The Power Pallet has significantly widened this window for success by embedding the needed “expertise” in an onboard electronic brain.   These smarts are further extended by a multi-stage gasification architecture, and an innovative “waste heat” capture and recycling system — what we call the[Tower of Total Thermal Integration (Hot TOTTI)](http://wiki.gekgasifier.com/w/page/6123834/Tower-of-Total-Thermal-Integration).   In traditional systems, hot engine exhaust and hot output wood gas have been “problems” requiring extra space and cooling components to counter.  With the GEK Hot TOTTI, we’ve transformed these “wastes” into useful new inputs to the gasification process.  It’s like adding a new “free” heat source to fix the old and well known thermal challenges of a gasifier.

This Gasifier-Engine thermal integration significantly improves tar conversion, fuel flexibility and general efficiency of the gasifier-engine system.  It enables the GEK to solve the tar issue in the reactor, not via a large downstream filtering system, saving much cost, complexity and installation footprint in the process.

These advantages are the result of breakthroughs in electronic control and

waste heat recycling. An onboard microcontroller provides the expertise

usually required from a trained operator. A multi-stage gasiﬁcation

architecture, combined with an innovative gasiﬁ er-engine thermal

integration, signiﬁ cantly improves tar conversion and fuel ﬂ exibility (see

page 13 for more information).

The Power Pallet consists of a multi-stage gasiﬁ er, spark

ﬁred industrial engine, generator head, and Process

Control Unit (PCU). The PCU monitors and responds to all

internal reactor, engine, and ﬁ lter conditions, displaying the

results on an LCD screen

The shipping container "platform" the potential for standardization and replicability of the solution, as well as provide a well integrated yet mobile test bed for the research portions of the project.

For the larger shipping container based system, we will be redesigning and building an upsized version of the GEK gasifier system, all in 304L stainless construction.

The Powertainer is a scale up of the Power

This will include a scale up and elaboration of the current GEK thermal integration of all waste heats between the gasifier and engine. The waste heat in output producer gas and IC exhaust has tremendous potential for augmenting the various "thermally challenged" processes in a gasifier. ALL Power Labs has developed a simple and compact heat exchange architecture to mine these waste heats, and return them to the temp appropriate processes in the reactor. The main modules of this system are:

1. Incoming air preheating and output producer gas cooling via flexible heat exchange tubes in the gas cowling around the reactor. See info pictures at www.gekgasifier.com.http://www.gekgasifier.com/gallery/gek-v10/gek-v10-air-preheating/

2. Heated fuel feed auger and drying bucket to drive fuel drying and preheating loads with the output producer gas. See info pictures here:

http://www.gekgasifier.com/gallery/gek-v30/gek-v30-auger/

3. PyroCoil gas circulating heat exchanger to drive pyrolysis loads with IC exhaust gas.

http://www.gekgasifier.com/gallery/gek-v30/gek-new-add-on/

Combing these three heat recycling systems, we can remove the majority, if not the totality, of all the "thermal drags" on the combustion zone in the gasifier. The result is increased gasifier efficiency, higher top temperatures for improved tar conversion, increased tolerance for high moisture fuels, and the ability to alter pyrolysis dynamics so as to produce less refractory tars that are easier to crack to clean gas.

For the next 6 months we'll be learning and refining the installation onsite, and hopefully ending with a daily running installation.  There are many details to work out, and surely many things yet to learn.

However, we are very satisfied with the fundamentals, and the general proving that one can compact and integrate the full gasification system (gasifier, filtration, engine and hopper) within one 20' shipping container.  The goal is the total system in a box, drop it off the truck and go.  No onsite construction.  Fill the hopper with a conveyor, skid steer or bucket tractor.

The first Powertainer was developed as part of a US Dept of Energy project with the University of Minnesota, Morris, Cummins Power, and the Diesel Research Lab of U of Minnesota, Twin Cities.

These numbers are still in process. All are tentative.

See here for the full gallery of photos from the install at Univeristy of Minnesota, Morris

[http://gekgasifier.com/wpgallery/powertainer-at-university-of-minnesota-morris/](http://gekgasifier.com/wpgallery/powertainer-at-university-of-minnesota-morris/" \t "_blank)

See here for the full gallery of photos from the testing at APL in Berkeley

[http://gekgasifier.com/wpgallery/100kw-powertainer-at-apl-june-2012/](http://gekgasifier.com/wpgallery/100kw-powertainer-at-apl-june-2012/" \t "_blank)