Louisiana State Energy Office Perspective on CHP
Louisiana Combined Heat & Power Stakeholder Forum

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Louisiana State Energy Office

Promotes Energy Efficiency in Louisiana Homes, Schools, Industry, Businesses, and Governmental Facilities

Promotes the Responsible Development of All Forms of Energy including Renewables such as Solar, Wind, and Biomass

Works with Partners such as the US Department of Energy, La Public Service Commission, La Dept. of Environmental Quality, La Dept. of Revenue, Clean Cities Coalitions, and various Local Governments

Promotes the use of cleaner alternative motor vehicle fuels such as Natural Gas, Propane, and Electricity

Combined Heat & Power (CHP)

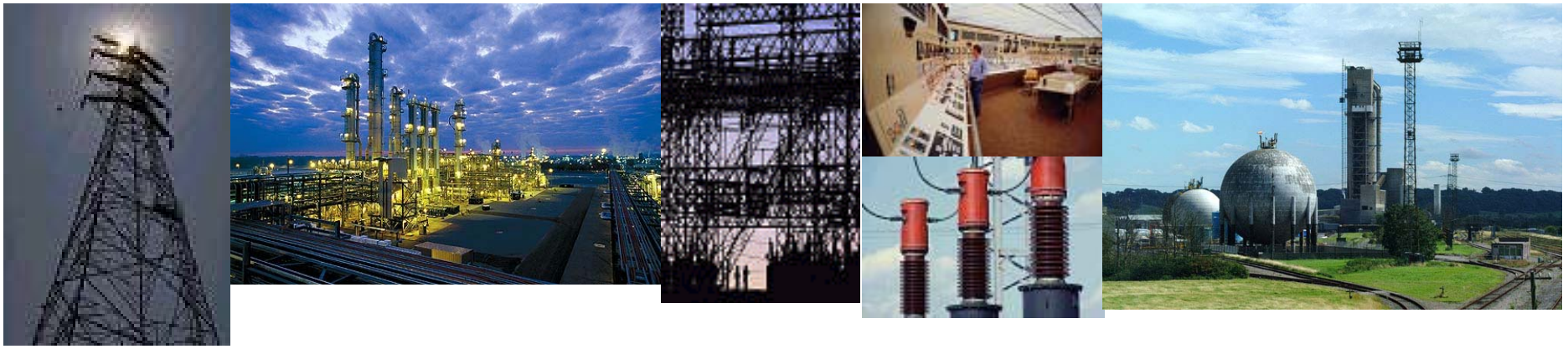
Combined heat and power sometimes referred to as cogeneration, is the simultaneous production of electrical and thermal energy.

Historical Perspective

- Louisiana's Energy Office has sponsored energy efficiency studies, seminars, conferences and activities by LSU, University of Louisiana at Lafayette, Louisiana Tech, and Texas A&M
- Sponsor the Annual Industrial Energy Technology Conference held in New Orleans which features new technologies and activities employed by various industries which result in energy conservation
- In 2013, we sponsored a Study by LSU to (1)evaluate existing operating CHP technologies, benefits, and costs (2)then evaluate the technical and economic potential for expansion of CHP installations over the next 15 years (3) assess the regulatory environment and barriers to CHP development.

Key Findings from 2013 LSU CHP Study

LSU Center for Energy Studies



The Gulf Coast Industrial Investment Renaissance and New CHP Development Opportunities

