of 35.66km with the main span of 1490m in dual lane suspension bridge., and a cable-stayed bridge on the other side of the suspension bridge.
It is the longest in China and third longest in the world.

全长 35.66 公里，其中南汊河主桥为主跨径 1490 米单孔双铰钢箱悬索桥，是目前中国第一、世界第三的特大跨径悬索桥，是中国桥梁史上工程规模最大、建设标准最高、投资最大、技术最复杂、技术含量最高的现代化特大型桥梁工程，也是长江上唯一一座由斜拉桥与悬索桥合成的特大型桥梁。

HONG KONG-ZHUHAI-MACAO BRIDGE, HONG KONG LINK ROAD-SECTION BETWEEN HKSAR BOUNDARY AND SCENIC HILL

- THE CLIENT-项目业主: Highways Department, HKSAR
- DATE OF COMPLETION-竣工日期: In Progress 在建
- MAIN WORKS-项目概述: to construct a bridge connecting the Hong Kong-Zhuhai-Macao Bridge and the SAR traffic system, a 12 km-long Hong Kong Link Road (HKLR) of 9.4 km-long dual three-lane elevated viaduct, civil, structural, architectural, mechanical and electrical, geotechnical, surveying, environmental protection, installation of traffic monitoring systems are also in plan.
Hong Kong Special Administrative Region (HKSAR) programs a series of strategic transport ancillary works, and this is one of the proposed plans connecting the Hong Kong-Zhuhai-Macao Bridge and the Hong Kong port.

港珠澳大桥项目是连接香港、澳门和珠海的超级跨海大型交通系统工程。它是一中国香港 - 威胜利联盟连接港珠澳大桥香港连线工程边界至西暑山段，主要包括建造 9.4 公里长的三线双程高架桥及立体结构、通风机电、环境保护、交通监控等，以及其它附属配套工程。

CHONGQING CHAOTIANWEN ARCH BRIDGE, CHINA

- DATE OF COMPLETION-竣工日期: 29 Apr., 2009
- MAIN WORKS-项目概述: a bridge comprising three spans 190m + 552m + 190m) built by steel trusses with the main span in arch structure, the approaches on two sides (304m + 245m) built by spans of continuous prestressed concrete beams. The whole Bridge is in double decks, the upper level has three-lane dual carriageways and the lower level accommodates the LRT.

重庆朝天门长江大桥全长 1741 米。上桥为跨径 190 + 552 + 190 米中承式钢桁连续系杆拱桥，双层桁架布置，上层为双向六车道和两侧人行道，桥面宽度 36 米，下层中间为双线轨道交通，两侧各设置一个汽车车行道。

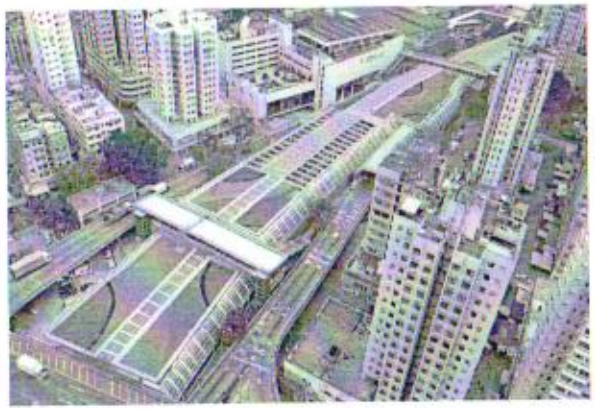
DESIGN, CONSTRUCTION AND COMPLETION OF THE SECOND PENANG BRIDGE, MALAYSIA

- THE CLIENT-业主：LEBUHRAYA KEDUA SDN. BHD.
- DATE OF COMPLETION-竣工日期：15 Sep., 2013
- MAIN WORKS-主要工程：It is a bridge with a total length of 22.5km (marine portion of 16.37km) making it the longest sea crossing bridge in Southeast Asia.
  CHEC is the Design and Build Contractor for Package 1 for the Works in the Main Navigation Spans (3 spans of stay cable in 117.5m + 240m + 117.5m), substructure and foundations of the Approach Spans. Innovative methods in design and construction had been adopted in particular of tackling the issues of seismic and tsunami.
  西环段为设计、建工总承包项目，是马来西亚 20 年来最大的土建工程，也是目前东南亚最长的跨海大桥。中资港湾承建第一标段海中主桥工程和引桥下部结构及基础工程，该桥全长 22.5 公里（海中桥全长 16.37 公里），主桥采用三跨双塔斜拉桥，跨径为 475 米，塔高为 103.28 米。在应对抗震及海啸等方面的设计和施工工艺有诸多创新。

SHA TIN NEW TOWN CONSTRUCTION OF ROAD T7 IN MA ON SHAN, HONG KONG, CHINA

DATE OF COMPLETION: 9 Jan., 2005

MAIN WORKS: a road with components consisting of 3.2km dual 2-lane carriageway with 1.2km of elevated viaducts, and a 330m long tunnel by "Drill & Blast" method, adopting incremental launching technique for the installation of precast bridge segments, 2.2km of semi-trackside and 1.7km of cantilever noise barriers along the carriageway to mitigate the traffic noise to the nearby residents.

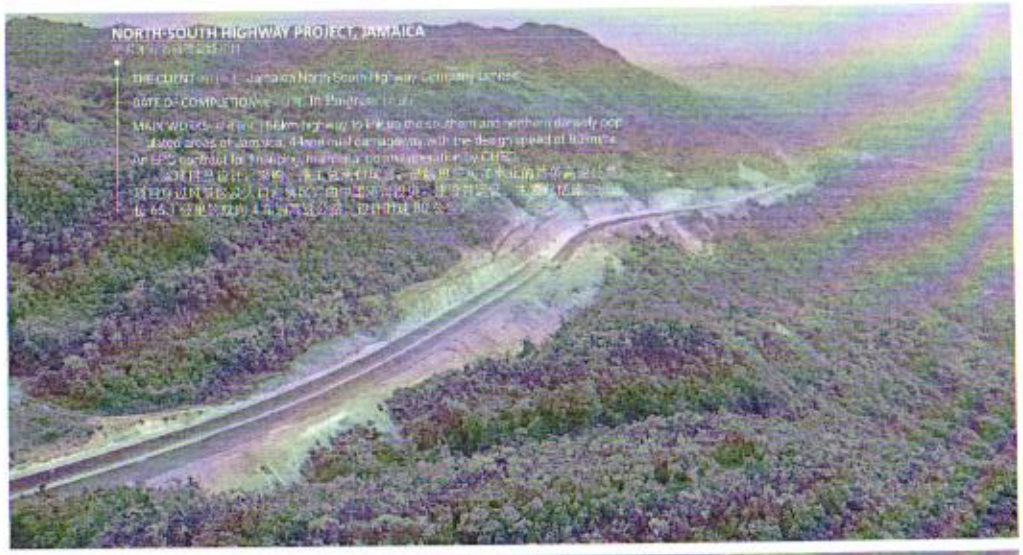


GOVERNMENT OF THE HONG KONG SPECIAL ADMINSITRATIVE REGION, CHINA

THE CLIENT: Highways Department, HKSAR

DATE OF COMPLETION: 30 Dec., 2014

MAIN WORKS: reconstruction and road improvement of the existing expressway with high standards of safety, environmental protection and quality, widening of traffic lanes, highway structures such as vehicular bridges, box culverts, underpasses and subways, and the installation of noise enclosure.

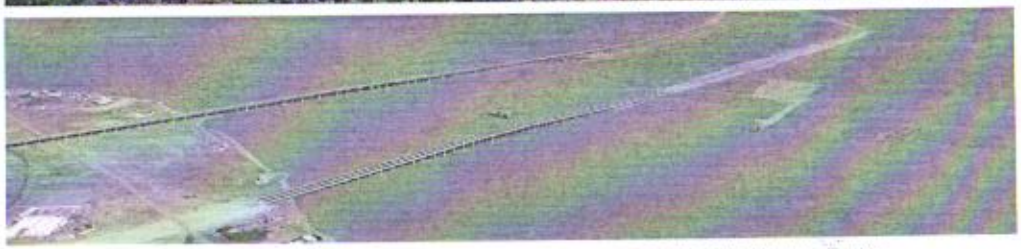


NORTH-SOUTH HIGHWAY PROJECT, JAMAICA

THE CLIENT: Jamaica North South Highway Company Limited

DATE OF COMPLETION: In Progress

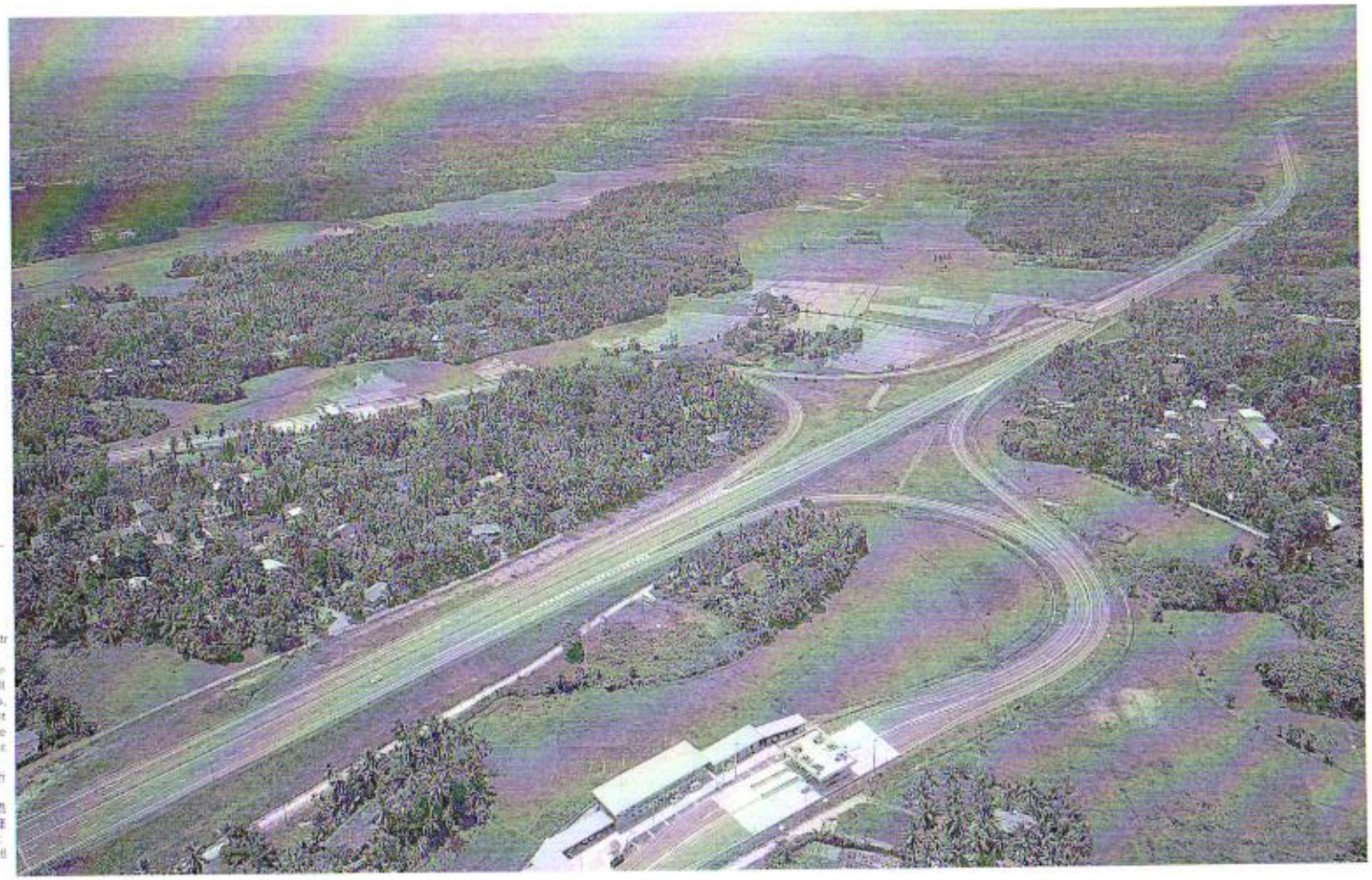
MAIN WORKS: a total 67.5km highway to link up the southern and northern densely populated areas of Jamaica, 44km dual carriageway with the design speed of 80km/hr or 100km/hr for sections, managed & commissioned by CHEC.



MUBARAK AL KABEER SEAPORT PROJECT, PHASE 1, STAGE 1 – ROAD, BRIDGES AND SOIL TREATMENT, KUWAIT

THE CLIENT: Ministry of Public Works (MPW), Kuwait DATE OF COMPLETION: 06 Feb., 2013

MAIN WORKS: design-and-construction of 28km three-lane dual carriageway plus another 28km railway formation, 1.42km highway bridge and 4.24 km railway bridge connecting Khor Al-Subbiyah to Boubyan Island. Approx. 50 million lin m vertical band drains plus the surcharge are designed for ground improvement.



SOUTHERN TRANSPORT DEVELOPMENT PROJECT CONTRACT PACKAGE I: KOTTAWA TO DODANGODA, SRI LANKA

- THE CLIENT-业主单位:
  Road Development Authority of Sri Lanka
- DATE OF COMPLETION-竣工日期: 16 Dec., 2011
- MAIN WORKS-主要业绩: This is the first expressway construction project in Sri Lanka.
  In Package 1, CHEC is responsible for building 34.5km out of the 128km including the road base and the asphalt concrete pavement, two grade separated interchanges, one continuous box girder bridge, one river bridge, eight underpass bridges and eight overpass bridges. The expressway is designed in 2-4mm dual carriageway but it is feasible to extend in 3-4mm standard.

  该项目是斯里兰卡首条高速公路项目。全长约128公里。

  中国港湾承建第一标段 34.5 公里，路面为沥青混凝土结构，标准路面宽度 26.5 米，双向 6 车道，2 座立体枢纽互通和 8 座天桥和 8 座涵通。以及其它附属配套工程。

THE HARBIN-DALIAN PASSENGER SPECIAL RAILWAY LINE, CHINA
中国哈尔滨至大连客运专线铁路

- DATE OF COMPLETION-竣工日期: 01 Dec., 2012
- MAIN WORKS-主要业绩: a section of 346km including the earthwork (hard and soft materials) of 15.72 million m³, twenty six large bridges with the total length of 28.8km, twelve medium-sized bridges of 3.5km, one hundred and fifteen culverts and 384km railway tracks; designed speed 250km/hr in winter and 300km/hr in summer.
It is a 921km railway line between Harbin to Dalian passing through the high latitude and freezing zone in Northeast China.
该项目是在中国寒冬、高纬度地区建设的高速铁路代表工程，全长 921 公里，设计标速冬季 200 公里，夏季 300 公里。中国海湾承建的标段主要包括建设 346 公里的高速铁路：土石方工程量 1,572 万立方米；特大桥 26 座，共 28.9 公里；大中桥 12 座，长 3.5 公里；涵洞 115 座，长 2.8 公里；正线铺轨 325 公里，站线铺轨 39 公里。

TAI-ZHONG-YIN RAILWAY PROJECT, CHINA
中国大中银高铁项目

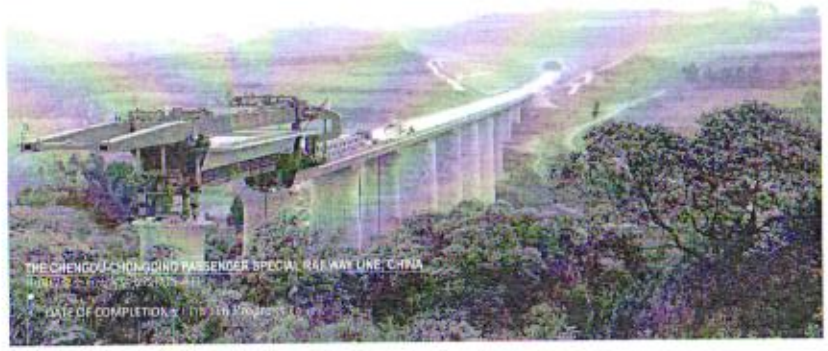
- DATE OF COMPLETION-竣工日期: Jun., 2011
- MAIN WORKS-主要业绩: approx. 210km rail, subgrade, bridges, culverts, tunnels, stations, fabrication and storage yards, and track installation.
It is a railway with a total length of 748km with the design speed of 160km/hr.
该项目是在中国中西部地区建设的铁路代表工程，正线全长 748 公里，设计时速 160 公里。中国港湾承建的标段包括修建铁路大跨至中卫（银川）线清徐至银铜段 210 公里站前工程，主要有路基、桥涵、隧道、车站、制梁场、双块式无缝轨道、有砟轨道铺轨架梁等工程。

BEIJING-SHANGHAI HIGH-SPEED RAILWAY PASSENGER LINE IN CHINA
中国北京至上海高速铁路客运专线项目

- DATE OF COMPLETION-竣工日期: 30 Jun., 2011
- MAIN WORKS-主要业绩: the section comprising two super-large bridges of 164.42km, three elevated stations and laying tracks of 155.4km, the design speed 380km/h. In order to satisfy the requirements of safety and comfort for high-speed railway, lines of fragments with no track and seamless lines of crossing-laying are extensively used. It is a landmark railway project with a total length of 1318km running through the economically developed and populated areas.
该项目是在中国东部经济发达、人口密集区域建设的高速铁路代表工程，全长 1318 公里，设计时速 380 公里。全线大量采用无砟轨道，一次铺设跨区间无缝线路，满足高速列车对安全性和舒适度的要求。中国海湾承建的标段主要包括 2 座特大型桥梁，长 152.42 公里；3 个高架车站；铺轨 155.4 公里。

LANZHOU-XINJIANG HIGH SPEED RAILWAY PROJECT, CHINA

- DATE OF COMPLETION: In Nov. 2013
- MAIN WORKS: ... a 22km ... tunnels, two tunnels of 3km and four bridges of 1.8km long.
  主要包括修建的铁路主要包括建设长 32 公里铁路，建设2座隧道64.35 公里，建设隧道5座，长35.6公里，建设桥梁4座，长1.8公里。



THE CHENGDU-CHONGQING PASSENGER SPECIAL RAILWAY LINE, CHINA

- DATE OF COMPLETION: In Progress

KCRC WEST RAIL DEPOT BUILDING, HONG KONG, CHINA

- DATE OF COMPLETION: 15 Oct., 2003
- MAIN WORKS:
  A two-storey 500m long EMU Maintenance Building and Pan Podium structure including the piling foundation, reinforced concrete structure, MEPF and ABWF are constructed. Phased hand-over are required to allow the commissioning of new railway line.
  中国香港西北铁路全长 30.5 公里，连接九龙至新界的屯门，是香港 6 个铁路扩建项目中规模最大的一个，也是当时香港最大的基建工程。

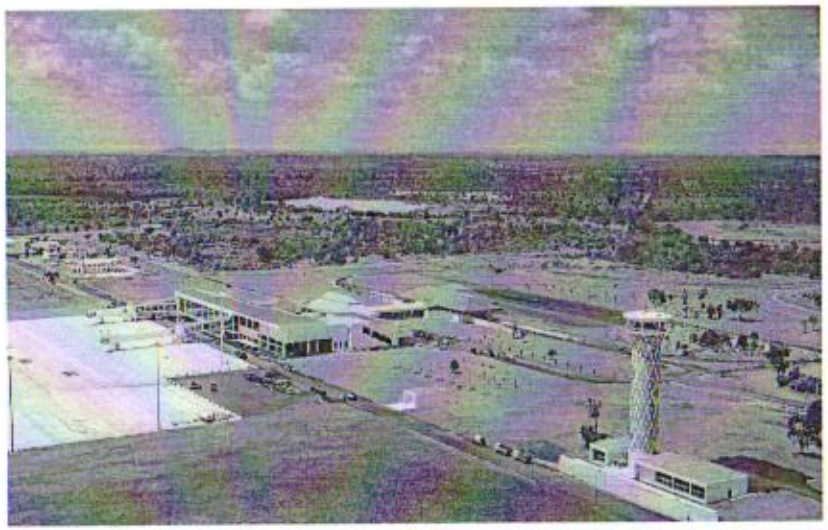
C370-CONSTRUCTION WORKS FOR TAIPA BORDER GATE SECTION OF MACAU LRT IN CHINA

- THE CLIENT: GIT-Gabinete Para as Infra-estruturas de Transportes
- DATE OF COMPLETION: In Progress
- MAIN WORKS: a railway with a total length of 3km, including three newly constructed stations and elevated viaduct in 4 range segments, electrical systems and other facility works.
  主要包括建设 3 公里的铁轨，4 个高架桥，3 个车站，机电设备等，以及其它附属土建工程。

AMPANG LRT LINE EXTENSION PROJECT IN KUALA LUMPUR, MALAYSIA

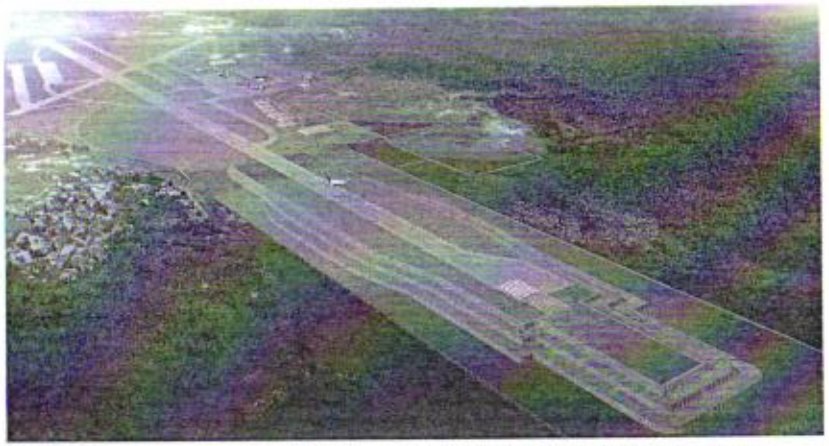
- THE CLIENT-业主单位 : George Kent (Malaysia) Berhad
- DATE OF COMPLETION-竣工日期: In Progress (在建)
- MAIN WORKS-承包项目: an 18km long light rail track (design speed in 90km/hr) including thirteen elevated stations between Sri Petaling Station and Putra Heights to serve the highly populated residential and commercial areas, and a new depot to accommodate LRV vehicles.

