Sindicatum
carbon capital

Developing Landfill Gas to Energy Projects in the US and Asia

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Who We Are

- Sindicatum Carbon Capital (SCC) is a global end-to-end developer of climate change and renewable energy projects
  a. Project origination
  b. Project planning
  c. Project management and execution
  d. Climate change expertise
  e. Funding
- SCC operates globally with offices in Houston, London, Beijing, Singapore, Jakarta, New Delhi, Thailand & Bahrain
- SCC Americas is a wholly owned subsidiary of SCC

SCC's Portfolio

- 9 landfill gas projects
- 4 coal mine methane projects
- 5 agricultural projects
- 1 hydro project
- 1 energy efficiency project

Bangkok Landfills, East and West

Project Features

- Bangkok based team
- SCC serves as PM
- Project divided into 2 sectors
- Phase 1: installation of GCCS

- *Phase 2: installation of flare & LFG pre-treatment*
- *Phase 3: installation of engines*
- *14 MW to grid*
- *Excess gas to on-site flare*
- *Power sold to Local Provincial Electricity Authority*

Basic project structure in Thailand and the US

Project Development and Value Proposition Largely the Same

- Project identification and diligence
- Contracting with partners
- Power and environmental attributes off-taker agreements
- Construction
- Operations
- *Revenue!*

Important distinctions – Project drivers and advantages in the US

- Increasing interest in local and domestically produced renewable energy
  a. Municipalities are interested
  b. Incentives and favorable rates for locally sourced renewable power
- Perceived long-term upside
  a. Future clean energy standards (both state- and federal level)
  b. Carbon market
- Robust legal system lowers project risk
  a. Permitting, while lengthy, is predictable
  b. Contracts enforceable
- LF operations highly regulated
  a. Increases certainty of reliable gas production

Important distinctions – Project drivers and advantages in Thailand

- Established and robust market for carbon credits
  a. Credits developed through UN's CDM program
  b. Sold into EU ETS, the largest compliance market for credits
- Capital expenditure is lower
  a. Materials and labor are cheaper
- Tax breaks for Renewable Energy Projects
- Premiums for renewable power

Risks for the US

- Power prices currently at historic lows
- Clean energy standards are not constant
- LFs in US more numerous but smaller in size
  a. High development costs
  b. Legal structuring requirements
  c. High interconnection costs
- LF ownership structure
  a. Many run by private entities with LFGE initiatives in place
  b. Implications for revenue and project structuring

Risks for Thailand

- LF operations and physical layout
  a. Deposition strategies often do not maximize production
  b. Due to high % food waste, higher temperatures and waste moisture the waste decay is much faster. Requires rapid installation of GCCS
- Enforceability of contracts
- Weather, rainy season, generating high quantities of leachate
- Political landscape
  a. 2010 Bangkok riots

How the Thailand Project was Implemented

- Potential gas production was analyzed using LandGEM model
- SCC serves as project manager
  - A team was established in Bangkok to develop and run the project
  - Local subcontractors were used to construct the various aspects of the project
- Project was divided into two; Bangkok East and Bangkok West
- Phase one consisted of installation of gas collection wells
  - Well design was based on an Asian biodegredation model
- Phase two consisted of installation of flares and pre-treatment
- Phase three consisted of installation of combustion units
- Power is being sold to Local Provincial Electricity Authority

Obstacles Encountered at Thailand Project

- Obstacle: Provision of local HDPE pipework and EF fittings
  a. Solution: Imported from UK, China and middle east
- Obstacle: No in country experience in LFG pipe & well installation
  a. Solution: SCC project managed with a team from China
- Obstacle: No in country LFG flare supplier
  a. Solution: Imported from China
- Obstacle: No LFG project operational experience
  a. Solution: SCC employed UK expat and trained local team over several months
- Obstacle: No local engine operator with full O&M experience in
  a. Solution: SCC employed own maintenance team to undertake all O&M

Notable Differences Between Asian and US Landfills

- Higher degradable content in Asian waste
- Most waste degradable content is food, giving a higher *k* value and quicker LFG generation
- Greater leachate generation due to rainy season
- Tipping practices differ, not cellular tipping plans
- Little compaction as bulldozers used instead of compactors

SCC's Optimum Biogas Collection "OBC™" Technology

- Major difficulty and expense in sourcing gravel locally
- Difficult to install gravel/stone around horizontal gas well, especially in rainy season, causing H&S concerns
- Review of other options to provide additional void around the pipe
- SCC developed and are patenting Optimum Biogas Collection (OBC™)
- Reduced material and installation costs with no specialist plant being required
- Increased gas collection efficiency from wells by maximizing waste to void contact area

THANK YOU

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