



## Texas Industries of the Future

### Report on the Scope for a “Guide to Low-temperature Waste Energy Recovery Technology Selection”

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Attendees at the *Technology Forum: Low Temperature Waste Energy Recovery in Chemical Plants and Refineries*, convened on May 16, 2012, identified the need for a better guide to low-temperature waste energy recovery technology selection. Due to the short time available at the *Technology Forum*, the guide was not defined in sufficient detail to progress the idea. This report summarizes the results from an industry workgroup convened after the *Technology Forum*. The workgroup was tasked with further defining the scope and function of the guide. The workgroup developed the following description:

The Guide is a web-based expert system that would assist end-users to identify technology categories or products that can use low temperature (<400 °F) waste energy at chemical plants and refineries.

The attached Scope defines the level of detail that will be needed from technology companies to populate the Guide. Based on the input from the end-user, the Guide would generate a list of technology applications that met the end-user’s technical and other criteria.

The workgroup included engineers from chemical plants and refineries that had attended the May 16 program, as well as other technology experts. They came from the following organizations: ExxonMobil, DOW Chemical, LyondellBasell, Eastman Chemicals, DuPont, Hudson Technologies and Ormat. The Scope document was also reviewed by ElectroTherm, a second provider of organic rankine cycle technology. Hudson Technologies reviewed the Scope for coverage of criteria pertaining to absorption chilling technologies.

The development of the Guide would be done in 7 tasks.

1. Convene end-user workgroup to advise during project development.
2. Select engineering firm to develop the expert system and collect and review technology data.
3. Evaluate and select expert system software.
4. Develop the Guide.

5. Identify low-temperature waste energy recovery candidate technologies and technology companies. Contact companies to provide data to populate the Guide. Ensure data makes technical sense (metrics, claims, etc.).
6. Test Guide with end users and technology companies. Revise based on feedback.
7. Launch Guide, including web marketing and articles in media.



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## **Scope for a “Guide to Low-temperature Waste Energy Recovery Technology Selection”**

### **Description:**

The Guide is a web-based expert system that would assist end-users to identify technology categories or products that can use low temperature (<400 °F) waste energy at chemical plants and refineries.

### **End-user Input to Query the Guide (based on screening for organic rankine cycle and absorption chilling technologies)<sup>1</sup>**

The end-user would provide the following information in order for the Guide to match their application to possible technologies or products:

- Type of Plant ( Refinery, Chemical Option of 2, 4 or 6 digit NAICS code if known)
- Location: City, State, and Country ( to identify regulatory factors)
- Waste Energy Source Description (Ex: off gas, boiler stack, heater stack, process fluid. Need to develop as complete a list as possible.) Allow multiple selections.
- Waste Energy Source Characteristic. Fill out for EACH waste heat source described above:
  - Flow mass/volume
  - Type of fluid (air, steam, gas, process fluid or combinations.) Allow multiple selections.
  - Source temperature (in F or C)
  - Annual average air temperature (in F or C)
  - Facility Considerations, such as availability of power, cooling water, city or well water. (develop as complete a list as possible.)

- Design limitations, such as corrosive components, particulate matter, other abnormalities, min/max on power output, footprint. Develop as complete a list as possible.
- Availability: intermittent or continuous. If intermittent, percent time available.
- Ease of recovering waste heat: real estate constraints, run-around loop
- Useful output desired from waste energy stream. Select all those that apply. If more than one is selected, prioritize the selections:
  - Electrical power
  - Chilled water (supply temperatures >40F)
  - Refrigeration
  - Heat pumping (Temperature desired in F or C)
  - Chemicals

#### Output from Guide:

Based on the end-users information, the Guide would identify the technology categories or products that match the waste energy stream characteristics:

- Description of technology, manufacturer, and contact information
- Number of commercial-scale units operating (must be greater than 1)
- Links to case studies that demonstrate use of the technology in the same or similar industrial sectors.
- Average installed unit cost based on size range (ex: \$/kw). Also specifies year and location of cost data, so that user can adjust cost accordingly.

#### Optional Filters for Selections (Set by End-User):

- Technology category (ex: organic rankine cycle, absorption chillers, fuel cell, etc)
- Number of commercial scale units operating (range selection)
- Produces power, cooling, and/or chemicals (based on selection by end-user)

Disclaimer:

- Only products with at least one commercial-scale operating unit will be included in the Guide database.
- The end-user is responsible for vetting the performance and suitability to their application of technologies identified through this Guide.
- Data in the Guide database for a product would be provided by the technology company, which would be contacted during the Guide development process.

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<sup>i</sup> Additional technologies, such as fuel cells and kalima cycle, could be included in the final Guide.