  该项目为设计、采购、施工总承包项目，主要包括建设长 18 公里的轻轨，设计时速 80 公里，13 座高架车站。



HAMBANTOTA INTERNATIONAL AIRPORT DEVELOPMENT PROJECT, SRI LANKA

- THE CLIENT: Airport And Aviation Services(Sri Lanka) Ltd.
- DATE OF COMPLETION: 05 Apr., 2013
- MAIN WORKS: 3500m long and 75m wide runway to accommodate Airbus A380, an apron area of 73,000m² to park 10 airplanes, a passenger terminal building (10,000m²), cargo building (5,000m²), control tower and ancillary buildings and facilities.
  This is an EPC plus financing project by CHEC.
  该项目为设计、采购、施工总承包项目，中国海湾格鲁斯夫项目概要：主要包括一条长 3.5 公里、宽 75 米能够停放有 380 飞机起降的跑道、一条长 370 米宽 60 米的滑行道、一条长 650 米宽 25 米滑行道、一个面积为 73000 平方米（可一停机位）的停机坪、一个面积为 10000 平方米的航站楼、一个 5000 平方米的货运大楼、35 米高的飞行检查塔以及气象塔、油库站、供水站、垃圾处理厂、飞行控制塔、2 个变电站、污水处理厂和与机场运作相配套的给排水系统、污水系统、灯光系统、电气工程、通讯导航系统、道路和停车场等。



EXTENSION OF CHEDDI JAGAN INTERNATIONAL AIRPORT,GUYANA

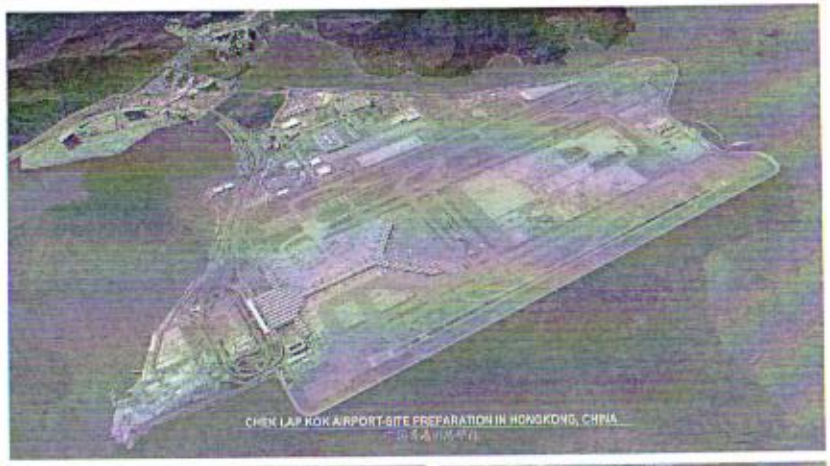
- THE CLIENT: Ministry Of Public Works And Communication
- DATE OF COMPLETION: In Progress
- MAIN WORKS: 1090m runway, taxiway, apron (approx. 7.2ha), a passenger terminal building (2-storey 16,800m2, 8 boarding bridges), navigation systems, lighting and ground handling systems.
  The airport is 61km away from Georgetown, the Capital city of Guyana.
  首都乔治敦 61 公里。扩建项目内容包括：跑道延长 1090 米、一条滑行道、停机坪（约 7.2 万平米）、新站楼新建（2 层 1.6 万平米，8 座登机桥）、导航、消防等配套设施。

NAY PYI TAW INTERNATIONAL AIRPORT, MYANMAR

- THE CLIENT: Department of Civil Aviation, Ministry of Transport, Myanmar
- DATE OF COMPLETION: 31 Mar., 2013
- MAIN WORKS: passenger terminal building, apron, runway, taxiway, control tower, electrical, fire-fighting and ground handling systems.

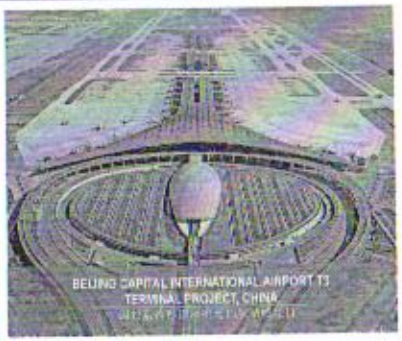
JUBA INTERNATIONAL AIRPORT PROJECT, PHASE 1, SOUTH SUDAN

- THE CLIENT: Ministry of Transport, Roads and Bridges, Republic of South Sudan
- DATE OF COMPLETION: To Proceed
- MAIN WORKS: To rehabilitate and extend the existing runway from 2400m to 3100m, a new taxiway, installation of the existing cargo apron, passenger terminal, fencing, drainage, airfield lighting, air traffic control and navigation systems.



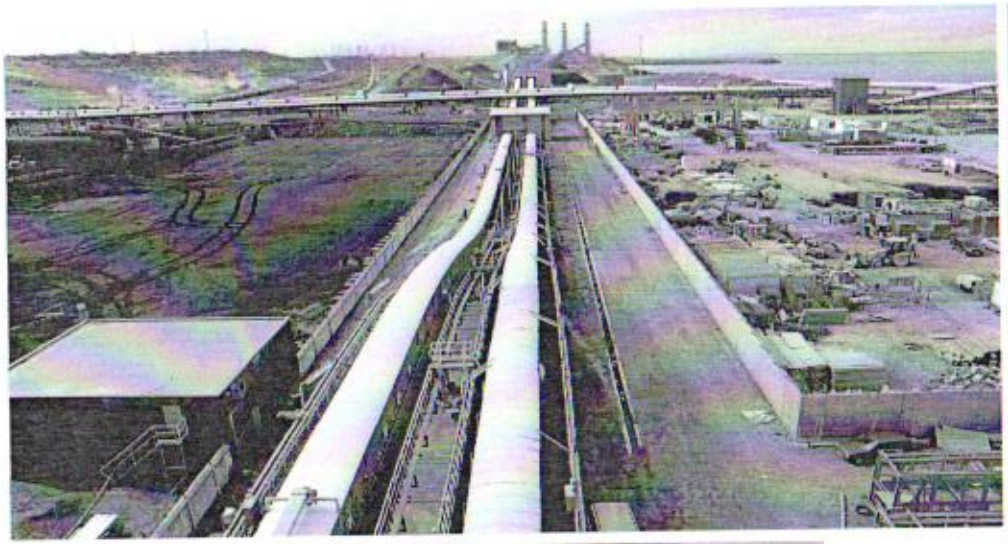
CHEK LAP KOK AIRPORT-SITE PREPARATION IN HONGKONG, CHINA

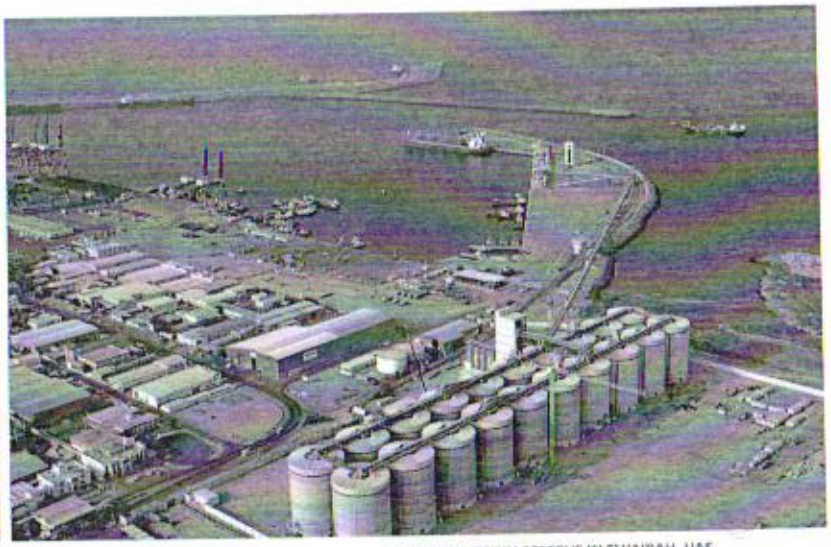
MACAO INTERNATIONAL AIRPORT WAS CONSTRUCTED ON AN ARTIFICIAL RECLAIMED ISLAND CREATED BY CHEC



BEIJING CAPITAL INTERNATIONAL AIRPORT T3 TERMINAL PROJECT, CHINA

THE PARKING APRON OF PUDONG INTERNATIONAL AIRPORT, SHANGHAI, CHINA





PORT MACHINERY PROJECT OF JORF LASFAR PORT THERMO-ELECTRIC POWER PLANT, MOROCCO

- THE CLIENT: Jorf Lasfar Energy Company 5&6 SA
- DATE OF COMPLETION: In Progress
- MAIN WORKS: To re-construct the existing transportation equipment for the coal terminal, to procure and to assemble the conveyor belt and stacker with the capacity of 2400t/h and 4600t/h respectively.

STRATEGIC GRAIN RESERVE IN FUJAIRAH, UAE

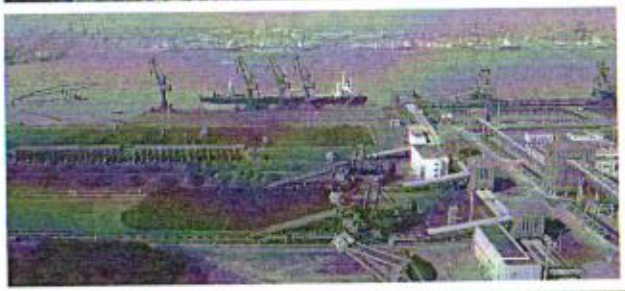
- THE CLIENT: Invest AD. Strategic Projects Real Estate Development Co. L.L.C.
- DATE OF COMPLETION: 24 Apr., 2013
- MAIN WORKS: Twenty reinforced concrete silos each at 28m in diameter and 45m in height, loader, conveyer, ancillary buildings, control, firefighting, lighting and plumbing systems, as well as testing & commissioning.

PORT MACHINERY OF THE KRIBI DEEP SEA PORT, CAMEROON

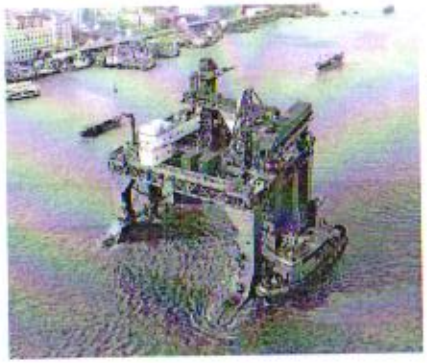
THE CLIENT: Ministry of the Economy, Planning and Regional development, Republic of Cameroon

MAIN WORKS: The electromechanical system includes facilities of refueling, power generating, lighting, communications, controlling, handling and transportation, navigator, tug boats, etc. covering an extensive scope and diversified specifications to satisfy the high integrated requirement.

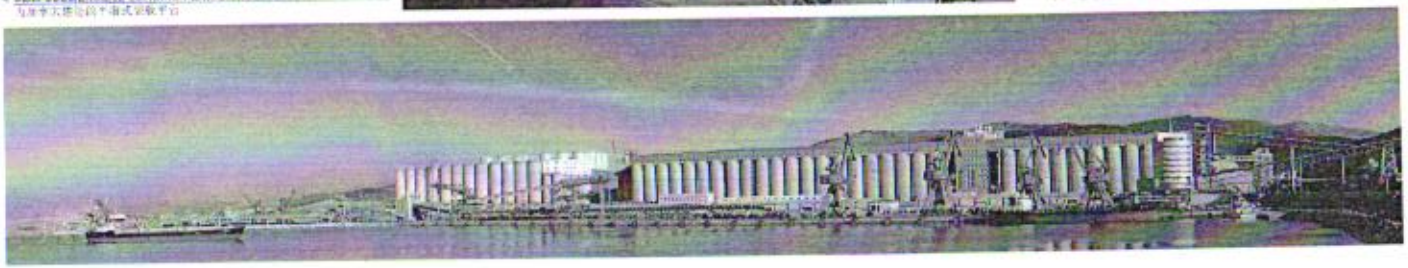
◀ THE TOTALLY SEALED TUBE RUBBER-BELT CONVEYOR WITH THE LENGTH OF 4,316M IS THE LONGEST OF ITS KIND IN ASIA TODAY.



◀ 7.5 MILLION TON COKE HANDLING PLANT FOR THE NANJIANG COKE TERMINAL OF TIANJIN PORT AUTHORITY

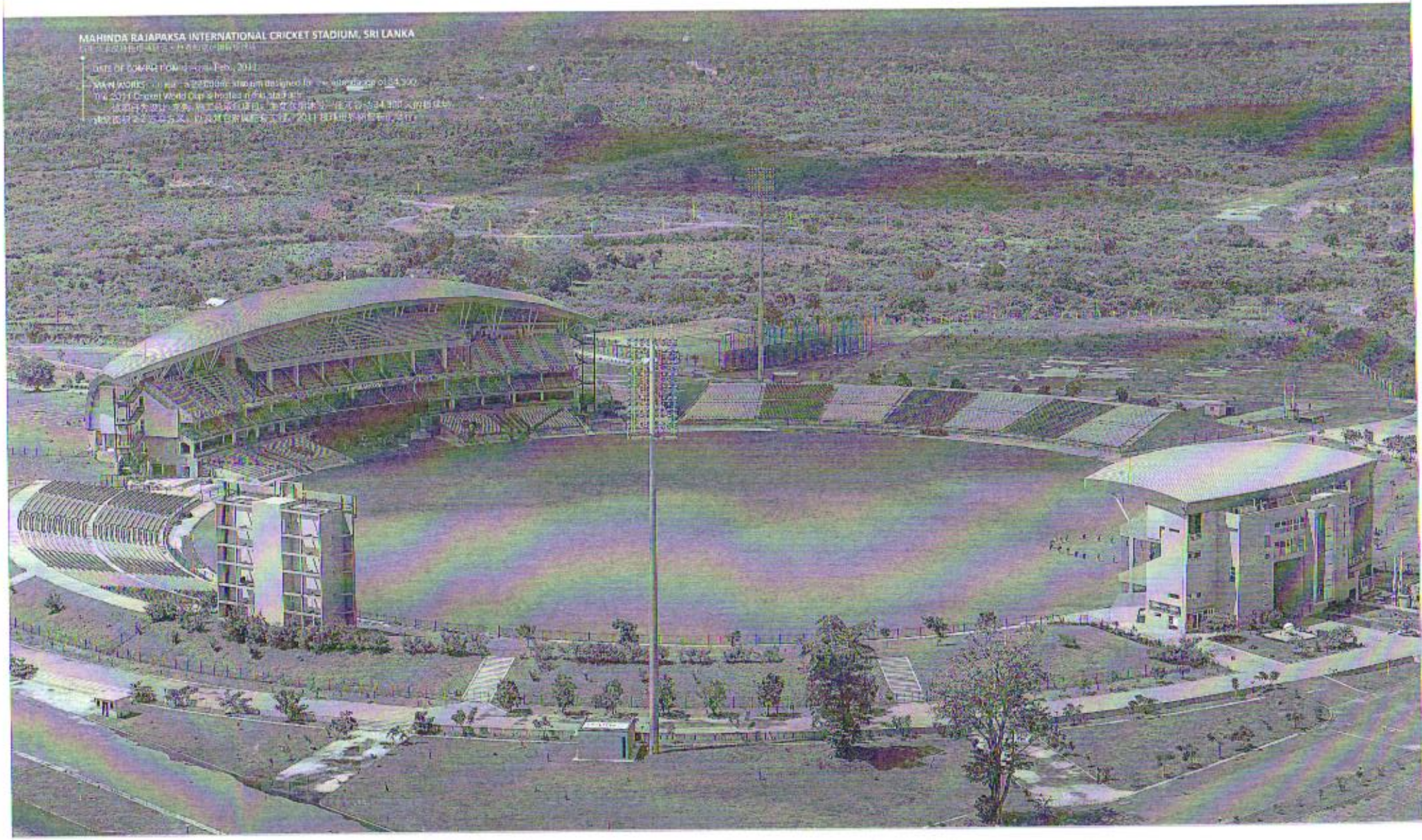


◀ SEMI-SUBMERSIBLE LOADING PLATFORM FOR CANADA



▼ DALIAN BEILIANG GRAIN SILOS WITH A STORAGE CAPACITY OF 384,000TONS, CONSISTING OF 128 SILOS OF HEIGHT 45M, WALL THICKNESS 22CM AND INTERNAL DIAMETER 12M.

MAHINDA RAJAPAKSA INTERNATIONAL CRICKET STADIUM, SRI LANKA



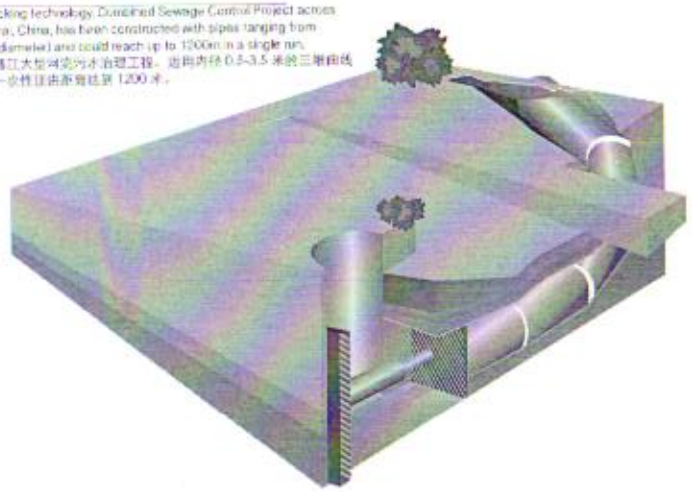
GRAND LISBOA HOTEL, MACAU

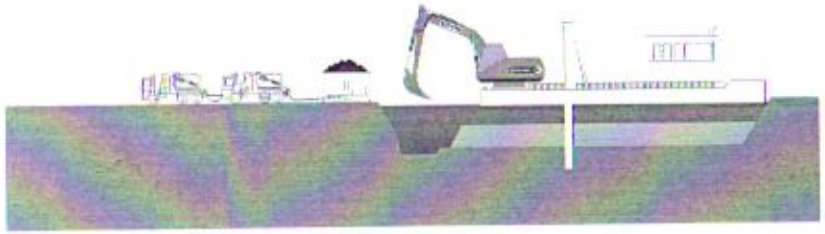
- DATE OF COMPLETION: Dec., 2008
- MAIN WORKS: 228m high, 44-floor hotel situated in the centre of Macau with a floor area of 12,000m². Since the completion of the hotel by the end of 2008, it is a landmark building in Macau.

  该项目为澳门的标志性工程，主要包括建设一座高 228 米，共 44 层的高层建筑，占地 12000 平方米。一期工程已于 2006 年度完成，二期工程已于 2008 年度完成。

Using 3D curve pipe jacking technology, Dunshihed Sewage Control Project across Huangpu River, Shanghai, China, has been constructed with pipes ranging from 0.5m to 3.5m (internal diameter) and could reach up to 1200m in a single run.

中国上海穿越黄浦江大型河流污水治理工程，运用内径 0.5-3.5 米的三维曲线顶管施工技术，最长一次性顶进距离可达 1200 米。



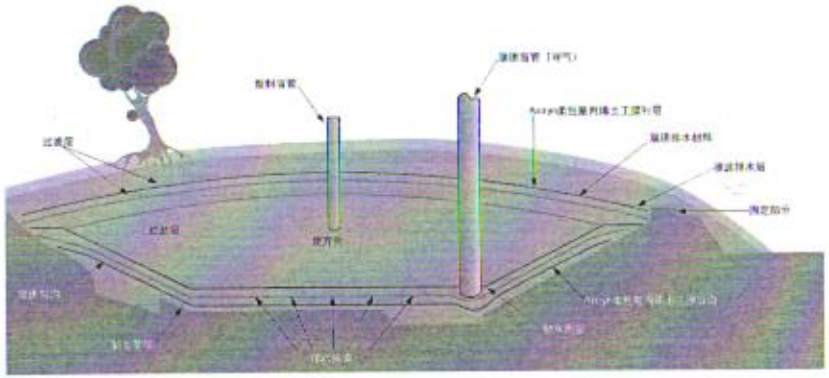


STREAM POLLUTION TREATMENT

- **MAIN WORKS:**

Industrialization brings catastrophe to waters. As Hong Kong government pledges to alleviate waterway pollution, CHEC collaborated with Organic Waste Technologies (an American company) in 2001, makes great contribution to Hong Kong government's bioremediation of Shing Mun River, and received a contract for further regeneration of this river.

中国香港城市工业化的不断发展，已对新界河流造成严重的污染。近年香港政府致力改善各主要河道的污染情况。中国海南联同美国的 Organic waste Technologies 公司于 2001 年成功取得城门河污染生化处理工程合约，帮助香港政府为河流污染的治理做出突破性的贡献。



LANDFILL GAS TREATMENT

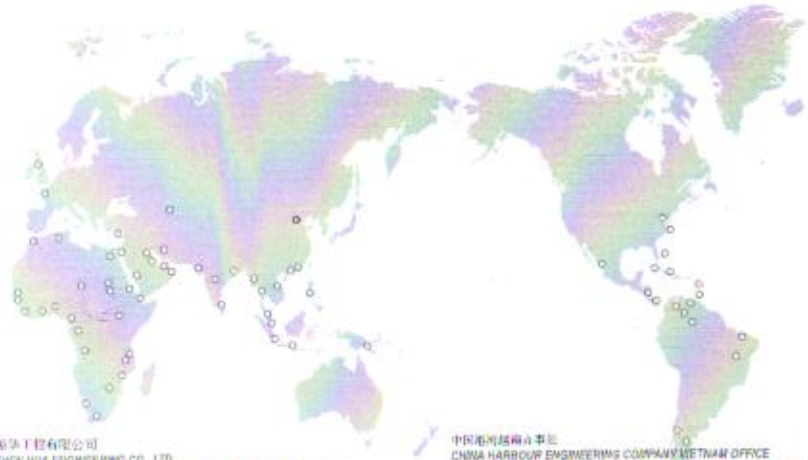
- **MAIN WORKS:**

Landfill gas capture and torching systems, gas collection network and environmental monitoring systems. CHEC converts landfill gas into tens of outcomes, among which fuel would be used for evaporation of sewage deriving from the process and generation of electric power.