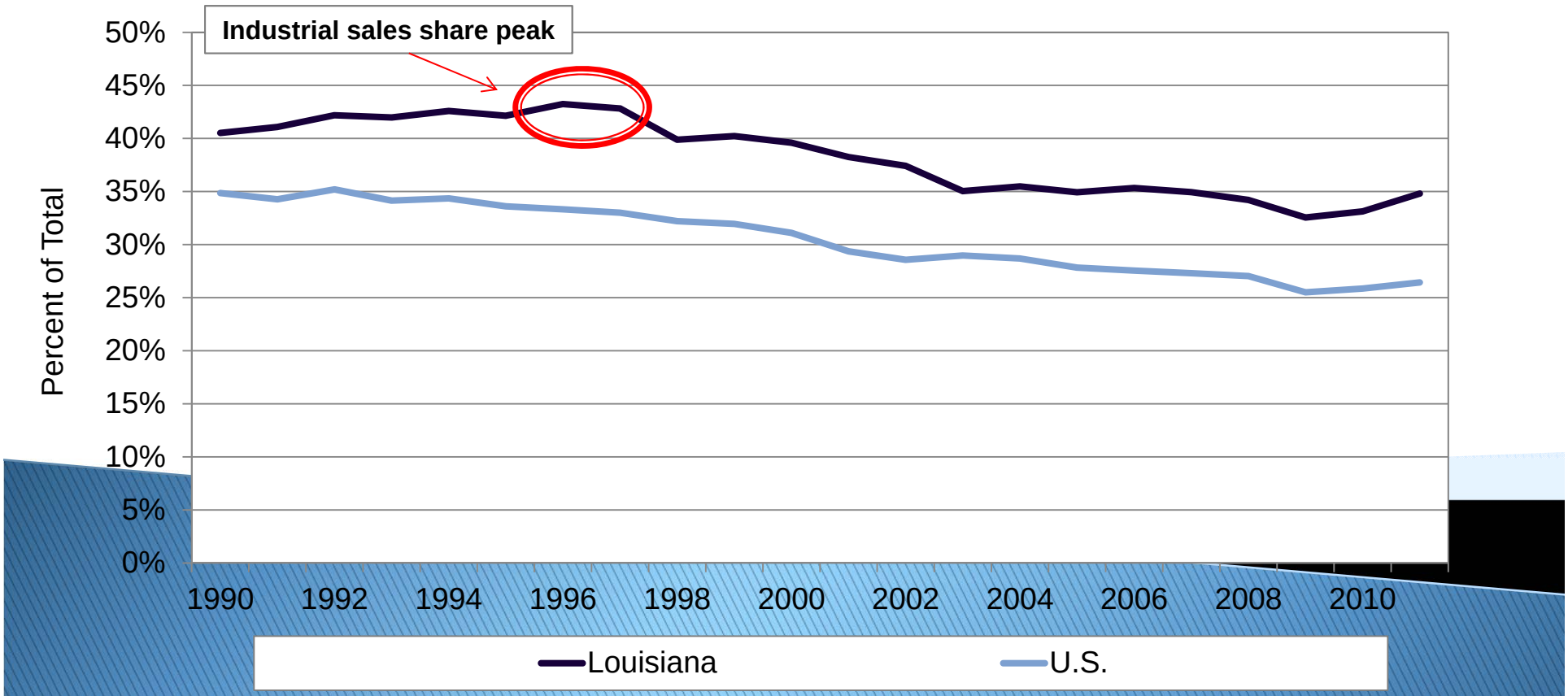
IETC Conference
May 20, 2014
New Orleans, Louisiana

David E. Dismukes, Ph.D.
Center for Energy Studies
Louisiana State University

LSU CENTER FOR ENERGY STUDIES

Industrial Electric Sales as a Percent of Total Electric Sales

In Louisiana, industrial electric sales as a percent of total electric sales have fallen 19.5 percent since their high in 1996. Similarly, during the same period, U.S., industrial electric sales fell just over 20 percent.



Source: Energy Information Administration, U.S. Department of Energy.

Estimated Industrial Average Usage by NAICS (2011)

