

MODULAR (PACKAGED) UTILITY SYSTEMS

Faster – Better - Cheaper

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DoE Better Buildings Summit
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GENERAL MOTORS

OPPORTUNITY-DRIVEN CHANGE AT GM

New programs required major utility upgrades at 3 plants:

- Process design significantly trailing building engineering
- New chiller and process tower water systems
 - > 18000 tons of chiller + tower cooling
- All systems the same ... but all different, 4500 -7500 t/site
- Varied capacities, heads, site interfaces, climates
- One GC, one A/E, but three PMs and site teams
 - Normal processes would drive 3 designs

Choices

- Do it the same way as always
- Do it a new way for a better outcome
- A few chose to pursue a new way ...
 - ... (that takes a lot of push!)
- Packaged supplier approach chosen



WHAT IS A PACKAGED SYSTEM? JUST OFFSITE FAB?

Offsite Fabrication

- A/E designed - burden on A/E for shop details
- Fabricated to the A/E design - Owner still owns design issues
- Shop fabricated but ...
 - Core stick built issues remain

Packaged Systems – More than offsite fabrication

- Owner-A/E specified for performance and content only
- Specialist system provider engineers to spec
 - Use packager's experience base
 - Shortened schedule
 - Compacted layouts
- UL/ETL listed appliance
 - NOT real property



WHAT DOES THAT PROCESS LOOK LIKE?



Proposal Model

5 x 1500 T chillers

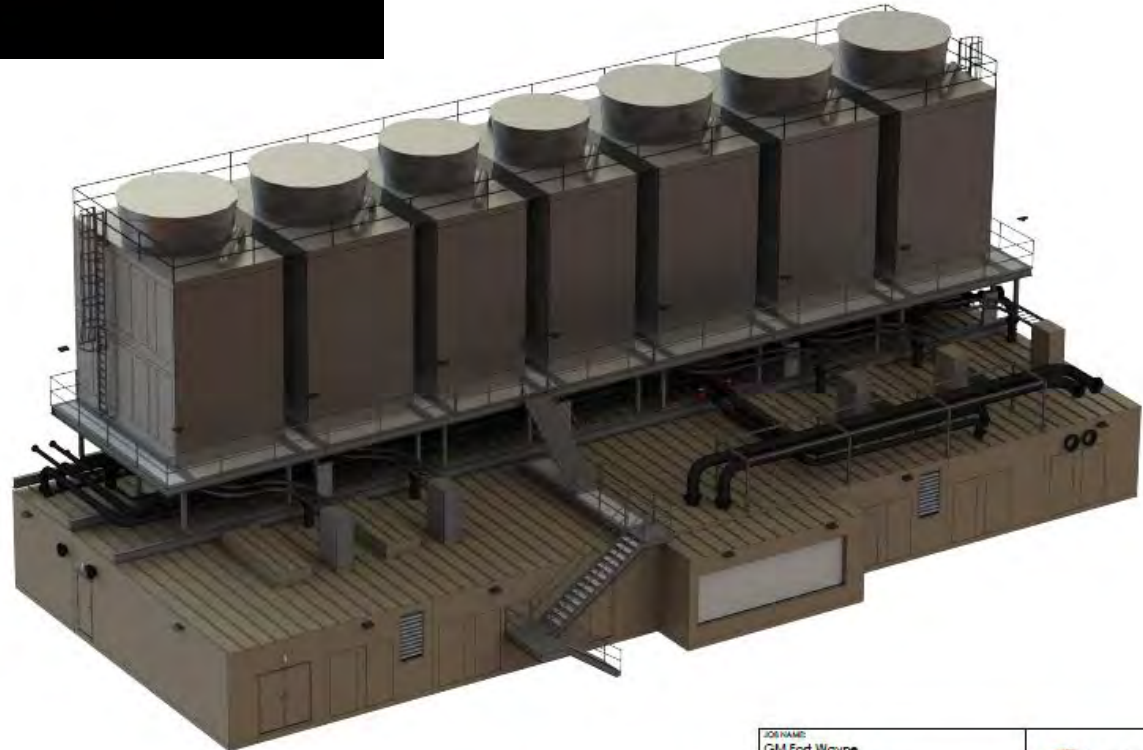
2 X 1500 T weld water systems

(3 future chillers also shown)