中国港湾设计和建造了填埋气体的输气和火炬焚烧系统、基体气测系统，并进行了环境监测（如图）。

中国香港将填埋场生成气体以十多种形式加以利用，燃料用于蒸发填埋场自身产生的污水，并用于发电。

业务分布 SUBSIDIARIES & OVERSEAS OFFICES



振华工程有限公司
ZHEN HUA ENGINEERING CO., LTD.
16/F, China Harbour Building,370-374 King's Road, North Point,Hong Kong
852 28878118
852 25120427
hongkong@chec.bj.cn

振华海湾工程有限公司
ZHEN HWA HARBOUR CONSTRUCTION COMPANY LIMITED
Alameda Dr. Carlos D' Assumpção, nºs 181-187, Centro Comercial Seiharmiano, 8º andar H, Macau.
+853 323535
+853 355112
macau@chec.bj.cn

振华（新加坡）工程有限公司
ZHEN HUA (SINGAPORE) ENGINEERING PTE. LTD.
29-06, 333 beach road, the concourse
singapore 199555
+ 65 63928321
+ 65 63928302
singapore@chec.bj.cn

中振建设（马来西亚）有限责任公司
CHEC CONSTRUCTION (M) SDN BHD
37-01, Menara Multi-purpose, Capital square, No 8, Jalan Munshi Abdullah, 50100, Kuala Lumpur, Malaysia
+6 03 26820668
+6 03 26841628
mukeyxia@checmsia.com

中国港湾（印尼）有限公司
PT. CHINA HARBOUR INDONESIA
TCC Batavia Tower one, 41st Floor JLKH. Mas Mansyur Kav.126 Jakarta Pusat 10220, Indonesia
+62 21 29678235
+62 21 29678238
indonesia@chec.bj.cn

中国港湾越南办事处
CHINA HARBOUR ENGINEERING COMPANY VIETNAM OFFICE
Unit 3, 8/F, Capital Tower, No. 06 Nguyen Khac Vien Road, Tan Phu Ward, District 7, Ho Chi Minh City, Vietnam
+84 8 54129115
+84 8 54129668
vietnam@chec.bj.cn

中国港湾（泰）有限公司
CHEC(THAI) COMPANY LIMITED
2/76 Sangha Complex 15/F Thonpol Building 4 Soi Sangha-Thad 25 Bangna,Bangkok 10260 Thailand
+66 23618512/13/14/15
+66 23618630
thailand@chec.bj.cn

中国港湾（缅甸）工程有限责任公司
MYANMAR CHINA HARBOUR ENGINEERING CO., LTD
Room No.601, 623, 624, 6th Floor, Hledan Center, Kamayut Township, Yangon, Myanmar
+95 1 2305841/2305842
+95 1 2305540
myanmar@chec.bj.cn

中国港湾巴基斯坦分事处
CHINA HARBOUR ENGINEERING CO.LTD OFFICE IN PAKISTAN
Plot No.20-C, Khayaban-e-Tanzeem, Tauheed Commercial Area, Phase-V, DHA, Karachi, Pakistan.
+92 21 35865186/35301874/35301875
+92 21 35873884
pakistan@chec.bj.cn

伊朗分公司
CHINA HARBOUR ENGINEERING COMPANY IRAN BRANCH
No. 132, 13th Floor, Negin-e-ghaik Building, Shariati St., Tehran, Iran
+98 2126640667, +98 2122611244
+98 2126640667
iran@chec.bj.cn

中国港湾阿尔及利亚有限责任公司
SARL CHINA HARBOUR ALGERIE
03,Rue Dkar Essouma villa No.10 El Biar Alger, ALGERIE
+213 (0)21 928201
+213 (0)21 928557
algeria@chec.bj.cn

摩洛哥分公司
CHINA HARBOUR ENGINEERING MOROCCO SUCCURSAL
17 place Charles Nicole, étage 7 bureau N°2-Casablanca- Morocco
+212 699918809
+212 522 450339
morocco@chec.bj.cn

中国港湾菲律宾办事处
CHINA HARBOUR ENGINEERING COMPANY PHILIPPINES BRANCH
Unit A, 5th Floor, Ramon Magsaysay Center, 1660 Roxas Boulevard, Manila. Philippines
+63 2 3032782
+63 2 3032783
philippines@chec.bj.cn

中国港湾（东帝汶）工程有限责任公司
CHINA HARBOUR TIMOR, LDA
CDB II 202-203, Timor Plaza, Dili, Timor-Leste
+670 7090140
easttimor@chec.bj.cn

南部事务区域管理中心（安哥拉本部）
CHEC SOUTHERN AFRICA DIVISION
avgo Joss Rigju 6/7, Bairro Nelito Soares, Municipio Rangel , Luanda
+244 923656468
angola@chec.bj.cn

莫桑比克分公司
CHINA HARBOUR ENGINEERING COMPANY LTD. MOZAMBIQUE OFFICE
Av. Ho Chi Min N. 760 4th floor Maputo Mozambique
+258 21 32216784
mozambique@chec.bj.cn

南非办事处
CHINA HARBOUR ENGINEERING COMPANY SA (PTY) LTD.
2nd floor,building 27,woodlands office park cnr woodlands & Kelvin Dr,woodmead,Sandton, Johannesburg, South Africa
+27 11 4500356
+27 11 4500361
southafrica@chec.bj.cn

纳米比亚办事处
CHINA HARBOUR ENGINEERING COMPANY LTD (NAMIBIA BRANCH)
24 Chamonix Street, Ausenblick, Windhoek, Namibia
+264 61 304478
+264 61 304479
namibia@chec.bj.cn

东部非洲区域管理中心（博茨瓦纳本部）
EASTERN AFRICA DIVISION
CHINA HARBOUR ENGINEERING COMPANY LTD
Plot No.72, Block 10, El-Riyadh, Khartoum, Sudan
+249 183229446
+249 183229246
sudan@chec.bj.cn

吉布提分事处
DJIBOUTI BRANCH
CHINA HARBOUR ENGINEERING CO. LTD
Zone Industriel Sodiol 241 Djibouti
djibouti@chec.bj.cn

厄立特里亚分公司
ERITREA BRANCH
CHINA HARBOUR ENGINEERING CO. LTD
House No.111, Tirovolo Akrure Street, Asmara, Eritrea
+291 1 180304
eritrea@chec.bj.cn

乌干达分事处
UGANDA BRANCH
CHINA HARBOUR ENGINEERING CO. LTD
Plot 1a Naguru East RoadKampala-Uganda
uganda@chec.bj.cn

南苏丹办事处
SOUTH SUDAN BRANCH
CHINA HARBOUR ENGINEERING COMPANY LTD
No.11B,Hai cinema, Juba Town, South Sudan Simple Riglie
southsudan@gmail.com

坦桑尼亚分公司
TANZANIA BRANCH
CHINA HARBOUR ENGINEERING COMPANY LTD.
Palm Residency, Ocean Road, Dar es Salaam, Tanzania
P.O.Box No.32550
tanzania@chec.bj.cn

中国港湾斯里兰卡区域公司
CHEC SRI LANKA DIVISION
Level 32, East Tower, World Trade Center, Colombo 01, Sri Lanka
+94 11 2470690
+94 11 2470697
srilanka@chec.bj.cn

科伦坡港口城基础设施项目公司
CHEC PORT CITY COLOMBO(PVT)LTD.
4th &5th Floors Central Point Building No.54 Chatham Street, Colombo 01 Sri Lanka
+94 112335140/41/42/43
portcitycolombo@chec.bj.cn

印度洋海事工程有限责任公司
INDIA OCEAN MARITIME ENGINEERING COMPANY PVT. LTD.
No.504, A-Wing, Delphi Orchard Avenue, Hiranandani Business Park, Powai, Mumbai - 400 076
+91 22 42142525
+91 22 42142555
india@chec.bj.cn

中国港湾（巴布亚新几内亚）工程有限责任公司
CHINA HARBOUR ENGINEERING COMPANY (PNG) LTD
P. O. BOX 594, KONEDOBU
Section 42, Lot 10, Ogoa Street, Granville, Port Moresby, NCD, PNG
+675 77542686
+675 77380057
png@chec.bj.cn

业务分布 SUBSIDIARIES & OVERSEAS OFFICES

CHINA HARBOUR ENGINEERING COMPANY LTD.

斯里兰卡事处
CHEC SRI LANKA DIVISION REPRESENTATIVE OFFICE IN BANGLADESH
HE Tower Level-14,40/7 North Avenue,Gulshan-2,Dhaka-1212,Bangladesh
+88 02 9886888
+88 02 9886888
bangladesh@checbd.com

中国港湾工程有限责任公司（阿联酋）
CHINA HARBOUR ENGINEERING CO.
Mazaya Business Avenue BB1 2302,JLT,DUBAI,UAE
+9714421016
+9714420709
uae@chec.bj.cn

阿曼办事处
CHINA HARBOUR ENGINEERING CO.L.L.C
Muscat Governorate / bawshar / north P.O.BOX 283
oman@chec.bj.cn

巴基斯坦代表处
CHINA HARBOUR ENGINEERING CO.LIMITED
kbanon@chec.bj.cn

卡塔尔代表处
CHINA HARBOUR ENGINEERING CO.
9th Floor, Al Mana Tower Airport Road, Doha, Qatar
+97444622735
+97444622517
qatar@chec.bj.cn

中国港湾沙特科伦分有限责任公司
CHINA HARBOUR ENGINEERING COMPANY LTD
Room 4 & 5, Level E, Sumou Building, Cross Of Prince Salman Bin Abdulaziz & Turki Bin Abdulaziz Road, Al Khobar, KSA.
+966 13 8868 3394/95
+966 13 8868806
saudiarabia@chec.bj.cn

科威特办事处
ChEC KUWAIT OFFICE
Building No.3, Street 13, Block 4, Sabah Al Salem, Kuwait
+965 22255299
+965 25515706
kuwait@chec.bj.cn

中国港湾（埃及）工程有限责任公司
CHINA HARBOUR ENGINEERING COMPANY EGYPT LTD.
Villa 39 Group 5 Ali Zaki El-Akaden Street, El-Rehab City, New Cairo, Cairo
+2 02 2892 8866
+2022892 8877
egypt@chec.bj.cn

西部非洲区域管理中心（加纳本书）
CHEC WESTERN AFRICA DIVISION
No 5 Abokobi Road, Cantonments, Accra, Ghana
+233 247775961/540710883
ghana@chec.bj.cn

几内亚办事处
CHINA HARBOUR ENGINEERING COMPANY GUINEA OFFICE
10th , 11th Floor, Dapian 2, Cokarli, Corakry, Guinea
+224 657107888
guinea@chec.bj.cn

中国港湾（科特迪瓦）工程有限责任公司
CHINA HARBOUR ENGINEERING COMPANY LIMITED (CÔTE D'IVOIRE)
06 BP 1667 Abidjan 06 Deux Plateaux, Cocody Abidjan, Côte d'Ivoire
+225 2241 2125
+225 2241 4776
cotedivoire@chec.bj.cn

利比里亚分公司
CHEC LIBERIA BRANCH
20th Street, Sinkor, Monrovia
+231 770288326
liberia@chec.bj.cn

中喀港湾（喀麦隆）工程有限责任公司
CHINA HARBOUR ENGINEERING COMPANY LTD. (CAMEROON)
Avenue Rosa Parks, BASTOS, B.P. 35518 Yaounde
+237 22208367
+237 22208367
cameroon@chec.bj.cn

加蓬代表处
CHINA HARBOUR ENGINEERING COMPANY LTD (GABON)
Résidence les Palétuviers, Sablière, Libreville, Gabon
+241 01443001/07556805
+241 01443001
gabon@chec.bj.cn

中国港湾（尼日利亚）有限公司
China harbour engineering company (nigeria) ltd.
阿布贾分事处地址：
Plot 32, Tunnie Street, Zone B, Wuse, Abuja, Nigeria
拉各斯分事处地址：
Block 10, Plot 8, Banana Island Road, Ikoyi, Lagos, Nigeria
234 09 2501585 (Abuja)
234 01 4540027(Lagos)
nigeria@chec.bj.cn

中国交建（哈立尼达和多巴哥）工程有限责任公司
CHINA HARBOUR ENGINEERING COMPANY (T&T) LIMITED
5th Floor, TATIL Building, Maraval Road, Port of Spain, Trinidad & Tobago
ttl@chec.bj.cn

牙买加分事处
CHINA HARBOUR ENGINEERING COMPANY (JAMAICA)
5th Floor Courtleigh Corporate Center, 6-8 St. Lucia Ave, Kingston
1 876 632 8888
1 876 906 0432
jamaica@chec.bj.cn

中国港湾巴拿马有限公司
CHINA HARBOUR ENGINEERING CO. LTD
Office 27-A & 27-B, Floor 27 Tower 1000, PH Oceania Business Plaza Main Street, Punta Pacifica, San Francisco, Panama, Republic of Panama
507 831-7086
panama@chec.bj.cn

中国港湾哥伦比亚分公司
CHINA HARBOUR ENGINEERING COMPANY LTD COLOMBIA
ROARD 97, NO.23-60, BUILDING PROKSOL,OFFICE 304, OGOTA, CUNDINAMARCA, COLOMBIA
57 1 6012611
57 1 6029324
colombia@checdalin.com

中国港湾（墨西哥）工程有限责任公司
CHINA HARBOUR ENGINEERING COMPANY LTD. MEXICO BRANCH
Paseo de las Palmas 735, 7th floor Col. Lomas de Chapultepec, Del. Miguel Hidalgo, Mexico City, CP11000
+52 55 52083500
mexico@chec.bj.cn

中国港湾（巴哈马）工程有限责任公司
CHINA HARBOUR ENGINEERING COMPANY (BAHAMAS) LTD.
#8-58 Sanford Dr.
bahamas@chec.bj.cn

圭亚那金都国际机场扩建项目总经理部
GUYANA CHEDDI JAGAN INTERNATIONAL AIRPORT EXTENSION PROJECT MANAGEMENT TEAM
Lot "D" Timehri Public Road East Bank Demerara, Georgetown, Guyana
+592 2612560
+592 2612560
guyana@chec.bj.cn

美国代表处
CHEC (USA) INC.
12667 Alcosta Blvd, Suite 195, San Ramon, CA 94583, USA
1 925 2771284
1 925 2771299
usa@chec.bj.cn

中国港湾（哥斯达黎加）工程有限责任公司
CHINA HARBOUR ENGINEERING DE COSTA RICA S.A.
Oficentro de la Sabana,Torre 7 Piso 4 San José
+506 40004838
+506 40004838
costarica@chec.bj.cn

中国港湾（格林纳达）工程有限责任公司
CHINA HARBOUR ENGINEERING COMPANY (GRENADA) LIMITED
CCNA Building, 2nd Floor, Kirani James Boulevard, St. George's, Grenada (1473) 4358888
grenada@checdalin.com

中国港湾（苏里南）工程有限责任公司
CHEC AMERICAS DIVISION SURINAME BRANCH
Verwulstraat, #30 Paramaribo, Suriname
597 55-1919
suriname@checdalin.com

中国港湾委内瑞拉有限公司
CHEC VENEZUELA S.A.
Oficina 5-2, Piso 5, Torre Oeste, Ext. Parque Cristal, Urb. Los Palos Grandes, Municipio Chacao, Caracas
+58 212 2861928
+58 212 2857791
venezuela@chec.bj.cn

加勒比海（巴巴多斯）基础设施投资有限公司
CARIBBEAN (BARBADOS) INVESTMENT INFRASTRUCTURE COMPANY (SPV1)
Chancery House, High Street, Bridgetown, St. Michael, Barbados
barbados@chec.bj.cn

中国交通建设股份有限公司古巴办事处
CHINA COMMUNICATIONS CONSTRUCTION COMPANY LIMITED CUBA OFFICE
Miramar Trade Center, Jerusalem Building, Office 411, 5th Avenue between 76 and 80, Miramar, Playa, Havana City, Cuba.
+5372088754
cuba@chec.bj.cn

阿根廷分公司
CHINA HARBOUR ENGINEERING CO.,LTD.
Carlos Pellegrini 869, Piso8, C.A.B.A, Argentina
+54 11 52352826
argentina@chec.bj.cn

中国港湾（巴西）工程有限责任公司
CHEC ENGENHARIA IN BRAZIL, LTD. (CHEC ENGENHARIA DO BRASIL, LTDA.)
Tenente Street 31, 10th floor, São Paulo, Brazil, postcode 04548-040 (Rua Tenente 31, 10 Andar, São Paulo, Brasil, CEP:04548-040)
+55 972858799
brazil@chec.bj.cn

中国港湾（智利）工程公司
CHEC CHILE SPA,RUT: 76.264.335-1
Calle 3024, Office 10,Las Condes, Santiago, Chile
+569 2 3352500
chile@chec.bj.cn

中国港湾开曼控股有限公司
CHINA HOLDING EQUITY CORPORATION
Suite 10, Second Floor, Jack & Jill Building, 19 Fort Street, P.O. Box 1306 George Town, Grand Cayman KY-1108, Cayman Islands
cayman@chec.bj.cn

246

CAPABILITY STATEMENT ON OIL&GAS / LNG / PORTS AND ENERGY

by

RAMBOLL and SOFREGAZ

RAMBOLL

- ENGINEERING OF LNG IMPORT AND REGASIFICATION TERMINALS
- SELECTED REFERENCES ON LNG PROJECTS
- ENERGY AND POWER TRANSMISSION
- HYDRAULIC AND COASTAL ENGINEERING

SOFREGAZ

- REFERENCES IN LNG TERMINALS

January 2017

RAMBØLL

ENGINEERING OF LNG IMPORT AND REGASIFICATION TERMINALS

RAMBØLL

MULTIDISCIPLINARY CONSULTANCY FOR LNG PROJECTS

RAMBOLL PROVIDES INDEPENDENT ENGINEERING CONSULTANCY SERVICES ON LNG PROJECTS WORLDWIDE

Liquefied Natural Gas (LNG) is one of the fastest growing means of transporting natural gas. LNG allows suppliers of natural gas to meet distant demands in a cost-effective manner.

LNG projects call for large investments and specialised knowledge. Therefore the right consultancy is a decisive factor for a successful LNG project. At Ramboll we have experience with managing large-scale projects in both the planning and construction phases.

LNG value chain

We provide professional and independent consultancy services in all areas of LNG. Our multidisciplinary approach enables us to provide all-inclusive consultancy services.

Our services cover the entire LNG value chain from gas produced from the field to gas conditioning, LNG storage, LNG transport, LNG re-gasification, gas transmission systems and underground gas storage services.

Market and economic studies

Ramboll has an extensive track record in market and economic studies for the oil and gas industry. Our studies provide facility owners, investors and other stakeholders with the necessary basis for making the right decision.

Site selection and environmental assessments

Selection of the optimal site for an LNG terminal should be based on the interface with existing facilities, existing gas transmission infrastructure, risk assessment and environmental impact analysis.

Ramboll has extensive experience with conducting infrastructure, risk and environmental assessments in relation to all kinds of onshore and offshore oil and gas projects.

Process and mechanical engineering

Ramboll's core competencies within new LNG projects include all services from initial early-phase studies through concept development to detailed design and implementation of projects.

LNG projects are sensitive to decisions made early in the process. Not all technologies are suitable for all climates, some technologies are motion sensitive and typically there are significant differences in the heat efficiency. The liquefaction and re-gasification processes require significant amounts of energy, and the differences in energy consumption between different technologies have a great impact on the overall profitability of the facilities.

Ramboll is one of few independent engineering consultancies that is competent to access the prioritory design of others, and we are accustomed to evaluate different technologies and life cycle costs in the early phases of LNG projects.

The processes set high demands for facilities, equipment and choice of materials. Ramboll offers consultancy on both the liquefaction and re-gasification phases.

Selecting types of LNG facilities

LNG can be liquefied onshore or offshore. It can be stored and re-gasified offshore on FSRUs (Floating Storage and Re-gasification Units), SRVs (Storage

SELECTED LNG REFERENCES

- Feasibility study, site selection analysis and concept definition for LNG import and re-gasification facilities, Finland
- Feasibility study, risk assessment and site selection for LNG import and re-gasification facilities, Estonia
- Detailed design and structural analysis of LNG tanks, China
- Snøhvit onshore LNG plant on Melkøya, Norway
- Engineering and construction consultancy for Borås gas filling station and LNG storage, Sweden
- BIMEC compliance and identification of technical, economic and political pros and cons of the Paldiski LNG project, compared to other LNG projects, Estonia
- Baltic energy market interconnection plan, Baltic Sea Region
- Feasibility study for LNG filling station infrastructure, Denmark
- Road map for LNG import facility, Lithuania
- Project execution review for LNG project, Poland
- LNG import terminal, Nynäshamn, Sweden

RAMBØLL

and Re-gasification Vessels) or in settings where, for example, the LNG is stored on 2nd hand vessels combined with onshore re-gasification facilities. This is also a robust concept to keep initial investments down.

Civil engineering

Ramboll is one of the largest companies in Europe within civil engineering, geophysical analysis, geotechnical engineering and foundation design and we hold vast experience in steel and concrete structures.

With a multidisciplinary approach, we handle all civil engineering aspects of an LNG project from planning, initial investigation, design and tender, to implementation, inspection and supervision.

Ports and marine engineering

Most LNG facilities will be placed in connection with jatties or existing port facilities. Ramboll is an independent and leading provider of professional expertise across the spectrum of port planning and engineering, coastal engineering and engineering of marine structures.

LNG storage tanks

Ramboll provides services within this specific field of engineering from preliminary design and FEED to detailed design of the pre-stressed concrete outer containment tanks for LNG storage. We carry out advanced analyses, civil design work and geotechnical design work, and we have experience with the relevant design codes and material requirements associated with LNG storage tanks.

Risk and safety

Safety is a key concern on all onshore and offshore installations. Management of risk and safety is an integral part of our LNG service portfolio as well as independent third party reviews of projects and installations.

Our LNG services

Ramboll offers engineering, market analyses and management services in different project roles to support all phases of LNG projects:

- Feasibility studies (incl. market analysis)
- Economic and financial studies
- Conceptual engineering and selection
- FEED (incl. specification of long lead items)
- Detailed design and procurement
- Construction and commissioning management
- Operations support
- Coordination with authorities
- Environmental impact assessments (EIA)
- Qualification of vendors and drafting of execution contracts
- Owner's representative during detailed design and construction

Contact

Per Jørgensen
Business Development Director
Ramboll Oil & Gas, Denmark
pej@ramboll.com

PICTURES
Front page: LNG terminal at Melkøya Norway. Picture courtesy Statoil

This page: LNG terminals and LNG carriers

Gasum

To whom it may concern

Finngulf LNG project - Services provided by Ramboll

Since 2008 Ramboll was working as a main consultant in close cooperation with Gasum in its strive to establish an LNG import terminal in Finland. The work was concluded late 2013.

Ramboll undertook a number of tasks in this respect:

- Investigation of suitable geographical locations along the south coast of Finland, including screening of environmental and land use planning issues
- Investigation of suitable state-of-the-art technologies to transfer and store LNG - both offshore and onshore
- Investigation of cryogenic pipelines for transport of LNG
- Site investigations of most relevant location options, including bathymetric offshore surveys, soils investigations and laboratory works
- Preparation of layouts for onshore and marine facilities
- Preparation of photo realistic visualisations of plant and facilities
- Preliminary design of LNG regasification facilities
- Preliminary risk analyses, incl. review of required safety distances
- Evaluation of marine fairways and navigational issues, a/o navigation in icy waters
- Evaluation of aspects r elated to land use planning
- Preparation of EIA programme for on- and offshore storage and regasification of LNG, including a staged development thereof and considering alternative geographical locations
- Participation in meetings with authorities and landowners, other stakeholders and vendors
- Preparation of development plans and time schedules
- Preparation of cost estimates for capital investments and operation
- Review of engineering tasks prepared by other consultants
- General project management assistance

Espoo, January 26th, 2015

Gasum Oy

/4<-.

Timo Kallio
Project Director

Gasum Oy
P.O.Box 21, (Miestentie 1)
FI-02151 Espoo
Finland

Tel +358 20 4471
Business ID 0969819-3
www.gasum.fi

Electronic invoicing address:
Gasum Oy
EDI code 003709698193
Operator 003714377140

Invoice:
Gasum Oy
EDI code 003709698193
P.O.Box 5392, FI- 70701 Kuopio
Finland

RAMBØLL

OIL & GAS

KLAIPEDA LNG - ROAD MAP

As preparation for the planning, design and construction of a LNG import facility in the port of Klaipeda, Ramboll established a road map describing the process and necessary steps.

The services included cost estimates and time estimates, including identification of critical paths for completion within the given time frame. In addition, different LNG import concepts (i.e. FRU, FSRU or onshore solution) and locations were identified, described and assessed. Finally, capacity considerations regarding the existing connecting gas grid and compliance with European regulation on security of supply was performed.

Value added for the customer
Ramboll assessed a number of previously prepared concept alternatives for import of LNG, reviewed the Klaipeda harbour location and vicinity, and derived a project proposal based on the use of floating storage and regasification of LNG. The work was concluded with the elaboration of a road map for its implementation.
The deliverables by Ramboll for used by the Client as basis for tendering the engineering of the terminal.

CUSTOMER
Klaipedos Nafta AB
LOCATION
Klaipeda
PROJECT COUNTRIES
Lithuania
PERIOD
2010-2011
SERVICES PROVIDED
Planning, cost and time estimates, location and technical assessment

IMAGE
Port of Klaipeda

252

RAMBØLL

OIL & GAS

GULFHAVN OIL TERMINAL LNG - TECHNICAL FEASIBILITY STUDY

The Inter Terminals business is one of the largest independent bulk liquid storage providers in northern Europe, and the largest in Scandinavia, with more than 4.25 million cubic metres of storage capacity (approximately 27 million barrels) located across sixteen terminals.

The terminals in Denmark and Sweden are located along the Baltic Sea and Danish Straits, a major petroleum trade route. The facilities function as a strategic storage and blending hub for the transhipment of petroleum products as well as an inland distribution hub for retail petroleum and petrochemical products.