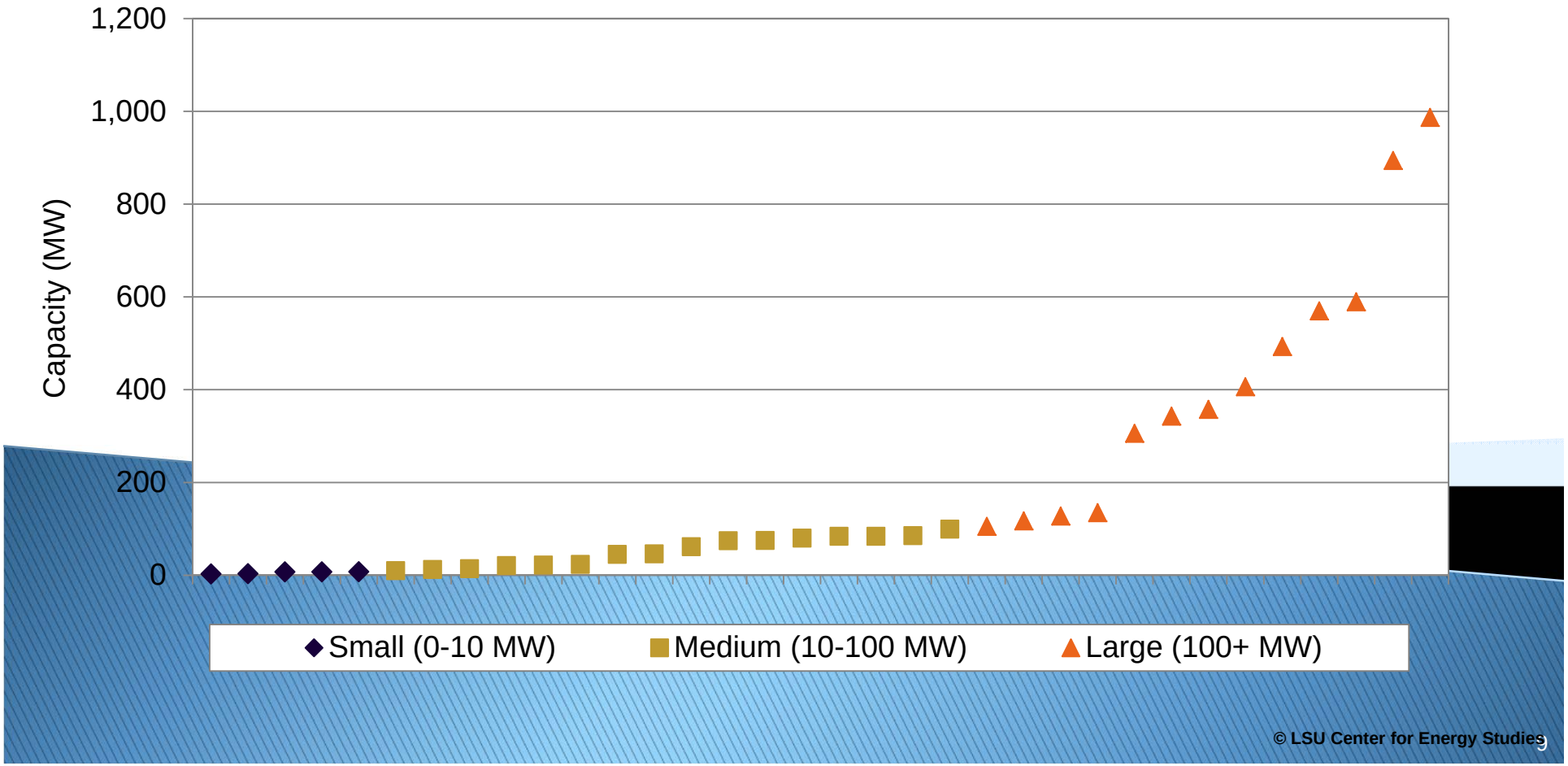
Major industrial electric users include the chemical industry (15.2 million MWh), the refining industry (9.4 million MWh) and the paper products industry (4.0 million MWh). In total, Louisiana industry used 30.1 million MWh.

NAICS Category	Total Electric Use (MWh)	Percent of Total (%)	Per Customer Average Use (MWh)
311-312 Food, Beverage and Tobacco	261,667	0.9%	9,986
313 Textile Mills	4,572	0.0%	5,583
314-315 Textile Products and Apparel	1,010	0.0%	617
316 Leather and Allied Products	1,956	0.0%	1,194
321 Wood Products	165,447	0.6%	14,431
322 Paper Manufacturing	4,032,947	13.4%	378,839
323 Printing and Related Support	38,763	0.1%	3,381
324 Petroleum and Coal Products	9,416,959	31.3%	605,247
325 Chemical Manufacturing	15,159,127	50.4%	272,233
326 Plastics and Rubber	335,630	1.1%	68,310
327 Nonmetallic Minerals	93,505	0.3%	22,837
331 Primary Metal Manufacturing	319,623	1.1%	48,789
332 Fabricated Metal Products	49,419	0.2%	4,642
333 Machinery Manufacturing	107,630	0.4%	6,918
335 Electrical Equip. and Components	14,322	0.0%	17,489
336 Transportation Equipment	53,023	0.2%	6,475
337 Furniture and Related Products	917	0.0%	560
339 Miscellaneous	1,900	0.0%	349
	30,058,415	**100.0%**	**156,197**

Source: MIPD.

Louisiana CHP Facilities by Capacity

There are 35 CHP facilities in Louisiana. These facilities range in size from 3 MW to 987 MW. Five facilities are considered small, or up to 10 MW; 16 facilities are medium (between 10 and 100 MW); and 13 are large, or greater than 100 MW. The large facilities account for 86 percent of total capacity.