Build Model

5 x 1500 T chillers

2 X 1500 T weld systems

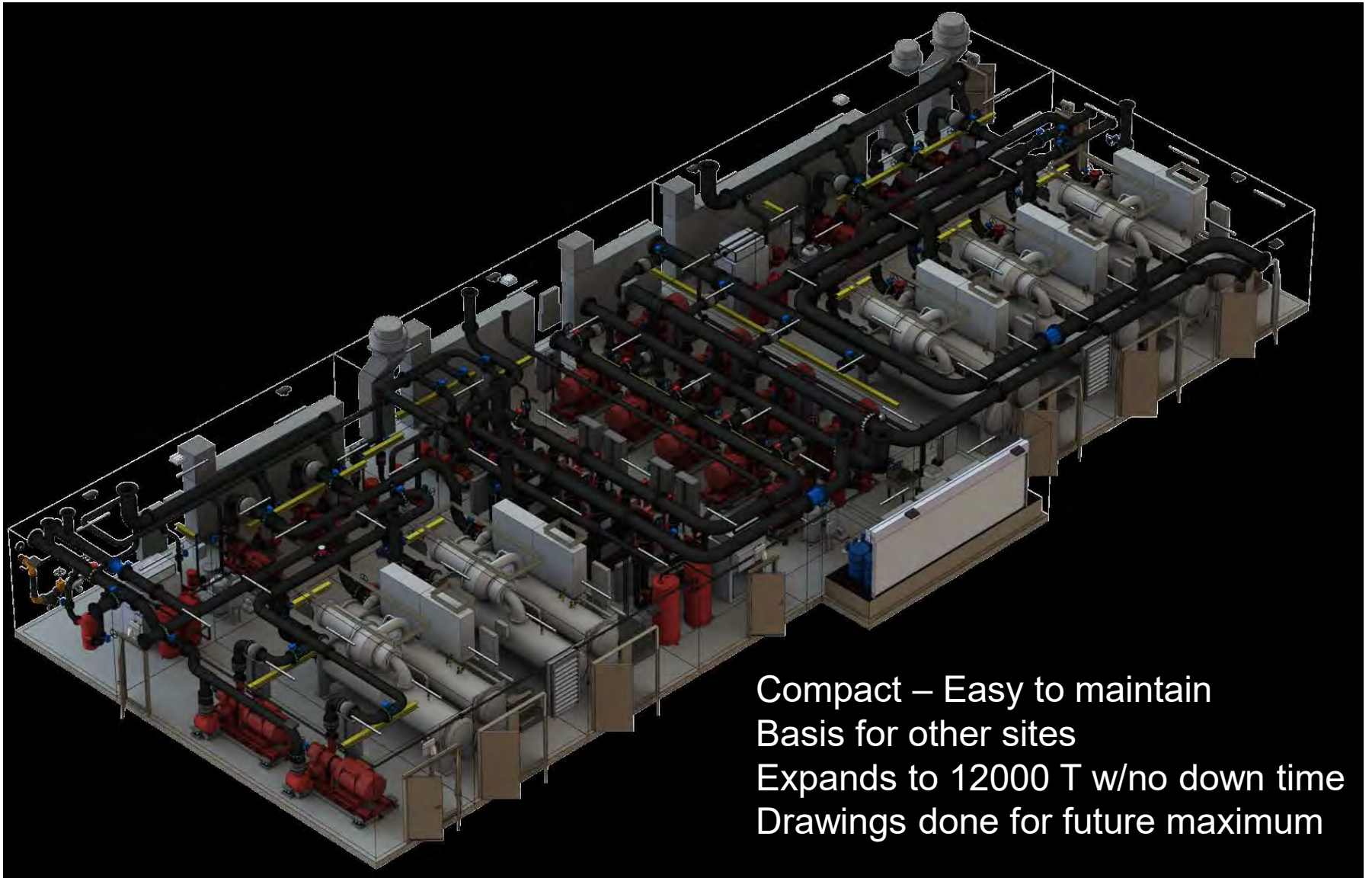


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JOB NAME: GM Fort Wayne	
JOB #: 150043	DRWG. NO.: 1037848-M-02
PHASE:	SHEET #: REV



FT. WAYNE – 3000 T (PAINT) + 4500 T (BODY) & WELD WATER



Compact – Easy to maintain
Basis for other sites
Expands to 12000 T w/no down time
Drawings done for future maximum

BUILD SEQUENCE - SYSTEM 1 OF 3



14 x 42' x 90k lbs.
maximum module size
7500 tons +

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ELAPSED FIELD TIME – 2 ½ WEEKS