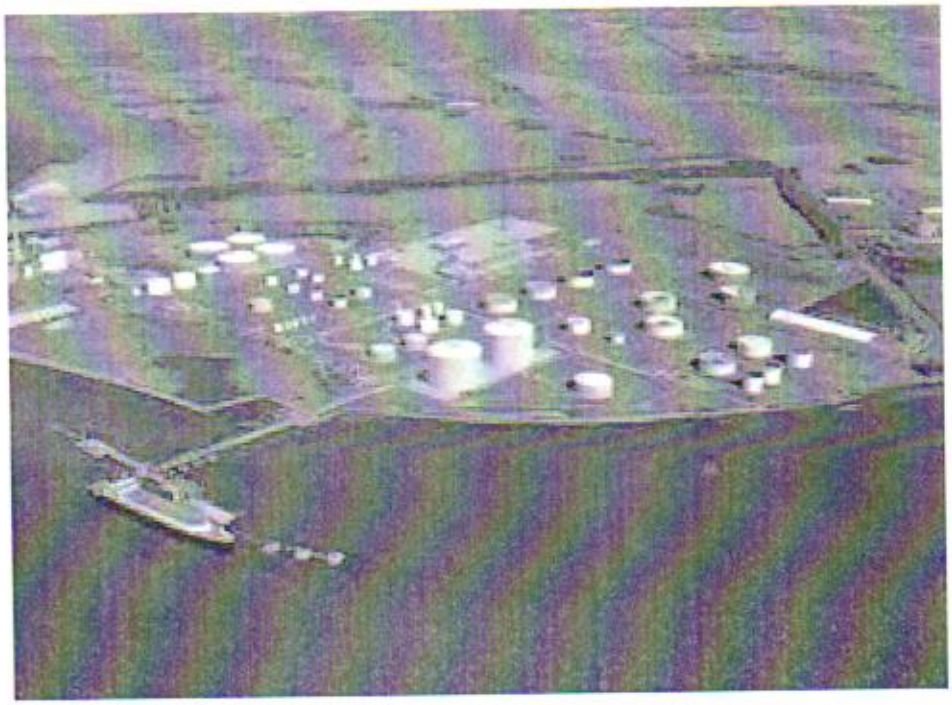
In Denmark, Inter Terminals operates deep draft coastal terminals at Asnæs, Ensted, Stigsnæs and Gulfhavn.

Inter Terminals' Gulfhavn Oil Terminal (GOT) is well located at the deep draft petroleum trade route at the shore of the Great Belt in Denmark.

Background

The MARPOL ('Marine Pollution') Convention of 1973 with later modified Protocol of 1978 "set limits on SOx and NOx emissions from ship exhausts and prohibit deliberate emissions of ozone-depleting substances." The Protocol came into effect in 2005 and a/o the Baltic Sea and the North Sea were identified as Sulphur Emission Control Areas

CUSTOMER
Inter Terminals SGOT ApS
LOCATION
Skælskør, Denmark
PERIOD
2014
SERVICES PROVIDED
Engineering: process, piping, mechanical, layout, E&IT, risk and environment and authorities.



(SECAs) or Emission Control Areas (ECAs) in which stricter controls for airborne emissions from ships were established.

To meet the requirement for an alternative fuel to heavy fuel oil for bunkering, a number of LNG terminals are now being planned and under construction in the Baltic Sea area. The terminals will likewise ensure security of the general gas supply and thus diversify sourcing of natural gas.

Ramboll was engaged to evaluate the technical feasibility of developing a:

i. Large scale LNG storage and regasification plant and an
ii. LNG bunkering terminal

at the Gulfhavn Oil Terminal in Denmark.

The study comprised development of technically feasible concepts for each of the terminals together with cost estimates and time frame for implementation of the concepts.

LNG Bunkering terminal
The LNG Bunkering terminal at GOT will receive LNG from smaller LNG bunker ships, and store it at the terminal's onshore LNG storage facilities. The LNG will be exported from the LNG terminal by either LNG road tankers or LNG export barges. The LNG Bunkering terminal will have a storage capacity of approximately 22,000 m^3 of LNG.

Large scale LNG storage and regasification terminal
The LNG regasification terminal at GOT will receive LNG by large LNG carriers and store it at the terminal in two large onshore LNG storage tanks. The LNG will then be regasified in vaporizers and exported to the Danish gas transmission net and to gas storage facilities. The study included a pipeline connection from the LNG terminal to the transmission net.

Ramboll's feasibility study
The technical aspects of both the LNG Bunkering and the large-scale LNG regasification terminal are assessed, including: process simulations for equipment sizing and heating/power requirements as a basis for the Mechanical Equipment List, as well as choice of regasification technology (for the large-scale terminal). This forms the technical basis for the cost estimate of the terminal.

In addition, the most feasible layout for each of the terminal concepts were proposed and illustrated with a 3D visualization of the terminals. The project included an overall evaluation of required marine facilities/structures and an environmental screening study.

Next steps
Inter terminals is, upon completion of the Technical Feasibility studies, proceeding with preparations for start of the Environmental Impact Assessment process for the LNG Bunkering terminal.

RAMBØLL

OIL & GAS

FINLAND - NEW LNG TERMINAL FOR GASUM PROJECT MANAGEMENT

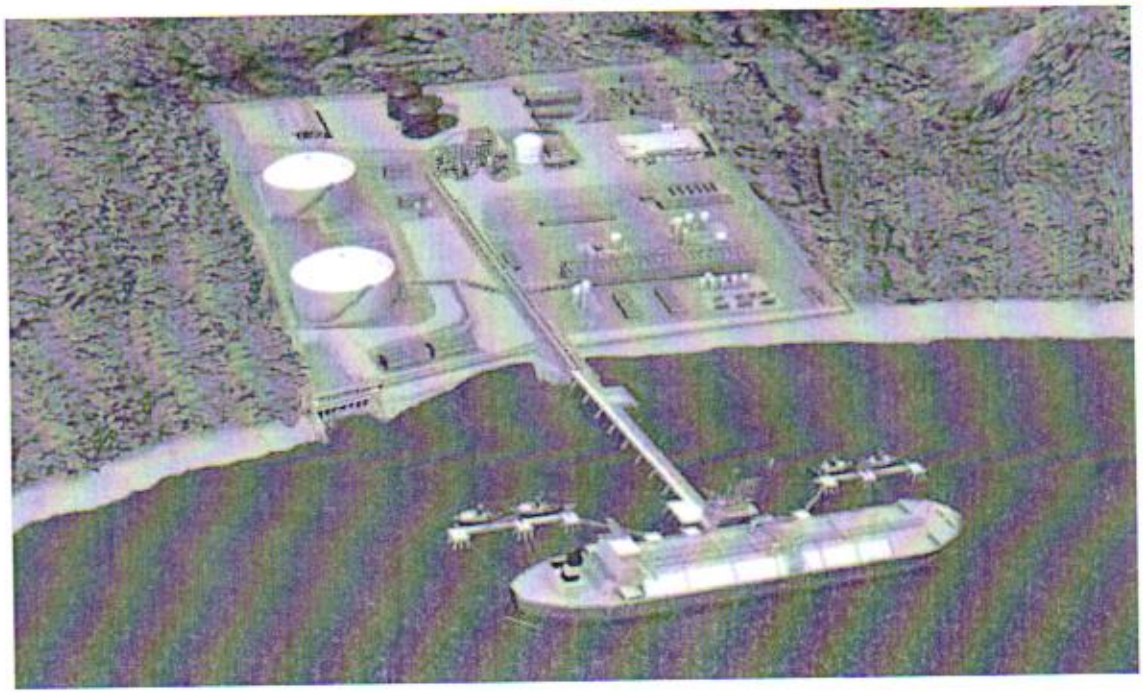
Land-use planning and preliminary environmental impact and risk assessment of LNG import terminal in Finland

Ramboll was selected as project management consultant to assist Gasum in developing an LNG import facility on the south coast of Finland. The initial key tasks were to develop a project plan and to focus on critical tasks for the project, a/o to arrange an amendment of the current land-use plan and to draft a programme for the environmental impact and risk assessment. Concurrently, Ramboll continued developing the concept for the LNG import terminal.

Value added for the customer
Ramboll's services were directed towards drafting a strategy and road map for the development of the Finnish LNG import terminal. Environmental and Social Impact Assessments were identified as being on the critical path, as well as further development of the project concept itself. These activities were put in action.

CUSTOMER
GASUM OY
LOCATION
Gulf of Finland
PROJECT COUNTRIES
Finland
PERIOD
2010-2011
SERVICES PROVIDED
Technical feasibility

IMAGE
Generic LNG import terminal



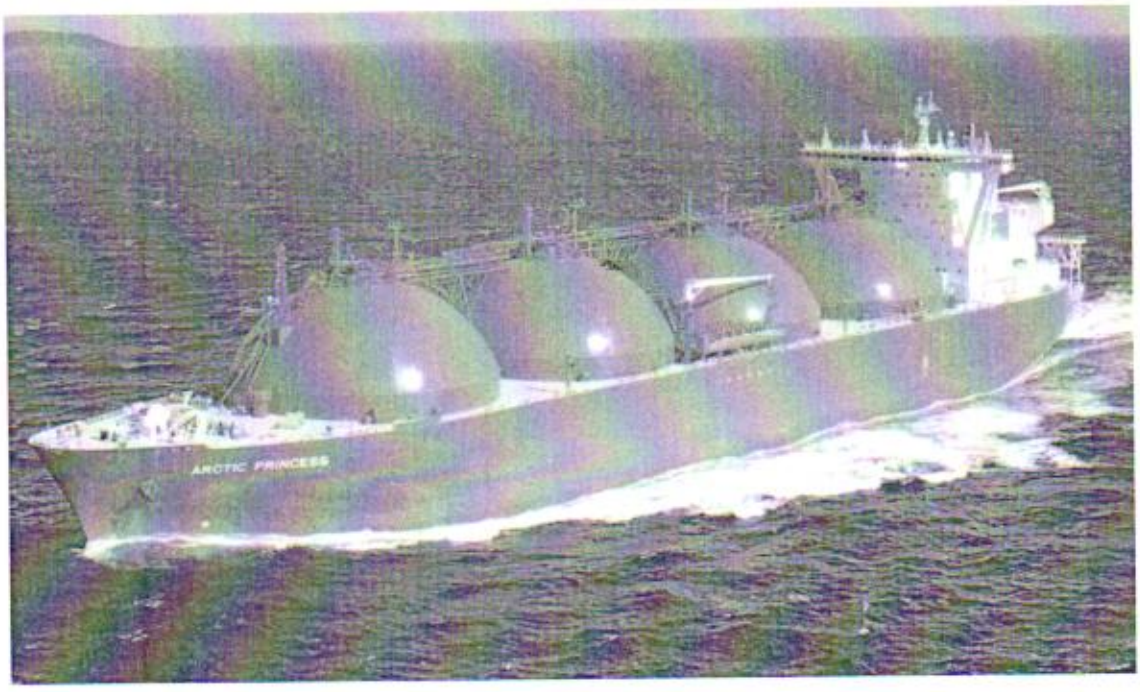
FINLAND - LNG IMPORT AND REGASIFICATION FACILITY FEASIBILITY STUDY

The project concerned a feasibility study to investigate the possibilities to construct an import and re-gasification plant in Finland.
The study involved investigation into novel onshore and offshore techniques for offloading and re-gasification of LNG with special consideration to navigating in the narrow Finnish archipelago and to the often cold climate.

Ramboll investigated a wide spectrum of technologies yielding a variety of output capacities, alternative solutions for storage of cryogenic LNG onshore or offshore, and possibilities for connecting onto the existing natural gas transmission system.

CUSTOMER
Gasum Oy
LOCATION
Finland
PROJECT COUNTRIES
Finland
PERIOD
2008-2009
SERVICES PROVIDED
Feasibility study - novel technical solutions or import of LNG

IMAGE
LNG tanker



RAMBØLL

OIL & GAS

GÄVLE LNG – CONCEPT STUDY

In Sweden, Swedegas owns and operates a gas network extending from Dragör in the south to Stenungsund in the north. Each year Swedegas supplies energy equivalent to about 15 TWh to distributors and directly connected customers. The gas grid services 33 municipalities, several power plants and industries using natural gas. Fleet owners and 34000 households are likewise users of natural gas.

Background

An LNG terminal outside Gävle would be strategically located in the centre of a number of major steel industries in the area north of Stockholm, bounded by Avesta in the south, in the west Falun and Sundsvall in the north. These industries consume a total of 2 TWh of oil and LPG in their processes annually. These industries would form the backbone of an LNG terminal in Gävle by converting their processes to utilize LNG as a fuel.

In addition, new strict emission standards on ships in the Baltic Sea opened up possibilities for the establishment of small scale LNG plants in a number of ports.

Ramboll carried out a baseline study to evaluate the technical feasibility of the development of a combined small-scale LNG storage and regasification plant and an LNG bunker terminal in Norrsundet outside Gävle in mid Sweden.

CUSTOMER

Swedegas
Jesper Engstrand
+46 31 43 93 56
jesper.engstrand@swedegas.se

LOCATION

Norrsundet, Sweden

PERIOD

2014 - (ongoing)

SERVICES PROVIDED

Engineering: Design (process, piping, mechanical and layout), Cost estimation, Risk evaluation and Authority Approvals.

The study involved the development of technically feasible concepts along with the cost and time frame for the development of terminal concepts.

LNG terminal
The LNG bunker terminal at Norrsundet would receive LNG by sea delivered by smaller LNG bunker vessels and towed LNG barges. The LNG would be stored at the site in anchored LNG barges and/or at the onshore facility in a cryogenic tank. LNG will be exported from the LNG terminal either by LNG tanker trucks or rail wagons, or it will be regasified and exported via the gas transmission grid. The terminal will have a storage capacity of approximately 14,000 m^3 of LNG (5,000 m^3 in the onshore LNG storage tank and 7800 m^3 in the anchored LNG barge).

Ramboll's feasibility study
The technical aspects of the LNG terminal were evaluated, including: process simulations for the design of equipment and heating / power requirements as the basis for the MEL (Mechanical Equipment List), as well as the choice of gasification technology. This formed the technical basis for estimation of cost of the terminal.

The project included a comprehensive evaluation of the necessary marine facilities and structures.

Furthermore, Ramboll carried out risk analyses (risk identification and consequence modelling) to optimize layout and design, as well as prepared a basis for initial contacts to regulatory authorities.

Ramboll concluded the work by recommending a most feasible concept and layout.

Next step
After the completion of the technical feasibility study, Swedegas continues with work on the EIA for the LNG terminal and by preparing for a regulatory approval.

RAMBØLL

OIL & GAS

LNG TERMINAL, NYNÄSHAMN

AGA Gas has established the first LNG plant in Sweden in Nynäshamn, the establishment is located at the northernmost part of the island Brunsviksholmen, outside the Nynäs refinery.

The plant receives vessels with LNG, which is transhipped to trucks. The Nynäs refinery uses gas for hydrogen production. Moreover, Gotland ferries operate on natural gas.

The project included building a 20000 m^3 LNG storage tank that is about 36 m in diameter and 29 m high, service facilities, a bridge between the mainland and Brunsviksholmen, and a new road from the Norvik Road to the bridge.

The road passes the Nynäs lagoon, which is behind an embankment bordering the sea.

CUSTOMER
AGA GAS AB

LOCATION
NYNÄSHAMN

PROJECT COUNTRIES
Sweden

PERIOD
2008-2011

SERVICES PROVIDED
Assistant project management, Site management, Qualification of office manager of pbl.

IMAGE
Nynäshamn LNG plant - Sweden

RAMBØLL

OIL & GAS

HIRTSHALS LNG – ENVIRONMENTAL APPROVALS

On the occasion of the new strict emission requirements that came into force in 2015 on emissions from ships in the Baltic Sea, the shipping company Fjord Line considered installation of the necessary treatment facilities for HFO, or using alternative fuels, in their fleet of vessels.

The EU and the environmental authorities of Denmark have pointed to the LNG as a possible alternative fuel.

Fjord Line decided to establish a small-scale LNG bunker terminal of approximately 500 m^3 to serve their two new passenger ferries sailing from the port of Hirtshals in Denmark to various destinations in Norway. These will be powered by LNG.

Regulatory Approvals
Ramboll assisted Fjord Line through the process of obtaining regulatory approvals and prepared an Environmental Impact Assessment including a safety report.

As part of the latter, a comprehensive risk analysis (impact modelling) was made to optimize the design, ensuring that the risks associated with the boarding of passenger ferries and terminal building would be acceptable.

Next step
Fjord Line has installed the LNG bunker terminal and has obtained final governmental approval. The company is now considering opportunities for bunkering of other vessels in cooperation with the port of Hirtshals.

CUSTOMER
Fjord Line Denmark A/S
Morten Larsen
+46 31 43 93 56
morten.larsen@fjordline.com

LOCATION
Hirtshals, Denmark

PERIOD
2012 - (ongoing)

PROJEC MANAGER
Claus Fischer Jensen

SERVICES PROVIDED
Engineering, Risk analyses, Environmental and Authorities Engineering.

260

RAMBOLL

OIL & GAS

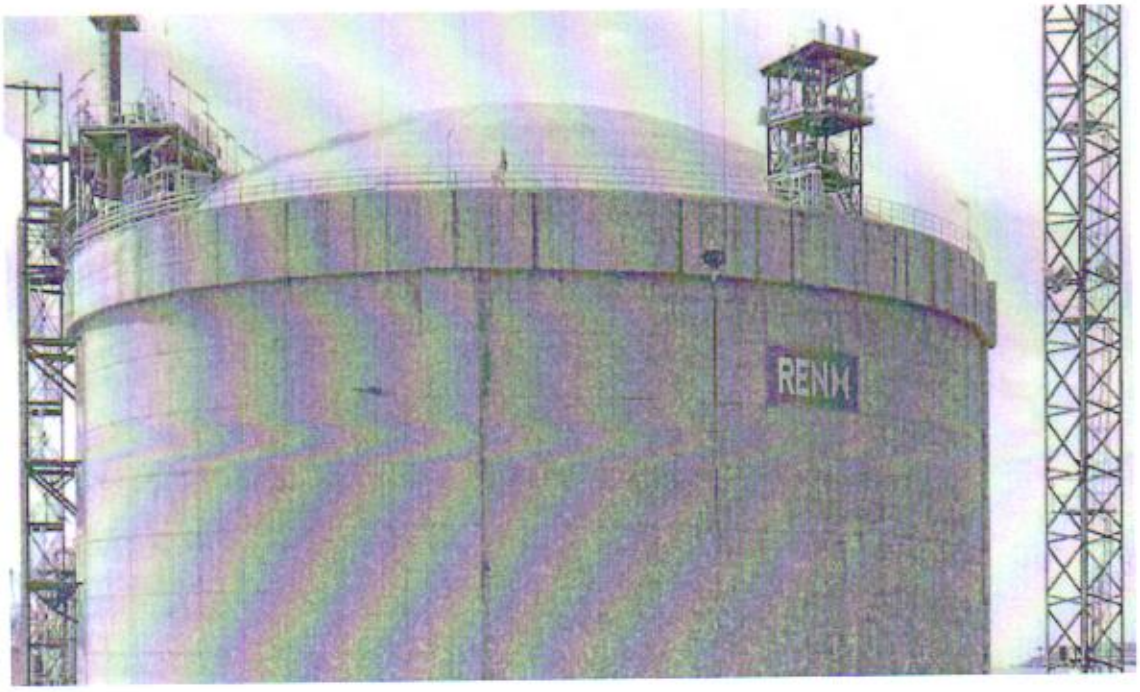
LNG TANK, PORTUGAL

As part of the upgrade to an existing LNG terminal in Portugal Gifford were appointed to carry out the detailed design the outer concrete containment for a new 150,000m^3 LNG tank. The work is being carried out in partnership with the tank designer Technodyne International Ltd.

The outer containment tank is constructed of pre-stressed concrete walls 0.75m thick sat atop a reinforced concrete foundation raft which is 1.50m thick for a 10m section around its periphery and 1.00m thick in its central section. This unusually thick raft is due to the 1 in 10,000 year Safe Shut Down Earthquake (SSE) that the tank had to be designed for. The tank is among the first in the world to be designed fully incorporating the requirements of the new Eurocodes. This included the requirement within the French EN14620 that the outer containment is designed to resist a major spill 'avec' an Operating Basis Earthquake (OBE). Under this case the outer containment has over 33 metres of -162oC LNG against it and then is subjected to a 30 second 1 in 500 year seismic event. This required materially non linear transient analysis of the outer containment to ensure that the tank not only survived but also remained liquid tight.

CUSTOMER
Technodyne International Ltd
LOCATION
Portugal
PROJECT COUNTRIES
Portugal
PERIOD
2008-2012
SERVICES PROVIDED
Power

IMAGE
LNG Tank in Portugal



RAMBØLL

OIL & GAS

POLSKIE LNG PROJECT
REVIEW OF PROJECT PROGRESS

Conducting a project review of the general state of an LNG project and its progress

During late 2011 Ramboll conducted a project review/audit of the Polskie LNG project with the intent to clarify an apparent lack of progress on the construction site in Świnoujście.

The project concept was developed by Canadian engineering company SNC-Lavalin Services. The works on the LNG project were carried out as an EPC-LSTK contract by a consortium under the leadership of Saipem s.p.a. in joint venture with Techint, PBG SA and PBG Export, and under the control of investor's supervisory consultant, WS Atkins - Polska Sp. z o.o.

The contract was signed mid-2010 and first shipment of LNG is scheduled for 2014. The construction work was experiencing serious lack of progress compared to the original plan, and Ramboll was authorised by the investor to identify reasons why and to recommend solutions to overcome these difficulties.

Value added for the customer
The audit report prepared by Ramboll will form a valuable input to the client in his attempt to streamlining the managerial procedures on the construction site in Świnoujście.

CUSTOMER
Ramboll Polska Sp. Z.o.o.

LOCATION
Świnoujście

PROJECT COUNTRIES
Poland

PERIOD
2011-2012

SERVICES PROVIDED
Project execution review/audit

IMAGE
1st. LNG storage tank under construction

RAMBØLL

OIL & GAS

RASGAS. UPGRADE OF LNG BERTH 2 FOR Q-FLEX

RasGas commissioned a Front End Engineering Design Study and a Detail Engineering Study to determine the modifications required to upgrade LNG Berth 2 at Port of Ras Laffan, Qatar so that berth facilities could accommodate Q-flex vessels with typical capacity of 217,000 m^3. Existing design capacity was vessels up to 135,000 m^3 capacity.

Primary object of concern was no modification to existing topside equipment on loading platform and no interruption of normal operation.

Ramboll performed this engineering study involving all ship-to-shore connections:

- Loading Arms
- Access Gangway
- Quick Release Hooks
- Fender
- Mooring Dolphins
- Breasting Dolphins

CUSTOMER
RasGas / Chiyoda Almana Engineering
LOCATION
Port of Ras Laffan, Qatar
PROJECT COUNTRY
Qatar
PERIOD
2011-2013
SERVICES PROVIDED
Project involved marine design for all structural elements and a review of equipment in cooperation with vendors.

IMAGE
LNG Berth 2 - Loading Platform and Breasting Dolphins

RAMBØLL

OIL & GAS

SKANGASS LNG BASE LOAD PLANT - RISAVIKA

Skangass LNG base load plant – Risavika

The energy and power company Lyse in Stavanger, Norway, together with an investment company Celsius Invest AS established the company Skangass AS to build and operate an LNG facility in Risavika in Sola Municipality.

Lyse Neon (formerly Lyse Gas) operates the pipeline network Rogass supplying the Stavanger region and North-Jæren with natural gas from the Kårstø LNG facility.

CUSTOMER
Lyse Infra AS

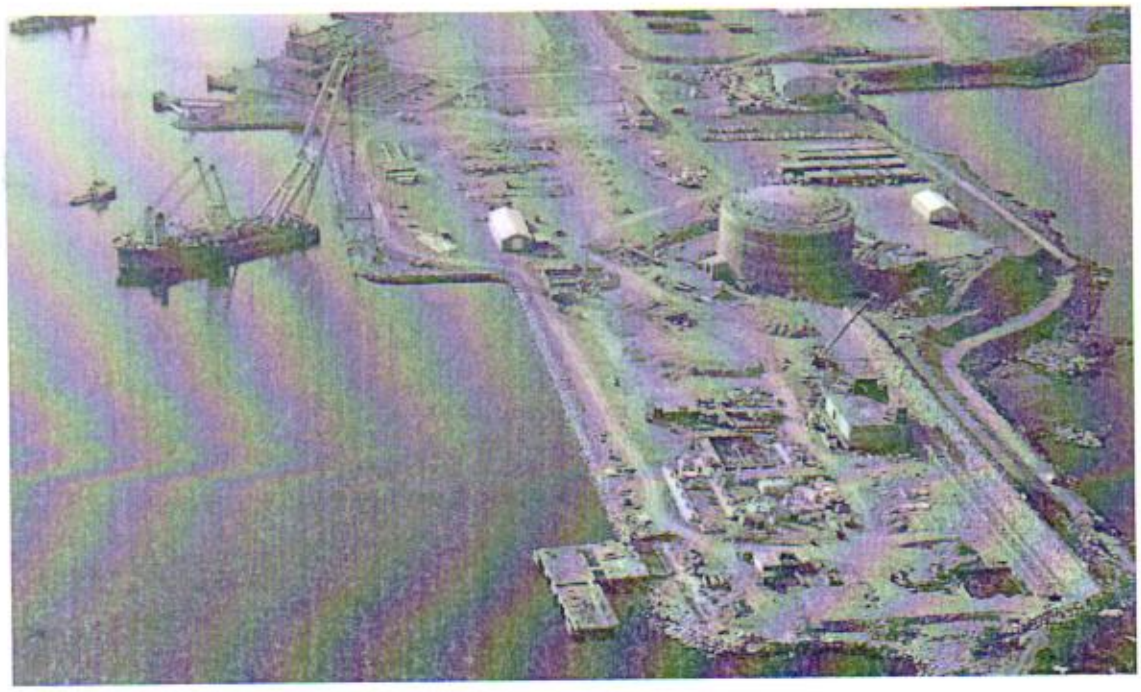
LOCATION
Sola Municipality

PROJECT COUNTRIES
Norway

PERIOD
2007-2010

SERVICES PROVIDED
Design coordination during the construction phase. Project Follow-up foundation and structural concrete work. Follow up on contractual matters.

IMAGE
Skangass LNG base load plant - Risavika



RAMBOLL

OIL & GAS

FULL CONTAINMENT LNG TANK DESIGN DAPENG, CHINA

Detailed design of a new 160,000m3 LNG storage tank for an existing terminal in China

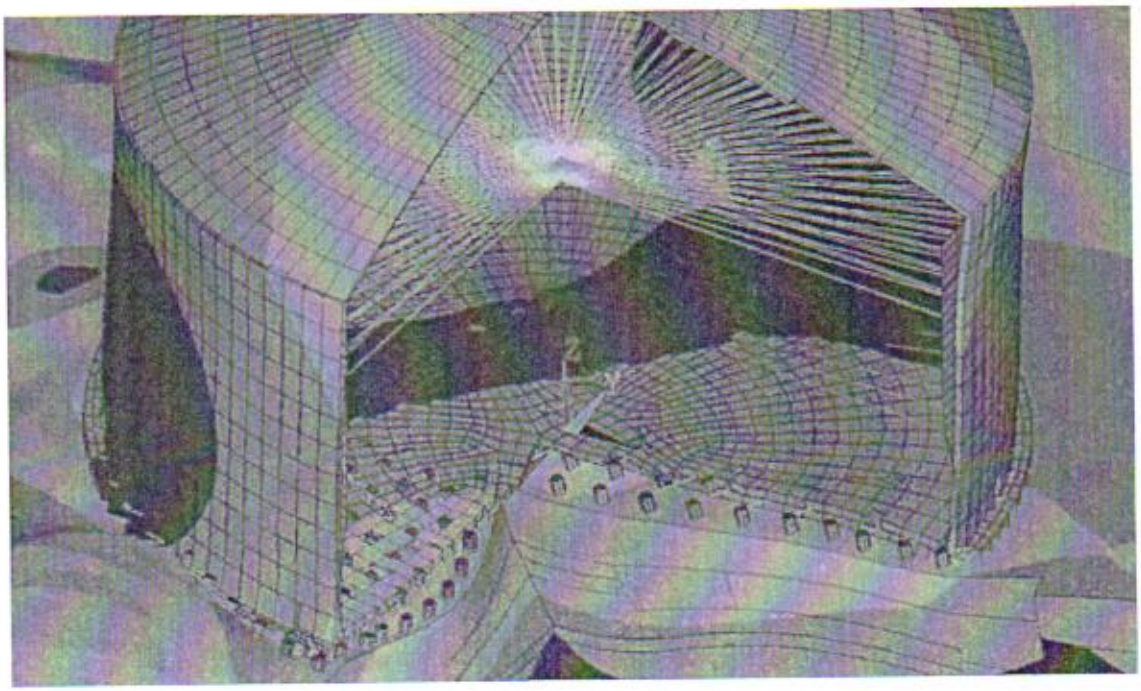
As part of the upgrade to an existing LNG receiving terminal in Dapeng, China, Ramboll were appointed to carry out the detailed design of the outer concrete containment for a new 160,000m^3 LNG tank. The work is being carried out in partnership with Technodyne International Ltd as part of a long term relationship delivering cryogenic storage projects in Europe and Asia.

Ramboll were involved in the early stages of the project providing geotechnical and structural support through the design and load testing of the foundations which are governed by seismic loading.

The tank is designed to the Eurocodes, including EN14620. This requires detailed engineering analysis of a number of severe accident scenarios, including a 1 in 10,000 year earthquake, Cold Spill, and Vapour Cloud Explosion. These requirements are in addition to the in service conditions, where the LNG is kept at a constant temperature of -165°C.
Work included geotechnical, structural, thermal and seismic analyses.

CUSTOMER
Technodyne International Limited
LOCATION
Dapeng
PROJECT COUNTRIES
China
PERIOD
2012-2013
SERVICES PROVIDED
Structural engineering, geotechnical design, seismic analysis, site support.

IMAGE
Computational Analysis



RAMBOLL

OIL & GAS

ADDITIONAL FUNCTIONALITIES AT LNG TERMINAL IN POLAND

Polskie LNG inquired companies about the possibility of expanding the LNG terminal's functionality

Polskie LNG intended to analyse possible additional functionalities of the new Polish LNG import facility which they could offer to its future clients.

For this reason a special study was commissioned to PwC with Ramboll as technical advisor to provide answers to key questions about the directions for development of the infrastructure constructed in Świnoujście.

This study and its conclusions will provide a sound basis on which to facilitate the decision-making process regarding a possible expansion of the terminal's functionality.

CUSTOMER
PWC Poland

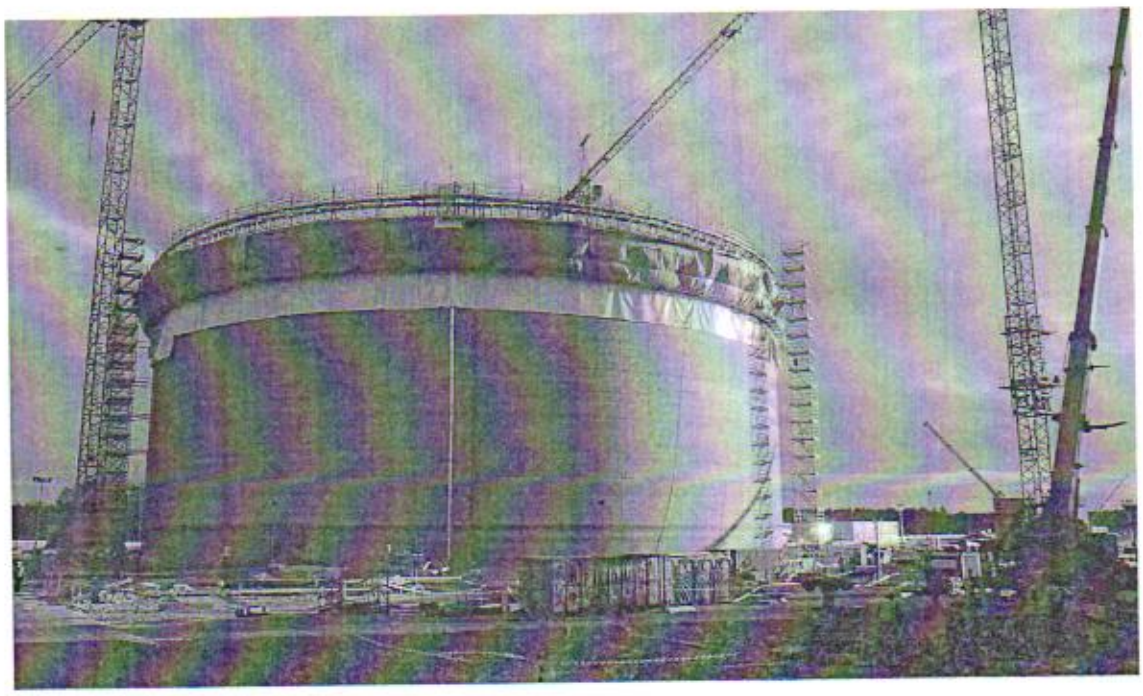
LOCATION
Świnoujście

PROJECT COUNTRIES
Poland

PERIOD
2012

SERVICES PROVIDED
Technical support

IMAGE
Construction of one of two 160,000 m3 LNG storage tanks



RAMBOLL

OIL & GAS

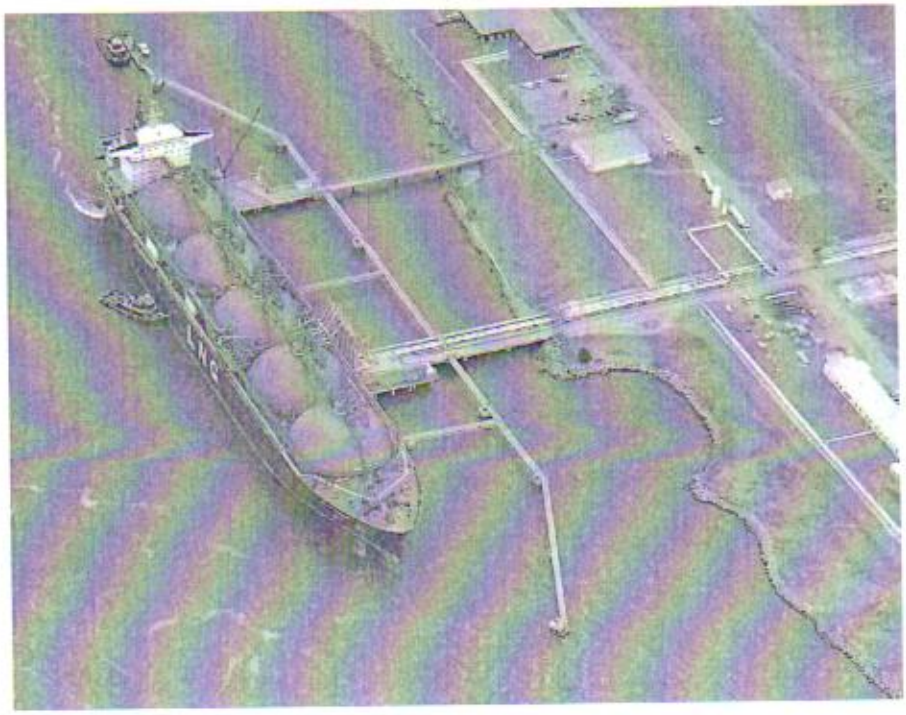
FEASIBILITY STUDY AND COST-BENEFIT ANALYSIS OF LNG

Feasibility study and cost-benefit analysis of LNG bunkering infrastructure construction in the harbours of port of tallinn.

Ramboll conducted a study wherein the feasibility of the construction of an LNG import terminal in Tallinn was investigated. The study included analysis of the potential bunkering demand for Tallinn harbor, the potential supply sources, the cost and the resulting financial feasibility of the terminal. The implications of the facility on security of supply in the Estonian and larger regional service area were also assessed.

Services provided
Evaluation of the feasibility of an LNG re-gasification plant in Muuga Harbour, Tallinn. Conceptualisation of LNG terminal, cost estimations and market and financial analysis for terminal operations providing security of supply to Estonian and Finnish markets and allowing for commercial uses of LNG including use as a bunker fuel.

CUSTOMER
Elering AS
LOCATION
Tallinn
PROJECT COUNTRIES
Estonia
PERIOD
2012



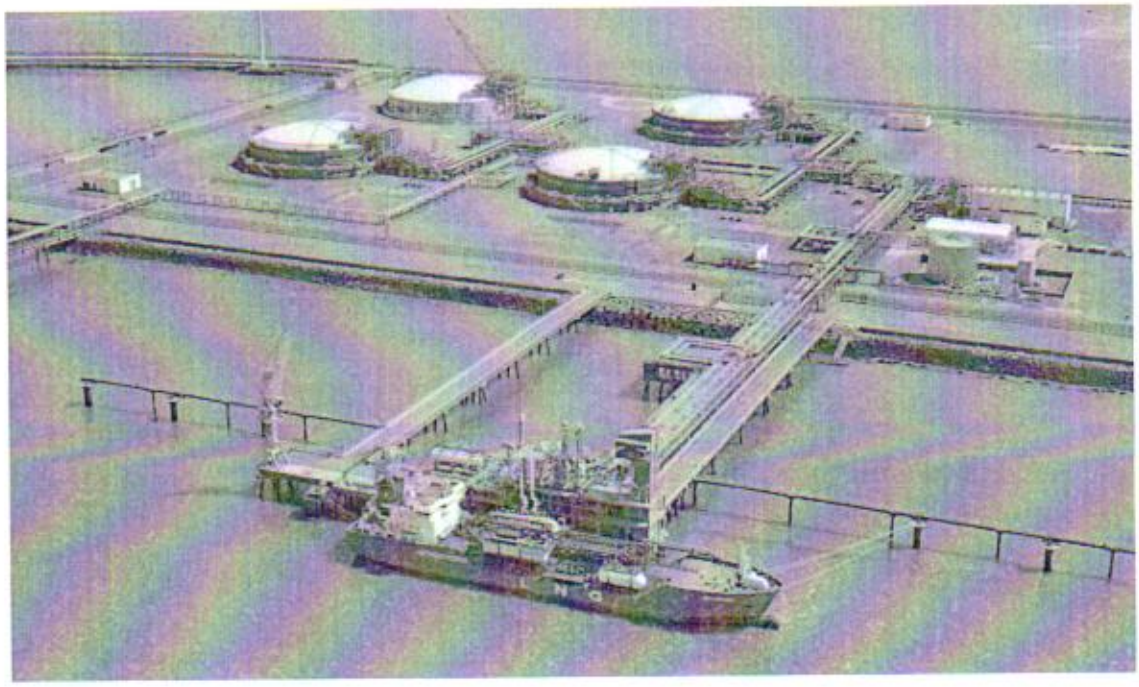
FEASIBILITY STUDY FOR AN LNG FILLING STATION INFRASTRUCTURE

The aim of the project was to set up recommendations on the establishment of a marine LNG infrastructure in Denmark and its implications on regulation, security of supply, grid operations etc.
The future emission constraints for the shipping industry provide incentives for adopting LNG in the shipping industry. Energinet.dk had been approached by many possible value chain participants regarding their potential involvement in setting up an infrastructure for the industry. The project addressed two main questions: 1. Who are the actors in the value chain and what is their future involvement in this sector? 2. What is the role of Energinet.dk and what arguments exist for their involvement?

Value added for the customer
In depth knowledge of the value chain, clarifications of possible involvement in the industry

CUSTOMER
Energinet.dk
LOCATION
Copenhagen Denmark
PROJECT COUNTRIES
Denmark
PERIOD
2011-2012
SERVICES PROVIDED
Value chain analysis, commercial drivers, pros & cons of public sector involvement

IMAGE
Coral Methane loading at Zeebrügge LNG terminal



RAMBØLL

OIL & GAS

ESTONIA - ONSHORE LNG IMPORT TERMINAL PRE-FEASIBILITY STUDY

Preparing basis for security of national gas supply

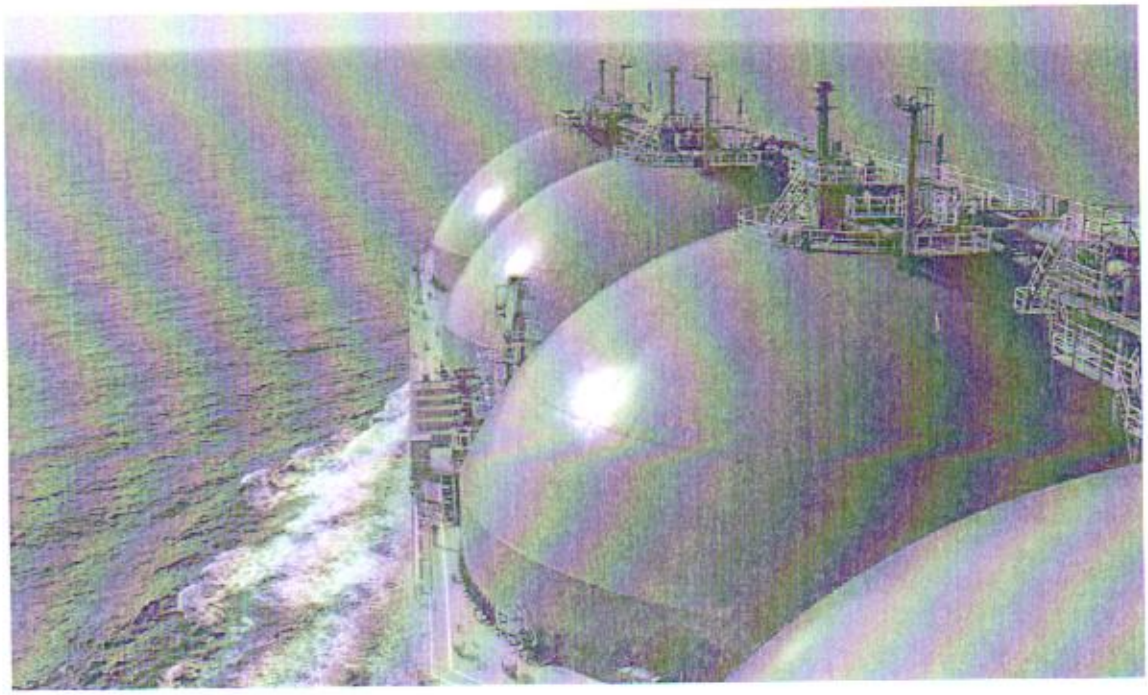
The project concerned a pre-feasibility study for a proposed new LNG terminal for LNG Estonia Ltd. LNG Estonia is a new player on the Baltic gas market, owned by the Port of Tallinn and private investors. The LNG import facility is meant to provide security of natural gas supply to Estonia, but is also intended to become an important actor on the liberalised gas market in the region, including Finland and Latvia. The study was an extension of a preceding site investigation study, which was also conducted by Ramboll. Ramboll's study gives a general market overview as well as suggests a location for the plant on Muuga harbor (Tallinn) - possibly extending into the sea.

The study comprises:

- Techno-economical pre-feasibility study
- Preliminary process and layout study
- Preliminary environmental screening
- Preliminary risk assessment study

CUSTOMER
Ramboll Eesti AS
LOCATION
Tallinn
PROJECT COUNTRY
Estonia
PERIOD
2008
SERVICES PROVIDED
Feasibility study

IMAGE
LNG tanker



Ramboll – Selected references on LNG projects

Ramboll has been active in providing knowhow on design of LNG facilities in the Baltic Sea Region and in particular the Gulf of Finland since 2004. Ramboll has been involved in assessments of the overall demand and supply of natural gas to the Nordic countries - including evaluation of the need to augment import of piped natural gas with import of LNG to the region.
More specifically, over the last decade Ramboll provided a continued expert assistance to developers of LNG import and regasification terminals in primarily Finland, Estonia, Lithuania and Sweden.

Ramboll has been heavily engaged in developing concepts for Gasum on large-scale LNG import and regasification terminals along the southern Finnish coast, concentrated around the harbours of Inkoo and Tolkkinen. A description of Ramboll's services for this client is presented in Annex 1.

In Lithuania, Ramboll assisted a client in the planning, design and construction of a LNG import facility in the port of Klaipeda. Terminal construction should follow a compressed schedule and hence Ramboll recommended the Floating Storage and Regasification Unit (FSRU) concept. Ramboll subsequently established a road map describing the process and necessary steps to take for rapid implementation of the terminal. CAPEX/OPEX estimates were prepared and identification of critical schedule path for completion was provided.
The terminal was located in the river mouth of the busy Klaipeda Port, wherefore navigational, geotechnical and risk issues played a major role and was analysed in depth.

A variety of selected references is given in the following.

GULFHAVN OIL TERMINAL LNG - TECHNICAL FEASIBILITY STUDY

Customer: Inter Terminals SGOT ApS
Location: Denmark
Period: 2014
Overall project value: Confidential
The technical aspects of both a LNG Bunkering and a large-scale LNG regasification terminal were assessed, including: process simulations for equipment sizing and heating/power requirements as a basis for the Mechanical Equipment List, as well as choice of regasification technology (for the large-scale terminal). This was the technical basis for the cost estimate for the terminal.

In addition, the most feasible layout for each of the terminal concepts were prepared and illustrated with a 3D visualization of the terminals.
The project included an overall evaluation of required marine facilities/structures and an environmental screening study.

GÄVLE LNG – CONCEPT STUDY

Customer: Swedegas
Location: Sweden
Period: 2014
Overall project value: Confidential
The technical aspects of a small to medium sized LNG terminal were evaluated, including: process simulations for the design of equipment and heating / power requirements as the basis for the MEL (Mechanical Equipment List), as well as the choice of gasification technology. This formed the technical basis for estimation of cost of the terminal.

The project included a comprehensive evaluation of the necessary marine facilities and structures.

Furthermore, Ramboll carried out risk analyses (risk identification and consequence modelling) to optimize layout and design, as well as prepared a basis for initial contacts to regulatory authorities.

Ramboll concluded the work by recommending a most feasible concept and layout.

LIQUEFIED NATURAL GAS (LNG) TANK, DAPENG, CHINA

Customer: Technodyne International Limited
Location: Dapeng
Period: 2012-2013
As part of the upgrade to an existing LNG receiving terminal in Dapeng, China, Ramboll were appointed to carry out the detailed design of the outer concrete containment for a new 160,000m^3 LNG tank. The work is being carried out in partnership with Technodyne International Ltd as part of a long term relationship delivering cryogenic storage projects in Europe and Asia.

HIRTSHALS LNG – ENVIRONMENTAL APPROVALS

Customer: Fjord Line Denmark A/S
Location: Denmark
Period: 2012
Overall project value: Confidential
Ramboll assisted Fjord Line through the process of obtaining regulatory approvals and prepared an Environmental Impact Assessment including a safety report.

As part of the latter, a comprehensive risk analysis (impact modelling) was made to optimize the design, ensuring that the risks associated with the boarding of passenger ferries and terminal building would be acceptable.

FINNGULF: LNG PROJECT MANAGEMENT CONSULTANCY AND EIA

Customer: Gasum Oy
Location: Finland
Period: 2012
Overall project value: 370.000 EUR
Ramboll was selected a Project Management Consultant for concept development of LNG import terminals at two discrete locations east and west of Helsinki. Ramboll had to consider a phased development of the facilities from a small-scale terminal for marine bunker fuel, over a floating storage and regasification solution, to a large-scale receiving terminal storing some 500,000 m^3 LNG.

Ramboll provided all technical input to the consultants elaborating the environmental impact assessment (EIA) and facilitated the Client in meeting various authorities and stake holders.