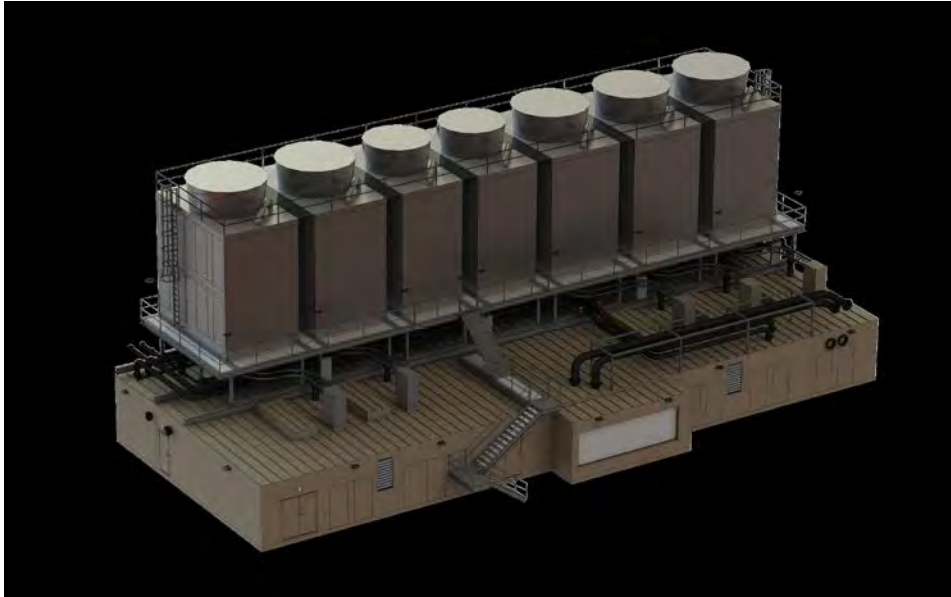
Ordered October 2015

On site July 18, 2016

Start up (potential) September 1, 2016, (actual) March 2017

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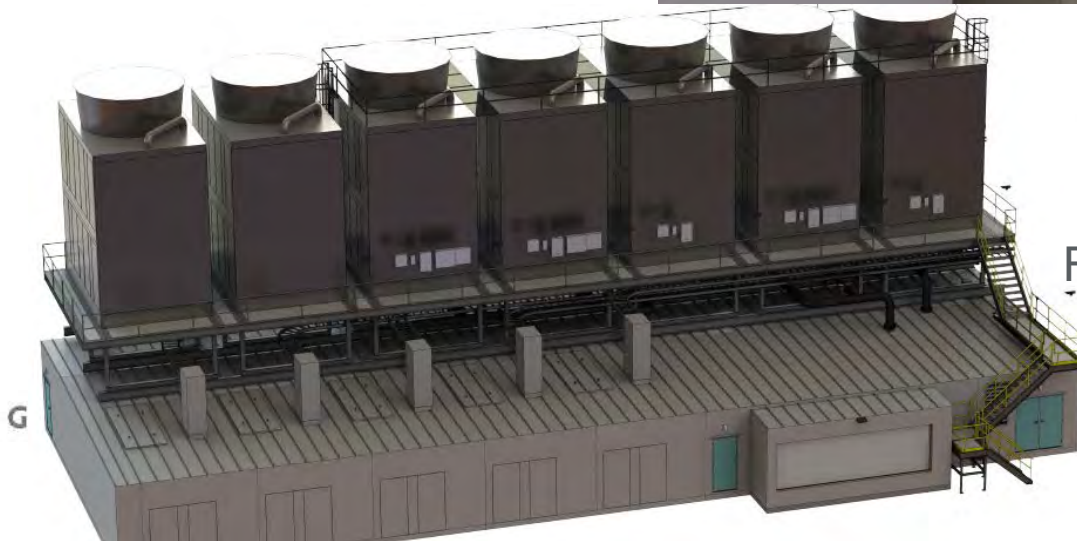
ONE PLAN - THREE PLANTS



Fort Wayne Body/Paint (base build)



Arlington Body (w/future)



Flint Body (w/future)

Flint & Arlington are opposite
2/3s of FWA!

CHANGE IS HARD ... EXPECT PUSHBACK

Expect active and passive initial opposition from:

- Conventional A/E (reduced scope and control)
- General contractor (perceived risk from change)
- Teamed mechanical and electrical subcontractors (reduced scope)
- 3 out of 4 project managers (it's different!)
- 4 out of 5 project engineers (hey, this is different)

Expect support from:

- 1 Construction group manager
- 1 Project manager

Why?

- Upsets traditional lines of supply
- Upsets traditional lines of control
- New (and frightening)

Beware of gravity

- Every traditionalist will pull back at every opening – never slip
- Prevent backsliding into detailed interference into the packager's work



LESSONS LEARNED

Packaged utility supply can be faster IF you develop your supply base

- Shorten total project schedule by 6-10 months
- Reduce A/E time and hours dramatically
- Reduce typical field schedule from 18 months to 6-10 weeks

Packaged system supply can be cheaper

- Reduce A/E & owner staff time and hours by 80%
- Reduce field labor and duration by at least 80%
- Overall cost reduction of 20% readily achievable (\$1200-1300/t installed)
- Future systems accumulate savings ... keep the team together