NORTH SEA LNG SUPPLY INFRASTRUCTURE

Customer: Esbjerg Harbour
Location: Denmark
Period: 2012
Overall project value: 18.000 EUR
Establishment of an LNG supply chain in the North Sea to service maritime sector and other sectors within transport.

FEASIBILITY STUDY AND COST-BENEFIT ANALYSIS OF LNG

Customer: Elering AS
Location: Estonia
Period: 2012
Overall project value: Confidential
Evaluation of the feasibility of an LNG re-gasification plant in Muuga Harbour, Tallinn. Conceptualisation of LNG terminal, cost estimations and market and financial analysis for terminal operations providing security of supply to Estonian and Finnish markets and allowing for commercial uses of LNG including use as a bunker fuel.

RASGAS, UPGRADE OF LNG BERTHS 1 AND 2 FOR Q-FLEX

Customer: Port of Ras Laffan
Location: Qatar
Period: 2009-2012
Overall project value: 200.000 EUR
RasGas commissioned a Front End Engineering Design Study and a Detail Engineering Study to determine the modifications required to upgrade LNG Berth 2 at Port of Ras Laffan, Qatar so that berth facilities could accommodate Q-flex vessels with typical capacity of 217,000 m^3. Existing design capacity was vessels up to 135,000 m^3 capacity.

Primary object of concern was no modification to existing topside equipment on loading platform and no interruption of normal operation.

Ramboll performed this engineering study involving all ship-to-shore connections:
- Loading Arms
- Access Gangway
- Quick Release Hooks
- Fender
- Mooring Dolphins
- Breasting Dolphins

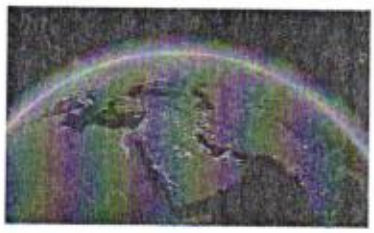
STUDY ON INTRODUCING NATURAL GAS AS FUEL IN THE DANISH SHIPPING SECTOR

Customer: Danish Environmental Protection Agency
Location: Denmark
Period: 2011-2012
Overall project value: 36.000 EUR
The study looked into the possibilities, environmental benefits and economic viability of introducing LNG or CNG as fuel in the Danish shipping industry. Ramboll contributed to the final report with chapters on synergies with land transportation and operational consequences for the shipping industry. Furthermore, Ramboll Oil & Gas served as the study's gas expert and delivered input to other chapters (e.g. inputs on risk and processing of LNG and CNG facilities).

FEASIBILITY STUDY FOR AN LNG FILLING STATION INFRASTRUCTURE

Customer: Energinet.dk
Location: Copenhagen Denmark
Period: 2011-2012
Project budget: 37.000 EUR
The aim of the project was to set up recommendations on the establishment of a marine LNG infrastructure in Denmark and its implications on regulation, security of supply, grid operations etc.

FEASIBILITY STUDY OF THE ELECTRICAL INTERCONNECTION AND ENERGY TRADE BETWEEN THE ARAB COUNTRIES



Customer: The Arab Fund for Economic and Social Development (AFESD)
Location: Copenhagen Denmark
Period: 2012
Project budget: 225.000 EUR
The Arab league of Countries has sought the assistance of AFESD to carry out a feasibility study with the goal of determining the possibility of energy trade among the Arab countries. The main objectives and scope of this study address the outlining of a strategy and master plan to develop the trade of energy among Arab Countries – focussing on prices of LNG, cost and supply of natural gas - determining the trade-offs between export of electricity and/or natural gas.
The work is carried out in cooperation with CESI of Italy.

INDUSTRY PARK OF SWEDEN, FEASIBILITY STUDY, PROJECT HELGA

Customer: INDUSTRY PARK OF SWEDEN
Location: Helsingborg
Period: 2011-2012
Project budget: 45.000 EUR
Feasibility study of project HELGA, an LNG-terminal nearby Helsingborg. Study of the procurement costs of the LNG terminal and expected demand for LNG from the maritime sector at the port. Market assessment on the basis of ship traffic, type and routing.

POLAND – ADDITIONAL FUNCTIONALITIES AT LNG TERMINAL

Customer: Polskie LNG
Location: Świnoujście, Poland
Period: 2011
Overall project value: 120.000 EUR
Polskie LNG intended to analyse possible additional functionalities the new Polish LNG import facility that they could offer to its future clients. For this reason a special study was commissioned to PwC with Ramboll as technical advisor to provide answers to key questions about the directions for development of the infrastructure constructed in Świnoujście. This elaboration along with its conclusions will provide reliable information to facilitate the decision-making process regarding the possible expansion of the terminal's functionality.

ESTONIA – TALLINN LNG TERMINAL PRE-FEASIBILITY STUDY

Customer: Elering (Estonian TSO); Vopak; Port of Tallinn
Location: Tallinn, Estonia
Period: 2012
Overall project value: 75.000 EUR
Evaluation of feasibility of an LNG re-gasification plant in Muuga Harbour, Tallinn. Conceptualisation of LNG terminal, cost estimations and market and financial analysis for terminal operations providing security of supply to Estonian and Finnish markets and allowing for commercial uses of LNG including use as a bunker fuel.

POLAND – POLISH LNG IMPORT TERMINAL. PROJECT REVIEW PROGRESS

Customer: Polskie LNG
Location: Świnoujście, Poland
Period: 2011
Overall project value: 30.000 EUR
During late 2011 Ramboll conducted a project review/audit of the Polskie LNG project with the intent to clarify an apparent lack of progress on the construction site in Swinoujscie.

The contract was signed mid 2010 and first shipment of LNG is scheduled for 2014. The construction work was experiencing serious lack of progress compared to the original plan and Ramboll was authorized by the investor to identify reasons why and to recommend solutions to overcome these difficulties.

FINLAND - NEW LNG TERMINAL FOR GASUM. PROJECT MANAGEMENT

Customer: GASUM OY
Location: Gulf of Finland
Period: 2010-2011
Project budget: 470.000 EUR
Ramboll was selected as project management consultant to assist Gasum in developing an LNG import facility on the south coast of Finland. The initial key tasks were to develop a project plan and to focus on critical tasks for the project, a/o to arrange an amendment of the current land-use plan and to draft a programme for the environmental impact and risk assessment. Concurrently, Ramboll continued developing the concept for the LNG import terminal.

SWEDEN – FYRISLUND CNG/LNG FUELLING BUS DEPOT

Customer: Polskie LNG
Location: Fyrislund, Sweden
Period: 2010
Overall project value: Confidential
Liquefied Natural Gas (LNG) or Liquefied Biogas (LGB) will be supplied to the plant and either used directly by LNG/LBG buses or vaporised and compressed to a minimum of 230 bar (g) and used to fuel CNG/CBG buses. Refuelling shall take place from four fast fill LNG dispensers, 80 slow fill CNG dispensers and one CNG fast fill dispenser, at any time of the day.
Ramboll has developed the specification for this refuelling plant from which tender documents were produced and submissions evaluated. Ramboll will remain involved for the testing, commissioning and handover phases in a co-ordination and project management capacity, working with ProcessKontroll and Cryo for the delivery of the project.

FINLAND - NEW FINNGULF LNG TERMINALS. PROJECT MANAGEMENT

Customer: GASUM OY
Location: Finland
Period: 2011
Project budget: 800.000 EUR
Ramboll was awarded a contract by Gasum Oy, Finland, for provision of project management services in connection with their plans for construction of a terminal on the south coast of Finland for import of liquid natural gas (LNG).

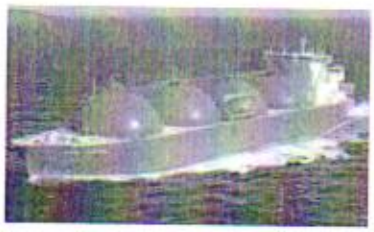
KLAIPEDA LNG - ROAD MAP

Customer: Klaipedos Nafta AB
Location: Klaipeda
Period: 2010-2011
Project budget: 58.000 EUR
As preparation for the planning, design and construction of a LNG import facility in the port of Klaipeda, Ramboll established a road map describing the process and necessary steps. Cost and time estimates, including identification of critical paths for completion were provided, along with identification, description and assessment of LNG import concepts and locations. Finally, capacity considerations regarding the existing connecting gas grid and compliance with European regulation on security of supply was performed.

NYNAS REFINERY NATURAL GAS SYSTEM

Customer: Nynas AB
Location: Nynäshamn, Sweden
Period: 2008-2010
Overall project value: Confidential
The customer Nynas AB has signed an agreement with AGA for the supply of natural gas from their LNG terminal to the Nynas refinery. The gas shall be used as a feedstock in two hydrogen plants where naphtha was used previously. The agreement also includes the supply of steam from Nynas AB for the evaporation of LNG. Ramboll is responsible for the design of the steam and natural gas pipelines.

FINLAND - LNG IMPORT AND REGASIFICATION FACILITY. FEASIBILITY STUDY



Customer: Gasum Oy
Location: Finland
Period: 2008-2009
Overall project value: 100.000 EUR
The project concerned a feasibility study to investigate the possibilities to construct an import and re-gasification plant in Finland. The study involved investigation into novel onshore and offshore techniques for offloading and re-gasification of LNG with special consideration to navigating in the narrow Finnish archipelago and to the often cold climate.
Ramboll investigated a wide spectrum of technologies yielding a variety of output capacities.

ESTONIA - ONSHORE LNG IMPORT TERMINAL PRE-FEASIBILITY STUDY

Customer: Ramboll Eesti AS
Location: Tallinn, Estonia
Period: 2008
Overall project value: 110.000 EUR
The project concerned a pre-feasibility study for a proposed new LNG terminal for LNG Estonia Ltd. LNG Estonia is a new player on the Baltic gas market, owned by the Port of Tallinn and private investors. The LNG import facility is meant to provide security of natural gas supply to Estonia, but is also intended to become an important actor on the liberalised gas market in the region, including Finland and Latvia. The study was an extension of a preceding site investigation study, which was also conducted by Ramboll.

SKANGASS LNG BASE LOAD PLANT - RISAVIKA

Customer: Lyse Infra AS
Location: Sola, Norway
Period: 2007-2010
Overall project value: Confidential
The Energy company Lyse in Stavanger has together with the investment company Celcius Invest AS established Skangass AS to construct and operate an LNG production facility in Sola, Norway. Ramboll provided assistance with project coordination during the construction phase as well as with follow-up on project contractual issues.

BORÅS GAS FILLING STATION & LNG STORAGE

Customer: Borås Energi & Miljö AB
Location: Borås
Period: 2007-2008
Overall project value: Confidential
Borås Energi and Miljö appointed Ramboll to act as their consultant in connection with the engineering and construction of a new biomethane vehicle filling station in Borås with an LNG storage plant as a backup system for the biomethane vehicle fuelling.

BALTIC ENERGY MARKET INTERCONNECTION PLAN (BEMIP)

Customer: European Commission
Location: Baltic sea region
Period: 2009
Overall project value: 59.000 EUR
The BEMIP is one of the six priority areas identified by the EU Commission in the Second Strategic Energy Review as published in November of 2008.
The BEMIP report analyses and evaluates natural gas infrastructure projects around the Baltic Sea in terms of evaluating the impact on market development and security of supply. The report makes recommendations on how to address the two major challenges of the region: energy market integration and the depletion of gas reserves in the North Sea.
Import of LNG played a major role in the evaluations made.

ADIATRIC LNG TERMINAL - TOPSIDES QUOTATION PROJECT

Customer: Initec S.A.
Location: Spain
Period: 2005
Overall project value: Confidential
The Adriatic LNG Terminal in Italia is the first ever offshore Gravity Based Structure (GBS) for unloading, storing and regasifying Liquefied Natural Gas (LNG).

Overall, the offshore Terminal is designed around a large concrete structure, which houses two LNG tanks, and includes a regasification plant and facilities for mooring and unloading LNG vessels. Ramboll's scope of service included supporting the client in the bidding phase for the terminals topsides modules on the basis of developed FEED documents.

Customer: Gasum Oy
Location: Espoo
Period: 2004-2007
Project budget: 2.500.000 EUR
Ramboll was appointed technical project management consultant and engineering consultant for the Balticconnector offshore pipeline project. The project comprised of a 100-150 km offshore pipeline linking the gas networks of Finland and Estonia. The work involved system layout and flow analyses of the offshore pipeline and connecting networks, as well as landfall evaluations and installation design.
Import of LNG to either of the countries was seen as a vital prerequisite for connecting the gas grids on either side of the Finnish Gulf.

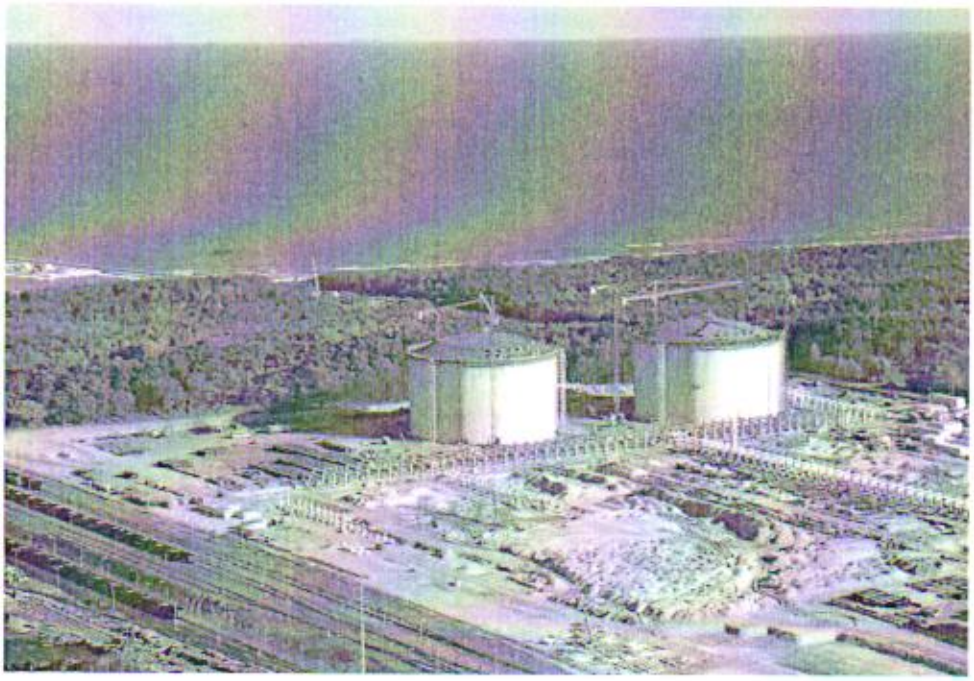
SAFETY CASE FOR ADGAS LNG PLANT

Customer: ADGAS
Location: United Arab Emirates
Period: 2004
Project budget: 45.000 EUR
The Safety Case covers description of the process facilities and safety systems, review and performance audit of the HSE management system, equipment integrity audit, HAZID, generic HAZOP, quantitative risk assessment, evacuation, escape and rescue analysis, temporary safe refuge analysis, and emergency response analysis. Conclusions from the studies in the Safety Case resulted in a formal justification for continued operation of the facilities. The software delivered with the Safety Case may serve as a framework for risk tracking, and as basis for risk evaluations in specific cases.

RAMBØLL

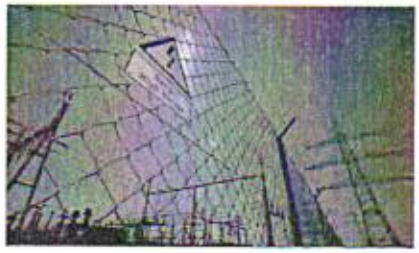
ENERGY AND POWER TRANSMISSION

Offshore wind, waste-to-energy, major power plants and district heating



RAMBØLL

Ramboll's approach



At Ramboll we acknowledge that the development of the energy sector requires a holistic approach in order to provide long-term solutions for the coming generations. We focus on providing solutions that can uphold the quality of supply throughout their entire lifetime.

For Ramboll, the technical solutions are only part of the delivery. It is clear that any project on the global market is characterised by increasing project complexity, demand for flexible solutions, greater focus on stakeholder involvement and decreasing cost (CAPEX & OPEX).

Ramboll's consulting expertise

Ramboll can offer engineering consultancy services ranging from design of HV equipment and substation automation all the way to offshore platform design and onshore constructions including civil works.

Furthermore, Ramboll offers consultancy services for engineering and design of HV overhead lines. We provide solutions for mast design and predesign covering geotechnical and topographical investigations and cables.

Consultancy services

Ramboll's power transmission services focus on four disciplines, which all supplement each other:

- Offshore substations
- Onshore substations
- Overhead lines
- HV cables

For every one of these segments, Ramboll has the competencies to provide consultancy services covering all engineering aspects.

As a preferred solution provider, Ramboll is accustomed to working as the Owner's Engineer at EPC level. In general, our services include:

- Technical, environmental and financial analysis and recommendations needed to support the investment decision
- Project management
- Conceptual design and layout
- Life time extension evaluation
- Management of the tendering and procurement process
- Contract management
- Supervision during construction and commissioning
- Operation and maintenance advisory services
- Project follow-up after delivery of the facility

Our competent power transmission team provide consulting services covering the entire project cycle from outline design to post construction in relation to both refurbishments and green-field power transmission projects.

RAMBOLL

RAMBOLL POLSKA

Ramboll Polska is an engineering consultancy company specializing in energy projects, with annual sales exceeding 3 million USD. The company has been operating in Poland since 1990 (earlier as Elsamprojekt Polska) and has participated in a number of projects implemented in Polish energy sector. The company is based in Warsaw. We currently employ over 30 consultant engineers, most of whom are highly qualified specialists with huge experience in all engineering disciplines, enabling Ramboll to perform engineering and consultancy services for power plants and cogeneration plants. After Ramboll global organisation took over ENVIRON, leading America consultancy in environment, the total number of Ramboll specialists in Poland exceeded 50 persons.

Beside the knowledge and experience of the Polish specialist from our office, in our work we use the knowledge and experience of engineers from our mother company. Ramboll has a large team of consultants in energy and engineering with broad international experience gained through designing, supervision over construction and providing operational support for over 90 large power plants throughout the world. Ramboll's offer includes maintenance and optimisation of existing thermal power plants by implementing new technologies, increasing efficiency and reducing noxious emissions , as well as designing new high-efficiency power plant based on high steam parameters and cogeneration of heat and power.

As an engineering company Ramboll Polska is fully independent of any suppliers, contractors and utilities operating in the power sector and our studies are fully acceptable by financial institutions and banks.

Ramboll Polska provides a full range of consultancy and engineering services for the energy sector. Our major fields of specialisation cover CHP units, CCGT units, units with supercritical steam parameters, rehabilitation of existing plants as well as large projects within renewable energy area.

We are able to provide services in all phases of an energy projects, starting with a conceptual and analytical studies in pre-project phase through procurement phase up to Owner's Engineer services during construction and commissioning.

Over the recent years we performed numerous concept studies and feasibility studies. We have the knowledge and experience required to prepare power projects in various technologies, in the power output range from a few MW to the largest power units. We have taken part in preparing Tender Specifications for turn-key project implementation and for package based project implementation. Among other, we prepared a number of conceptual studies for Vattenfall (now PGNiG Termika) for cogeneration units at Warsaw CHP Plants. The analyses included power output range from 125 to 600MWe, both with fluidised bed and with pulverised fuel boiler. Basing on our analysis covering multiple alternatives, the concept of new 480MWe/500MWt unit at Siekierki CHP Plant with a PF boiler. We also made feasibility studies for green field power plants: coal fired 2x800MW, coal fired 1000MW, gas fired 2 x 450MW. We made feasibility studies for gas based and biomass based cogeneration plants of lower power output, i.e. 10-100 MWe at ZEC Kogeneracja, CHP Pruszków and CHP in Łódź.

As Technical Advisor/Owner's Engineer we took part in the implementation of important power projects. These included the construction of Poland's first combined cycle units in Nowa Sarzyna, Rzeszow and Lublin, where we acted as Owner's Engineer. As a Contract Engineer we also participated in the construction of ELCHO Chorzów Power Plant.

Our works are performed in compliance with the Quality Management System based on ISO 9001:2008 implemented in our company– certificate number 9444.

RAMBOLL

SELECTED REFERENCE CHP PROJECTS

Client/Year	Project description
Grupa Azoty, Division Pulawy 2015 – in progress	*Technical Advisory in the project of 400 MW CCGT* Ramboll provides consulting services mainly in the procurement process of the project.
TAURON Wytwarzanie S.A. 2013	*Feasibility Study for the construction of CCGT unit with district heating generation at TAURON Wytwarzanie, Łagisza Power Plant in Będzin.* As part of the Study, the possibilities of power construction were analysed, covering power output from 450 MW to 600 MW and heat output of approx. 250 MWt. The Study analysed the site conditions, assessed the possibility of using the existing infrastructure and systems of Łagisza Power Plant for the new CCGT unit and compared to options of connecting to the gas system (distribution vs. transmission system). A comparative analysis of various CCGT locations within the premises of the existing Power Plant was made. Competitive power projects in Poland were analysed, as well as electricity prices on the stock exchange, and probable operation profiles of the new units on the competitive market were defined. An active economic model was prepared. Economic analysis, including sensitivity analysis, was performed, and the conditions on the power market and natural gas market influencing the operation mode and profitability of the new gas fired unit operation were discussed.
PGE GiEK S.A. and GAZ-SYSTEM S.A. LNG Terminal 2012	*Feasibility study for a combined cycle gas turbine (CCGT) unit with infrastructure for LNG Terminal in Świnoujście.* The study analysed the possibility of applying cogeneration systems based on gas engines, gas turbines and a CCGT unit, with outputs in the range of 40-140 MW. Conditions and limitations for the new unit construction in terms of site/local conditions, environment, connection to the power grid were assessed, taking into account the existing and new facilities and infrastructure. Alternative technical connections were analysed to use heat for LNG regasification. A detailed concept of selected alternatives was prepared, including an economic and financial analysis together with active economic model.
Energa Invest 2012 – 2015	*Services for the construction of CCGT unit in Gdańsk.* The scope of work included preparation of Feasibility Study analysing a 420-520 MW CCGT unit with closed cooling system. The study analysed site conditions and limitations, connection to the infrastructure and to the power grid. The Study included analysis of energy market, analysis of environmental impact, detailed technical concept, legal and organizational analysis, detailed time schedule for project implementation, economic and financial analysis, including an active technical and economic model. Services also include preparation of EIA as well as preparing necessary documentation, technical and legal advice in the

RAMBOLL

	permitting process of documentation, technical and legal consultancy in the administrative process of obtaining the Environmental Decision for the project.
PGNiG Termika **2013 – 2014**	*Preparing Tender Specification and permitting process for the public procurement for a new CHP Plant in Pruszków* Work included developing a concept of Pruszków CHP Plant in the conditions of limited gas supply. The study analysed a technical concept for installation of gas engines of total output approx. 10 MWe, modifying the existing HOB boiler WR25 to meet environmental requirements and a new peak-load and reserve boiler plant. A complete tender documentation was prepared for 3 tendering procedures: for modernisation of K12 and K13 water boilers for stricter environmental standards, for the construction of water pre-treatment plant; for the delivery and erection of a cogeneration unit based on gas engines and a peak-load and reserve boiler plant (cogeneration unit of approx. 10MWe, 3-5 gas engines). An information sheet was prepared for the modernisation of K12 and K13 HOB boilers for stricter environmental standards and environmental decision for the project was obtained. An environmental impact assessment (EIA) report was prepared, and environmental decision was obtained.
Energa Invest **2012-2013**	*Technical Advisor services in a project of approx. 900MW CCGT unit construction in Grudziądz.* The scope of works included preparing Feasibility Study analysing the application of F&H class turbines. The study included a review of current applications of gas turbines and solutions for CCGT units, case study analyses (detailed contracting and management systems in projects similar to the analysed project, in Poland and internationally), reference to Polish public procurement conditions, analysis of energy market in terms of competition, power trade market, detailed technical concept, legal an organisation analysis, economic and financial analysis. Besides environmental analyses were made and input to EIA report was prepared. SWOT analysis was also conducted, as well as risk analysis and competition analysis for the project neighbourhood. Detailed concept of CCS installation was presented in the study as well as CCS information as an input to investor's environment impact analysis. Thermal balance calculations were made and thermodynamic model was prepared in Thermoflex.. And active technical and economic (financial) model was prepared, enabling flexible change of unit operation mode following power price changes during the day and during the week, and including maintenance plan for gas turbines.

RAMBOLL

Vattenfall Heat Poland **2011**	*Environmental impact report for planned 450MW CCGT at Zeran CHP Plant* Environmental impact report for a project of modernization and extending Zeran CHP by constructing a 450MW CCGT plant with all necessary infrastructure and elements of spatial arrangement, including 5-month full nature inventory and thermal analysis of the discharge of post-cooling water to the Vistula and Zeran Canal, and an analysis covering CO2 capture from flue gas (CCS). A detailed concept of CCS system was presented in the Feasibility Study: Analysis of a project involving construction of a gas fired unit at Żeran CHP Plant, Warszawa, including optimisation of technical and operational parameters" Basing on the report, Environmental Condition Decision was issued.
MPEC Olsztyn **2014**	*Feasibility Study for a CHP plant in Olsztyn, including RDF as main fuel, 90 MW total available capacity.* The study analysed various alternatives for CHP plant with an RDF fired unit (grating boilers, CFB, BFB). Extension of the CHP plant with an installation firing natural gas, biomass or coal was also analysed. Site related conditions and limitations were analysed. CAPEX was evaluated, economic analysis was made and an active technical and economic model for the project developed. Basing on the study, the technological alternative for the CHP plant was selected from implementation, consisting in a cogeneration WtE unit and a gas/oil fired peak loading boiler plant, and guidelines for Terms of Reference were defined.
Vattenfall Heat Poland **2010**	*Feasibility Study: Analysis of a project involving construction of a gas fired unit at Żeran CHP Plant, Warszawa, including optimisation of technical and operational parameters.* The study included analysis of multiple project alternatives for the construction of CCGT unit of approx. 300-500 MWe and approx.. 250 MWt. Optimisation analyses were conducted, taking into account several sizes of gas turbines and CCGT units, in one-shaft and multi-shaft configurations, with backpressure stream turbine and with extraction/condensing steam turbine. Thermal balances and a thermodynamic model using Thermoflex software were prepared. An economic analysis of project profitability was carried out. Various operation modes were analysed depending on the change of power prices throughout the day and on the gas price structure. The analysis included operation of VHP's other generating facilities.

RAMBOLL

ENERGY

CHP STUDY AND LNG IN ŚWINOUJCIE

Feasibility study and cost-benefit analysis of LNG bunkering infrastructure construction in the harbours of port of tallinn.

In 2012 Ramboll Polska prepared a feasibility study for Gas-System covering technical concepts of CHP on the premises of LNG terminal in Świnoujście

Options to co-generate power based on heat demand of SCV regasification units served as the background for the study.

Six technological options were analysed in the study, including: CCGT, gas turbine, gas engines.

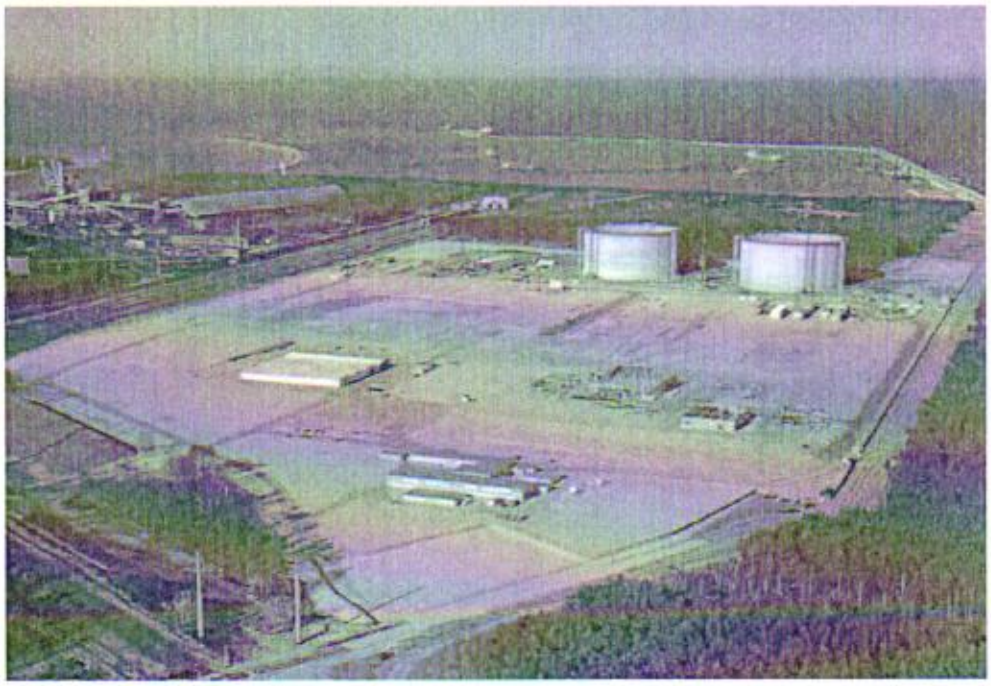
CUSTOMER
Gas-System

LOCATION
Świnoujście

PROJECT COUNTRIES
Poland

PERIOD
2012

- Units of 42÷128 MWe electrical output and 38 ÷112 MWt thermal output were considered
- Expected heat demand of SCV regasificators (110 MWt peak demand, 1500 TJ/a heat consumption) was used as the basis for technical solutions of planned CHP
- Investment schedule: CCGT – 26-30 months; gas engines/gas trurbine – 18-22 months
- Capex (2012 prices): CCGT – 374-579 mln PLN; gas engines – 177 mln PLN; gas trurbine – 192 mln PLN
- 50 MWe/50 MWt unit (gas turbine) was recommended for further analysis
- Constraints in grid infrastructure were identified as the main obstacle for larger electrical output capacities
- Profitability of the investments highly dependent on regulations (support scheme for CHP)
- Study needs to be updated in order to take into account: changes in the regulatory environment, price forecasts, conclusions from first operational experience of the terminal, any grid reinforcements realised by DSO in the meantime, new concepts raised by the client etc.



RAMBØLL

HYDRAULIC AND COASTAL ENGINEERING

with focus on LNG

RAMBØLL

HYDAULIC AND COASTAL ENGINEERING

DESIGN AND ANALYSIS OF STRUCTURES EXPOSED TO HYDRODYNAMIC AND COASTAL PROCESSES

Coastal and marine structures are subject to the changing meteorological and oceanographic conditions in terms of wind, waves, current and water levels. This has to be taken into account in the design, but also the effect of the structures on the local conditions often has to be analysed. This could be the influence from a breakwater on the wave climate and the effect on the current conditions and sediment transport in the area. The most effective tool for evaluating the hydrodynamic and oceanographic conditions is numerical hydraulic models.

Wave models

Wave modelling constitutes one of the core areas in Rambolls hydraulic expertise. For analysing the wave climate and design wave conditions wave modelling is often the best tool to use. On basis of bathymetry and meteorological data waves generated in an enclosed area can be analysed using a spectral wave model and in the same way transformation of offshore waves to near shore areas can be modelled. Setting up a spectral wave model is often the first step in analysing the wave climate in a specific area. The wave modelling can both be made for representative directional scenarios and for extreme events such as typhoons or hurricanes.

Detailed studies of wave tranquillity in ports and behind breakwaters is a central part when optimizing the layout and design. In ports wave disturbance simulations are important in order to plan the berthing facilities and in relation to downtime analysis for the ships at the harbour. The wave tranquility analyses are carried out using a Bousssinesq wave model which is capable of taking factors such as shoaling, refraction, diffraction and partial reflection/transmission for irregular waves into account.

Sediment transport and coastal impacts

Coastal structures often have an influence on the current conditions and sediment transport in the area. Ramboll carries out analysis of sediment transport problems such as sedimentation in entrance channels, coastal erosion and shoreline development, and also the necessary sediment transport modelling. Furthermore Ramboll carries out planning and design of coastal protection solutions, provides expert consultancy for shoreline management and prepares coastal protection strategies.

Environmental impacts

For larger coastal and port projects an environmental impact assessment is required. Analyses of the effect of dredging and reclamation on water quality and sedimentation will be analysed using particle transport and sediment transport models. The results of the modelling will be fed in to the environmental assessment and constitutes an important basis. Also blocking effects influencing the current conditions and water quality can be analysed by hydraulic modelling.

Design input

When designing structures in coastal and marine areas design critaria's for wind, waves, water level and current are required. Design criteria are evaluated based on statistical analyses of extreme weather events. Complex problems are evaluated on basis of in-situ investigations and numerical modelling using hydraulic models.

Metocean studies

When complete metocean studies are required Ramboll provides all the hydrodynamic modelling of waves, currents and water levels as well as the data analyses. The data analyses will include extreme value analyses and exedance and persistence probabilities as well as presentation of data in rose plots and scatter tables. All analyses will be made with respect to directional intervals and season.

Hydraulic modelling using MIKE by DHI

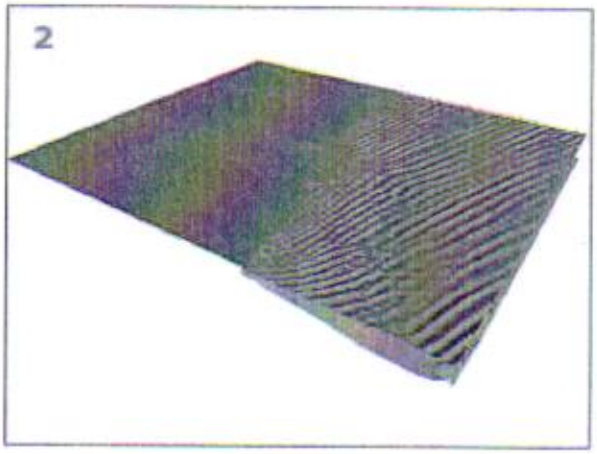
The internationally recognized MIKE 21/3 and LITPACK models developed by DHI are utilized to analyse the hydrodynamic climate of coastal regions, wave modelling well as sediment processes, coastal development and particle dispersion in oceans, rivers and estuaries. The models are used by an experienced staff with expertise within ports, hydrodynamics and coastal morphology.

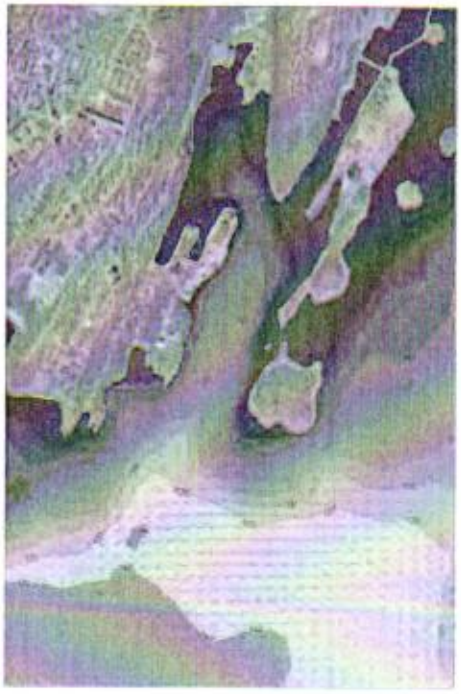
Contact

Ramboll
Ports & Marine
Hannemanns Allé 53
2300 København S

T +45 5161 1000
F +45 5161 1001

RAMBØLL





Battleship Murmansk – Technical evaluations, Norway - 1

The sunken Russian battleship "Murmansk" in Sørvær in northern Norway has been attempted salvaged. Breakwaters and retaining walls were constructed around the battleship, but damaged during a storm. Subsequently Ramboll has been responsible for technical evaluations of the design including an analysis of design waves using MIKE 21 SW and BW, to assess the contractors design assumptions.

Coastal hydraulic assessment, Hambantota, Sri Lanka - 2

As part of the feasibility study for a new seaport at Hambantota, Ramboll carried out wave tranquility analyses and simulated wave conditions for the new harbour. Sediment transport analyses were carried out to investigate possible sedimentation problems in the entrance channel and the optimum arrangement of the entrance channel and breakwaters suggested. Impacts on the coastal environment were investigated as part of an EIA.

EIA for expansion of Port of Nuuk, Greenland - 3

In connection with an expansion of the Port of Nuuk to accommodate larger container and cruise vessels Ramboll has performed an EIA for the port expansion, including hydraulic modelling and assessments of manoevring conditions for the large vessels. The hydraulic assessment consisted of numerical model analyses for evaluating the current conditions as well as sediment dispersion modelling for evaluating the effect of dredging.

RAMBØLL

FEASIBILITY STUDIES AND PORT MASTER PLANNING

ASSISTING THE PORT WITH PLANNING AND DECISION MAKING

Feasibility Studies

Based on the construction of consistent development scenarios, Ramboll prepares feasibility studies and provides expert consultancy in port master planning.

Feasibility studies typically include technical investigations, traffic analyses, financial analyses and environmental impact analyses. Further, Ramboll assists with conceptual and preliminary designs, authority management and development policy. Financial and economic evaluations are typically based on the set up of solid traffic forecasts.

Ramboll is uniquely qualified to identify and analyse port cargo-potentials and to subsequently prepare the reliable viability analysis. In-depth technical, environmental and economic issues must be evaluated when greenfield seaport projects are considered.

Ramboll can assist port authorities, municipalities, and other decision-makers with preparing a basis for decision-making. We have vast experience within project management of large projects through all phases from preinvestigations and planning to design and project implementation in the field.

Feasibility studies typically form the basis for investor decisionmaking. Ramboll is well qualified to prepare feasibility studies that fulfil the specific requirements of development banks. Based on our feasibility studies, we have helped clients get financing for their projects from financial institutes.

Port Master Planning

When port authorities consider expanding and upgrading port facilities to accommodate new or larger vessels, a number of facilities may need to be reconfigured such as, for example, berths, land storage areas, mooring systems, and scour protection. The first step, however, is evaluating and analysing the facilities. Ramboll will assist port authorities with all necessary evaluations and analyses.

The need to keep up operations during expansion and upgrades are duly considered in all our studies.

In our evaluation of the manoeuvring conditions at project sites, we include real-time ship simulations—preferably carried out by local captains. In the design of mooring arrangements and quays, the dynamics of moored ships, which are influenced by wind, waves, currents and passing ships, are analysed using numerical mooring models.

The crucial analysis of wave climate in coastal regions, wave agitation and sediment processes in ports, coastal development and particle dispersion in oceans, rivers and estuaries, are carried out using the state-of-the-art and internationally recognized MIKE 21/3 and LITPACK numerical models developed by DHI. The models are used by our highly qualified staff, who are experts in ports, hydrodynamics and coastal morphology.

Our Services

- Feasibility studies
- Port master planning
- Traffic forecasts
- Site identifications and land-use assessments
- Technical pre-investigations
- Wave disturbance and sediment transport analyses
- Coastal impact assessments
- Environmental and socio-economic assessments (EIA and SIA)
- Assessments and real-time simulations of maneuvering conditions
- Port and terminal planning
- Economic and financial viability assessments
- Commercial and financial project structuring
- Conceptual design

Contact:

Ramboll
Ports & Marine
Hannemanns Allé 53
DK-2300 Copenhagen S
Denmark

T +45 5161 1000
F + 45 5161 1001

RAMBØLL

Feasibility study for Sangley Airport and Seaport Project, Manila (Philippines) -1

Ramboll has performed a feasibility study for the combined Sangley Airport and Seaport Project in Manila. The study covers a new international airport and seaport with supporting traffic infrastructure comprising roads, bridges, an immersed tunnel and a light rail connection.

Feasibility study for new greenfield seaport, Hambantota (Sri Lanka) - 2

Ramboll has assisted Sri Lanka Port Authorities (SLPA) with planning of a new major greenfield seaport at Hambantota. The seaport will contain a wide variety of terminals, including a dry bulk, liquid bulk, break bulk, Ro-Ro and a container terminal.

Port Extension, Sisimiut (Greenland) - 3

The Municipality of Sisimiut extended the existing Port of Sisimiut. Ramboll has assisted the Municipality with ship traffic assessments, port planning, wave tranquility analyses, conceptual design and preparation of tender documents.

New Cruise Terminal for Port of Copenhagen (Denmark) - 4

The Port of Copenhagen intends to develop a new modern Cruise Terminal in the North Harbour of Copenhagen. The project implies development of 900 m new quay, connection roads, terminal buildings and adjustments to the existing approach channel. Ramboll has been responsible for the preliminary investigations, ship simulations, and elaboration of design basis and conceptual design.

RAMBØLL

ADVANCED DESIGN OF PORT AND MARINE STRUCTURES

RAMBOLL HAS VAST EXPERIENCE WITH THE DESIGN OF ADVANCED PORT AND MARINE STRUCTURES FROM PROJECTS WORLDWIDE.

Ramboll has through a various number of projects around the world gained wide experience with the design of advanced marine structures. Ramboll offers a design which is optimized with regard to material use, fabrication and installation cost, as well as operation and maintenance cost. Furthermore, limiting the environmental impact is an integrated part of the design process.

Port and Marine structures
Ramboll has experience with design of all types of marine structures:

Sheet Pile Quay Wall

Steel sheet pile wall with a concrete capping beam on top, with one or more anchor levels consisting of stretch, anchors and anchor heads.

Diaphragm Quay Wall

Reinforced concrete wall cast in a deep ditch with a capping beam on top, anchored with a tie rod to a structure of piles, a barette wall or a dead man.

Block Quay Wall

Precast concrete blocks stacked on top of each other and thereby forming a wall which is stable by its deadweight.

Concrete Caisson Quay Wall

Precast concrete caissons placed in a line, forming a quay wall. The caissons are typically cast in a dry dock, on a barge or similar, floated to the site and filled with ballast. The caissons can if necessary be anchored by a tie rod and a dead man.

Gravity based foundations for offshore wind turbine generators

Concrete structures casted on land, transported to sea and lifted in place, where it is filled with ballast material.

Gravity based foundations for offshore transformer stations

Precast concrete caisson, floated to the site and filled with ballast. On top of the concrete caisson a steel transition piece which carries the topsite structure will be placed. The foundation additionally consists of secondary structures such as boat landing, fenders, J-tubes etc.

Design process
Marine structures are often highly complex, and the design requires a wide range of competences. Ramboll has the expertise to cover the entire spectrum of disciplines required for the design of marine structures. The most important aspects of the design are:

Geostatic analysis

The geostatic analysis contains soil bearing capacity, stability, settlement analysis etc.

Structural design of steel and concrete structures

The structural design of steel and concrete structures are carried out by numerical modelling. The design comprises of ULS, SLS, FLS, ALS as well as seismic analysis.

Floating stability

For floating structures, the depth of immersion as well as the stability is analyzed.

Software
Besides varies kind of specialized in-house developed software programs, Ramboll uses the following commercial programs for analyzing advanced marine structures:

Plaxis 3D

PLAXIS 3D is a finite element package intended for three-dimensional analysis of deformation and stability in geotechnical engineering. It is equipped with features to deal with various aspects of complex geotechnical structures and construction processes using robust and theoretically sound computational procedures.

LUSAS

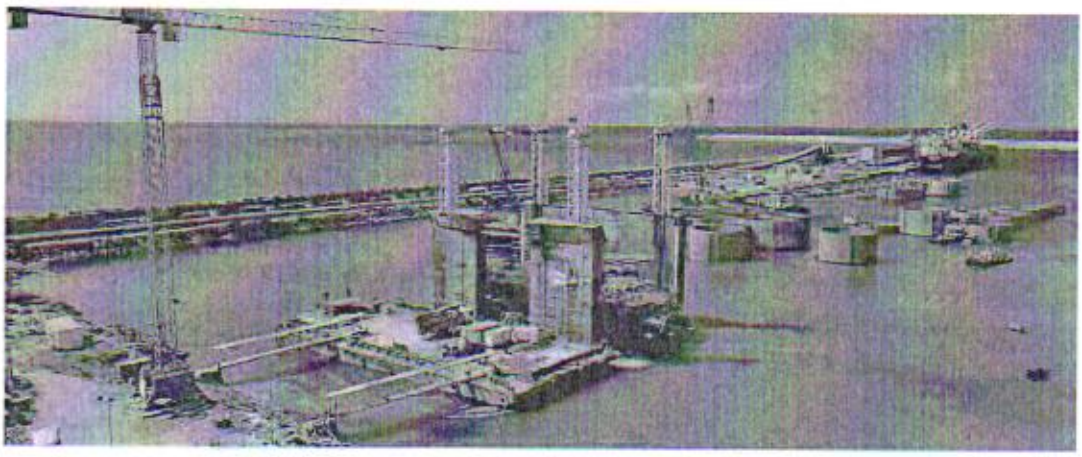
LUSAS is a world-leading finite element analysis software application for the analysis, design and assessment of all types of structures.

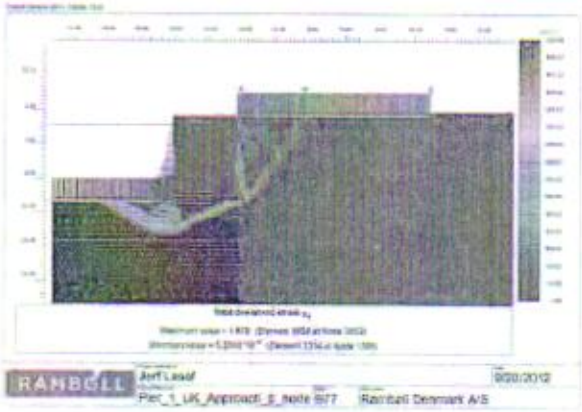
D-sheet

D-sheet is a tool used to design sheet pile retaining walls. D-sheet automatically calculates the optimized length for a retaining structure. D-Sheet Piling verifies the safety of the sheet pile wall for selected construction stages. The stability of the anchor wall is checked according to the Kranz theory. A Bishop slip-circle analysis is used to check the overall stability of the wall and soil.

Contact:
Ramboll
Ports & Marine
Hannemanns Allé 53
2300 København S
T +45 5161 1000
F +45 5161 1001
www.ramboll.com

RAMBØLL





Port of Jorf Lasfar (Morocco)

Frontpage and upper photo

Ramboll has carried out detailed design for remedial and extension works at the Port of Jorf Lasfar in Morocco. The work includes rehabilitation and increasing the draft of 6 existing quays and construction of seven additional quays.

Ramboll has carried out all detailed design work for the site including: Remedial works and durability design, Quay wall design, Concrete caisson design, 2D & 3D Plaxis Modelling, Revetment & scour, Design of M&E works, Drainage design, Design of crane rails, Planning of Dredging works.

Ramboll has been working for the EPC Contractor.

Port of Beirut (Lebanon)

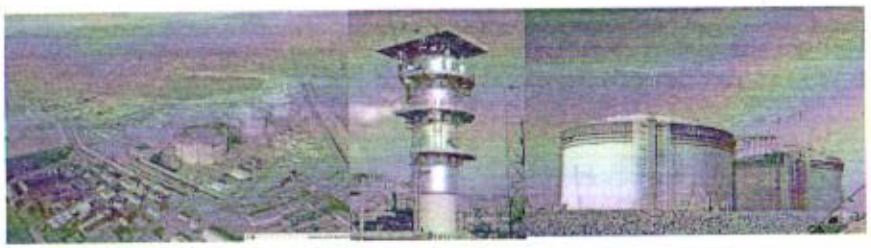
Lower photo

Ramboll has been responsible for all design works related to the expansion of the new Quay 12-14 - including the construction of a new 500 m long deep water block quay wall, dredging works in front of the new quay wall, reclamation of the old harbour basin to make space for an additional 20 hectares container terminal, as well as new fenders, bollards, crane rails, pavements.

Ramboll has prepared detailed design for the Contractor and participated in the Approval process with Port of Beirut.

SOFREGAZ

References in LNG Terminal



LNG REGASIFICATION

SOFREGAZ unique history and experience in LNG regasification terminals and storage

HIGHLIGHTS

- **96 LNG REGASIFICATION TERMINAL REFERENCES**
  - 20 FEED Studies
  - 9 LNG Regasification terminals designed and built (11 LNG tanks with a cumulated capacity of 1,450,000 m3)
  - 67 References in feasibility studies, PMC, basic engineering, and process design
- **STUDIED ALL LNG REGASIFICATION TERMINAL CONFIGURATION**
  - Land based LNG Terminal
  - Offshore, FSRU type LNG Terminal
  - Offshore/onshore, FSU + land based regasification LNG Terminal
- **SUPPLIED THE FOLLOWING VAPORIZER TECHNOLOGIES**
  - Open Rack Vaporizer (ORV)
  - Submerged Combustion Vaporizer (SCV)
  - Intermediate Fluid Vaporizer (IFV)
  - Shell and Tubes Exchanger (STE)
- **DESIGNED THE FOLLOWING TANK TECHNOLOGY**
  - 9% Ni single, double, and full containment
  - Stainless steel membrane containment

Since its creation in 1959, SOFREGAZ has carried out 96 LNG receiving terminal projects either as Feasibility studies, FEED, PMC or EPC contractor.

Among them, forty projects have been awarded during the last decade confirming SOFREGAZ position as a key partner in LNG regasification projects. The

Regarding Gaz System current and futures requirement we have presented our list of references in order to highlights where the following expertises have been studied:

- **Expansion**. SOFREGAZ has undertaken **4 expansions** of LNG terminal at FEED and EPC phases.
- **Offshore/onshore, FRSU**. SOFREGAZ has studied at FEED or due diligence phase **3 projects** that are being implemented currently.
- **Technico economic studies**. In the recent technico-economic studies that we have undertaken, all different type of technologies for vaporization, and storage tank in particular have been studies, compared and presented. **More than 60 feasibility, conceptual studies** have been undertaken which included technico-economic scope.
- Synergy of CHP with LNG terminal. We have studies on 2 particular LNG terminal projects the synergy between CHP units and regasification.
- **New commercial development**, bunkering/truck loading type. Most of the recent projects are in demand of implementing new commercial development to their terminal in order to maximize the selling of LNG. SOFREGAZ has developed **7 projects** where bunkering, truck loading, rail loading have been studied. All these projects are today under implementation at EPC phase.
- PMC, Commissioning and operation. SOFREGAZ has done 9 EPC for LNG Terminal where SOFREGAZ has been involved in all phases of the project being engineering, procurement, construction and commissioning activities and training of future operators. In addition to our EPC references we have supported many of our clients in PMC, commissioning activities and training of operators. This allows us to propose a strong commissioning/optimization of operation service, being implementation of commissioning activities or optimization of operation.

Specific references more detailed after the list of references

Project	Client	Country	Award Date	Completion Date	Sofregaz Scope of work	Specificities	Capacity
SUDAN LNG TERMINAL	SUNAGAS	Sudan	2016	Ongoing	FEED		5 MMTPA
TEMA LNG (FSRU)	GNPC	Ghana	2016	Ongoing	Due Diligence	FSRU technico – economic study	3.5 MMTPA
TRUCK LOADING INSTALLATION	PORT DE DUNKERQUE	France	2016	Ongoing	FEED	Additional commercial development	To be determined
PANAMA LNG RECEIVING TERMINAL	AES	Panama	2015	On going	FEED	Offshore/onshore LNg terminal	0.4 MMTPA
REVITHOUSSA LNG TERMINAL 3rd expansion	TERNA (end User DESFA)	Greece	2015	On going	Basic & Detailed engineering of Revithoussa LNG import terminal third expansion	Expansion of regasification + CHP integration	2.5 MMTPA
KLAIPEDA RELOADING STATION	KLAPEIDOS NAFTA	Lituania	2014	2015	FEED for reloading station (truck loading & ship bunkering)	Technico economic + Additional commercial development	0.4 MMTPA
SUDAN LNG TERMINAL	SUN NATURAL GAS	SUDAN	2013	2014	Feasibility Study	Technico economic	5 MMTPA
LNG transhipment facilities at the Dunkerque LNG Terminal	COFIVA/ DUNKERQUE LNG	France	2013	2014	Update civil works specifications, preparation of buildings permits, follow-up "Etude de danger"	Additional commercial development	5 MMTPA
Dunkerque LNG Terminal Feasibility study of re-loading LNG tankers	DUNKERQUE LNG	France	2013	2013	Determination of the maximum re-loading capacity	Additional commercial development	9,600 m^3/h
Guang Xi LNG Receiving Terminal	Sinopec	China	2012	On going	FEED + PMC during EPC	Onshore terminal including truck loading + commissioning + training of operators	3 MMTPA
Hazira LNG Receiving Terminal	SHELL HAZIRA (HLPL)	India"	2012	2013	Process Study	Expansion of regasification	7 to 10 MMTPA
Dunkirk LNG Receiving Terminal	DUNKERQUE LNG (EDF)	France	2011	On going	PMC during EPC	PMC	6.5 MMTPA
Termonoroeste LNG Terminal	ODEBRECHT ENERGY	Dominican Republic	2011	2011	Pre-Feasibility	CHP synergy	0.5 MMTPA

SOFREGAZ Industrial References in LNG Terminal

Project	Client	Country	Award Date	Completion Date	Sofregaz Scope of work	Specificities	Capacity
LNG Project (Corsica)	EDF	France	2011	2011	FSRU Feasibility Study	Offshore terminal	0.5 MMTPA
Shandong LNG Receiving Terminal	Sinopec	China	2010	On going	FEED + PMC during EPC	Onshore terminal including truck loading + commissioning+ training of operators	3 MMTPA
Jiangsu LNG Receiving Terminal	HQCEC	China	2008	2012	PMC during FEED, Commissioning & Training	commissioning	3 MMTPA
Dalian LNG Receiving Terminal	HQCEC	China	2008	2012	PMC during FEED, Commissioning & Training	commissioning	3 MMTPA
Singapore LNG Receiving Terminal	SAMSUNG	Singapore	2010	2010	BOG Recondenser Design		3.5 MMTPA
Hainan LNG Receiving Terminal	HAINAN LNG (CNOOC)	China	2009	2010	FEED		2 MMTPA (expandable to 3 MMTPA)
Dunkirk LNG Receiving Terminal	DUNKERQUE LNG (EDF)	France	2008	2010	FEED		6.5 MMTPA
Adria LNG Terminal	ADRIA LNG	Croatia	2008	2009	FEED		4 MMTPA
Fos Cavaou LNG receiving terminal	GAZ DE FRANCE	France	2004	2009	EPC		6.5 MMTPA
Revithoussa LNG Receiving Terminal 2nd Extension	DESFA	Greece	2008	2009	Feasibility Study	Expansion storage and regasification	3 MMTPA
Panigaglia LNG Terminal	GNL ITALIA (ENI)	Italy	2008	2009	FEED		5 MMTPA
Guangdong LNG Terminal Extension (4th tank)	GUANGDONG DAPENG LNG	China	2008	2008	Feasibility and Impact Study + FEED	Expansion storage and regasification	3.7 MMTPA unchanged
Guangdong LNG receiving terminal	GUANGDONG LNG	China	2003	2008	EPC		3.7 MMTPA
Le Verdon LNG Terminal	ENDESA France	France	2008	2008	Feasibility Study	Technico economic	3.7 MMTPA
Brindisi LNG receiving terminal	BRINDISI LNG S.P.A	Italy	2005	2008	EPC		6 MMTPA
Cacouna LNG Receiving Terminal	PETROCANADA – TRANSCANADA	Canada	2006	2007	FEED & Open Book Cost Estimate EPC proposal		4 MMTPA

SOFREGAZ Industrial References in LNG Terminal

Project	Client	Country	Award Date	Completion Date	Sofregaz Scope of work	Specificities	Capacity
Adria LNG Terminal	ADRIA LNG	Croatia	2006	2007	Conceptual Study	Technico economic	4 MMTPA
Dunkerque LNG Receiving Terminal	ELECTRICITE DE FRANCE	France	2005	2007	Conceptual Study	Technico economic	6.5 MMTPA
Revithoussa LNG Receiving Terminal 1st Extension	DEPA	Greece	2005	2007	EPC		2 MMTPA
Coega LNG Receiving Terminal	IGAS	South Africa	2007	2007	Conceptual Study	Technico economic	3 MMTPA
Puerto El Musel (Gijon) LNG Terminal	ENAGAS	Spain	2006	2007	FEED		2.5 MMTPA
Jamaica LNG receiving terminal	MUSTANG	Jamaica	2006	2006	FEED Subcontractor		1 MMTPA to 2 MMTPA
Shanghai LNG receiving terminal	CNOOC & SHENERGY	China	2005	2006	FEED		3 MMTPA
Tangshan LNG receiving terminal	HUANQIU	China	2005	2006	FEED		6 MMTPA
Canaport LNG Terminal	INITEC (IRVING OIL & REPSOL YF)	Canada	2005	2005	Process studies		4 MMTPA
Rosignano LNG – Ethylene Terminal Project	EDISON - BP	Italy	2004	2005	FS + pre-FEED	Technico economic	6.1 MMTPA
Tenerife LNG Terminal	Compania Transportista de Gas Canarias	Spain	2003	2004	FEED		1 MMTPA
Gran Canaria LNG Terminal	Compania Transportista de Gas Canarias	Spain	2003	2004	FEED		1 MMTPA to 1.8 MMTPA
Hazira LNG Terminal	HLPL (Shell Gas BV)	India	2001	2004	FEED & EPC		2.5 MMTPA
Arinaga LNG import terminal	GASCAN	Spain	2003	2004	FEED		1.2 MMTPA
Fujian LNG import terminal	FUJIAN LNG CNOOC	China	2003	2003	Feasibility Study	Technico economic	2.6 MMTPA
Bilbao LNG Terminal	BAHIA DE BIZKAI GAS (BBG)	Spain	2000	2003	EPC		5 MMTPA
Idku LNG export terminal	BG - EDISON	Egypt	2002	2002	Feasibility Study	Technico economic	3.6 MMTPA

SOFREGAZ Industrial References in LNG Terminal

Project	Client	Country	Award Date	Completion Date	Sofregaz Scope of work	Specificities	Capacity
Rosignano LNG – Ethylene Terminal Project	EDISON - BP	Italy	2001	2001	Feasibility Study	Technico economic	2.3 MMTPA
Adriatico Offshore LNG terminal	EDISON GAS	Italy	2001	2001	Feasibility Study	Technico economic	3 MMTPA
Suape LNG & LPG Import Terminal	SHELL / PETROBRAS	Brazil	1999	2000	FEED		3.5 MMTPA
Chengtoujiao LNG Terminal	TOTAL / GAZ DE FRANCE	China	1999	1999	Feasibility Study	Technico economic	Confidential
Fos/Mer LNG Terminal	GAZ DE FRANCE	France	1998	1999	Detailed Engineering		Revamping
Montoir-de-Bretagne LNG Terminal	GAZ DE FRANCE	France	1998	1999	Detailed Engineering		Revamping
Revithoussa LNG Terminal	DEPA	Greece	1996	1999	EPC		1 MMTPA
Dahej Import LNG Terminal	PETRONET LNG	India	1998	1999	FEED		5 MMTPA
GBS/FRSU Kakinada LNG Facilities	TOTAL	France	1998	1998	Feasibility Study	Technico economic	
LNG Import Terminal in Lebanon	TOTAL	Lebanon	1998	1998	Feasibility Study	Technico economic	
Finland LNG Import Terminal	IVO INTERNATIONAL LTD.	Finland	1996	1997	Feasibility Study	Technico economic	
Offshore LNG Terminal	I.E.C	Israel	1997	1997	Feasibility Study	Technico economic	
Low Cost LNG Terminal	TOTAL	France	1996	1996	Feasibility Study	Technico economic	
Essar LNG Import Terminal	ESSAR/GAZ DE FRANCE	India	1996	1996	Feasibility Study	Technico economic	
Rotterdam LNG Import Terminal	KEMIRA AGRO (TECHNIP)	Netherland	1996	1996	Feasibility Study	Technico economic	
LNG Unloading Arm Environmental Study	COSEREP Canada	Canada	1995	1995	Feasibility Study	Technico economic	
Fos-sur-Mer LNG Terminal	GAZ DE FRANCE	France	1994	1995	Detailed Engineering		

300

SOFREGAZ Industrial References in LNG Terminal

Project	Client	Country	Award Date	Completion Date	Sofregaz Scope of work	Specificities	Capacity
Kerala LNG Import Terminal	KERALA STATE IND. DEV. CORP.	India	1995	1995	Feasibility Study	Technico economic	
Gujarat LNG Import Terminal	GUJARAT POWER CORP. Ltd.	India	1994	1995	Feasibility Study	Technico economic	
LNG Import in Israel	MIINISTRY OF ENERGY	Israel	1994	1995	Feasibility Study	Technico economic	
LNG Import Terminal Project	TRANSENERG	Philippines	1995	1995	Feasibility Study	Technico economic	
1st Extension of Pyong Taek LNG Terminal (Addendum)	KGC	Korea	1993	1994	Technical Assistance		
LNG Studies for TRANSGAS	LNCE/TRANSGAS	Portugal	1994	1994	Feasibility Study	Technico economic	
Setubal LNG Import Terminal	TRANSGAS	Portugal	1994	1994	Basic Engineering		
Mosgaz Peak Shaving Plant	GAZ DE FRANCE	Russia	1994	1994	Feasibility Study	Technico economic	
LNG Import - IPP Projects	MDX ITALTHAI	Thailand	1994	1994	Feasibility Study	Technico economic	
Zhanjiang LNG Import Terminal	SITHE ENERGIES INC. NY	USA	1994	1994	Site Survey		
LNG Import to Pakistan	WORLD BANK	Pakistan	1993	1993	Feasibility Study	Technico economic	
Marmara LNG Terminal	TECHNIGAZ / BOTAS	Turkey	1990	1993	E & P		
Cost of a LNG Chain (Part: Receiving Terminal)	TOTAL	France	1992	1992	Cost Estimate		
LNG Terminal associated to a Power Plant	CEPM	France	1992	1992	Feasibility Study	Technico economic	
1st Extension of Pyong Taek LNG Terminal	KGC	Korea	1990	1992	Technical Assistance		
Revamping of the LNG Tanks - Arzew Liquefaction Plant	SONATRACH	Algeria	1989	1991	EPC		
LNG Import to Hong Kong	CHINALIGHT/TOTAL/SHELL/GDF	China	1991	1991	Feasibility Study	Technico economic	

SOFREGAZ Industrial References in LNG Terminal

Project	Client	Country	Award Date	Completion Date	Sofregaz Scope of work	Specificities	Capacity
North Taiwan LNG Import Terminal	PACIFIC ENGINEERS & CONSTR.LTD	Taiwan	1991	1991	Feasibility Study	Technico economic	
LNG Terminal associated with a Power Plant	GAZ DE FRANCE DDII	Thailand	1991	1991	Feasibility Study	Technico economic	
LNG Import Terminal in Ireland	BGE	Ireland	1990	1990	Feasibility Study	Technico economic	
LNG Import to India	GAIL	India	1989	1989	Feasibility Study	Technico economic	
LNG Import Terminal in Greece	DEP	Greece	1987	1987	Feasibility Study	Technico economic	
Hong Kong LNG Terminal	H.K & CHINA GAS COMPANY	China	1984	1984	Feasibility Study	Technico economic	
Pyong Taek LNG Terminal	KGC	Korea	1982	1984	Basic & Detailed Engineering		
Adriatica LNG Project	SES	Croatia	1981	1981	Feasibility Study	Technico economic	
LNG Tanks (Roll Over)	ENAGAS	Spain	1979	1979	Safety Study		
Zeebrugge LNG Terminal	DISTRIGAZ	Belgium	1977	1977	Safety Study		
LNG Import Terminal-Kopper	PETROL LJUBLJANA	Slovenia	1977	1977	Feasibility Study	Technico economic	
Barcelona LNG Terminal	ENAGAS	Spain	1976	1976	Feasibility Study	Technico economic	
LNG Import Terminal in Germany (Wilhemshafen)	DFTG	Germany	1975	1975	Feasibility Study	Technico economic	
LNG Import Terminal in Attica (Greece)	MINISTRY OF INDUSTRY	Greece	1973	1974	Feasibility Study	Technico economic	
LNG Import Terminal in Spain	ENAGAS	Spain	1974	1974	Feasibility Study	Technico economic	
LNG Storage Tank (New Concept)	STOGAL	France	1971	1971	Feasibility Study	Technico economic	
Chile & Sao Paulo & Rio de Janeiro LNG Import Projects	INTEROCEANIA	Chile/Brazil	1964		Feasibility Study	Technico economic	

GNPC
TEMA LNG FSRU
TEMA, GHANA

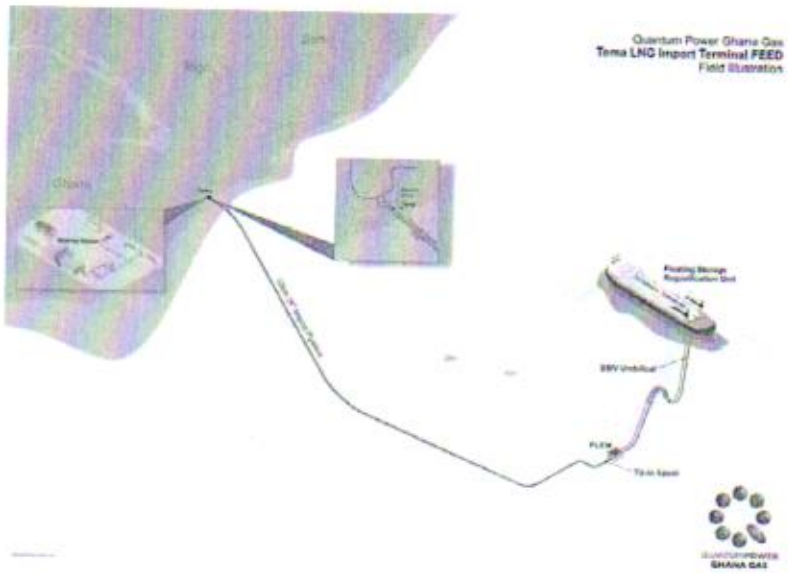
LNG Send-out capacity design: 3.4 MTPA FRSU

Contract: Due Diligence
Review of the study prepared by co-investor of GNPC including budget estimates. Assist and advise GNPC in relation to tender preparation and evaluation activities.

Scope of work:

- Review and validation of the operational objectives, scope and level of services offered as stated by Quantum Power
- Review and validation of the Standards to be met by the project
- Review and validation of development costs
- Review and validation of the Engineering Solution
- Review of Construction phase
- Review of the facility Operation and Maintenance arrangements
- FSRU
- Review of compliance with industry standards
- Review and validation of the Standards to be met by the project

Ongoing



AES
PANAMA LNG IMPORT TERMINAL
PANAMA

LNG Send-out capacity design: 0.4 MTPA

Vaporizers: SCV and IFV

Tanks: 10 000 m3 PHASE 1 + FSU

160 000 m3 PHASE 2

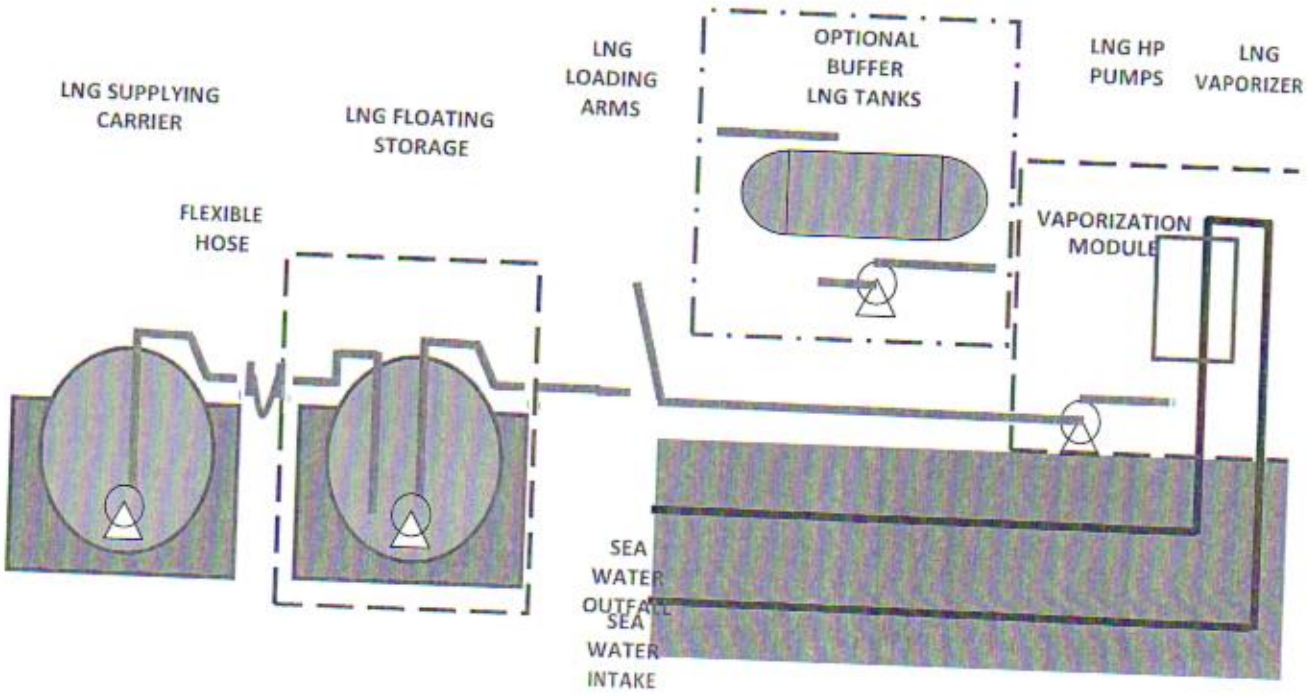
Contract: Lumpsum FEED

Finished in 2016

Challenge was to have LNG in 18 months due to readiness of CCGT. What has been implemented is a phase 1 with FSU and vaporization onshore, and a buffer tank of 10 000m3 in order to be ready in 18 months to vaporize the LNG.

PHASE 2 will be done in parallel which consist of expansion of vaporization and erection of a 160 000m storage tank full containment.

PHASE 1



DESFA
REVITHOUSSA LNG IMPORT TERMINAL
REVITHOUSSA, GREECE

LNG Send-out capacity design:	1MTPA
	2 MTPA 2nd expansion
	2.5 MTPA 3rd expansion
Vaporizers:	ORVs and SCVs
Tanks:	2 x 65,000 m^3 (9%Ni Full Containment Tanks) +1 in construction
Contract:	**1998 – 2000** EPC
	2006 – 2008 EPC of 2nd expansion
	2008-2009 Feasibility study on additional services and 3rd expansion
	2016 – ongoing Basic Engineering and detailed engineering during EPC of 3rd vaporization expansion

Ongoing

SOFREGAZ is the privileged engineering company of REVITHOUSSA LNG TERMINAL since its construction in 1998. SOFREGAZ has participated in all the expansion phases of the terminal since 1998.