Unit Specific CHP Statistics and Trends

CHP Capacity and Average Capacity by Sector

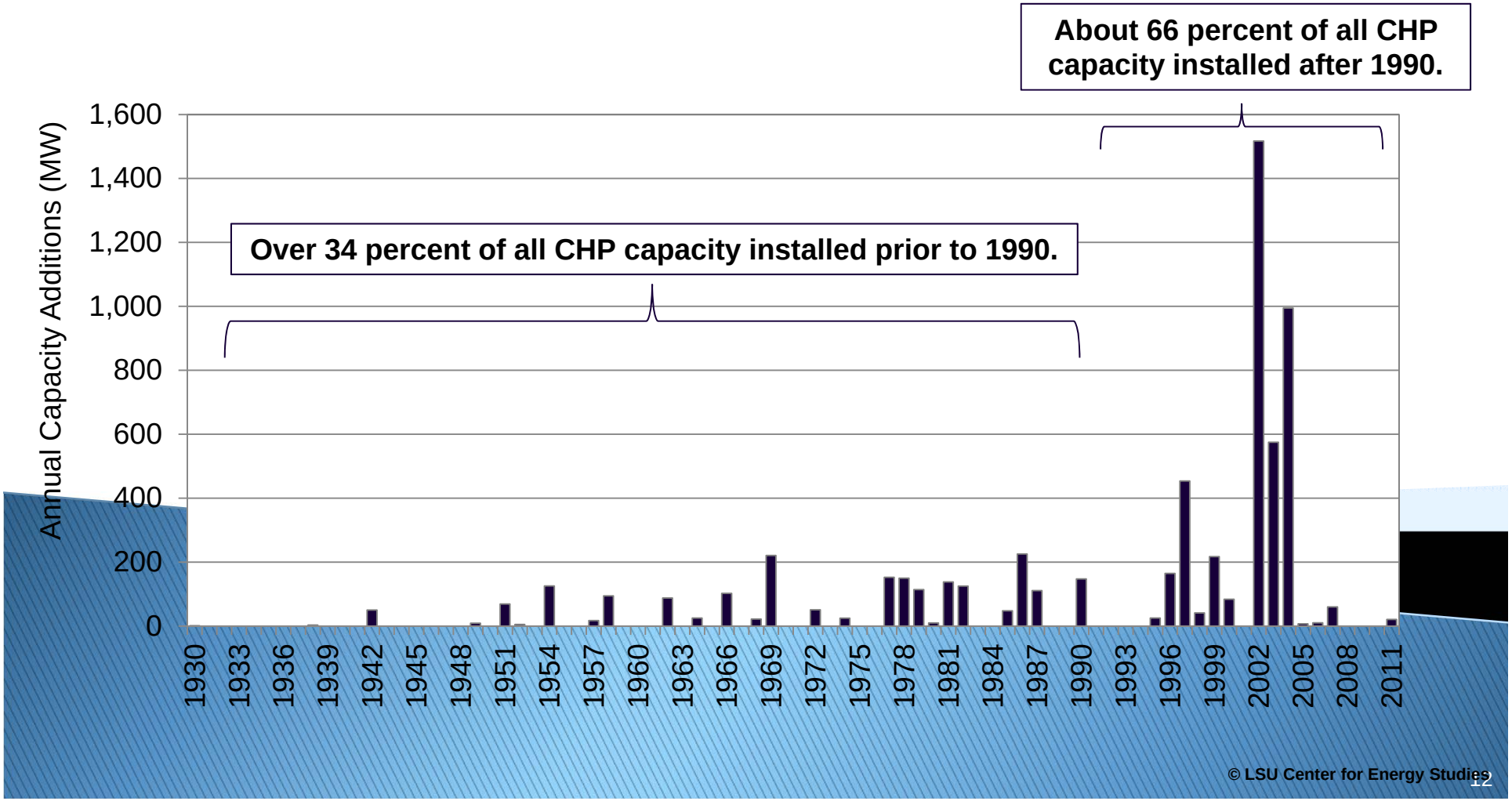
In Louisiana, CHP capacity totals 6,300 MW. Chemical manufacturing is the largest category, accounting for almost 5,000 MW, or about 80 percent of total CHP capacity. These units also tend to be the largest, averaging 91 MW per unit.

NAICS		Capacity (MW)	Percent of Total	Average Capacity (MW)
311-312	Food, Beverage and Tobacco	24	0.4%	2.7
322	Paper Manufacturing	556	8.8%	30.9
324	Petroleum and Coal Products	644	10.2%	35.8
325	Chemical Manufacturing	4,984	79.1%	90.6
331	Primary Metal Manufacturing	84	1.3%	28.0
	Misc	8	0.1%	7.5
	Total	**6,299**	**100.0%**	**60.6**

Note: The "Misc" category includes the Louisiana Tech University Power Plant in Lincoln Parish.

CHP Capacity by Installation Year

Over 1,500 MW (24 percent) of CHP capacity was installed in Louisiana in 2002 alone. Most capacity was developed after 1990.



Summary of Potential Louisiana CHP Market by NAICS

Phase 2 identified 92 facilities with the technical potential for CHP. Most of these are from the chemical and petroleum refining sectors with a combined total of 960 MW of load, or 90 percent of the overall market not already supplied by CHP.

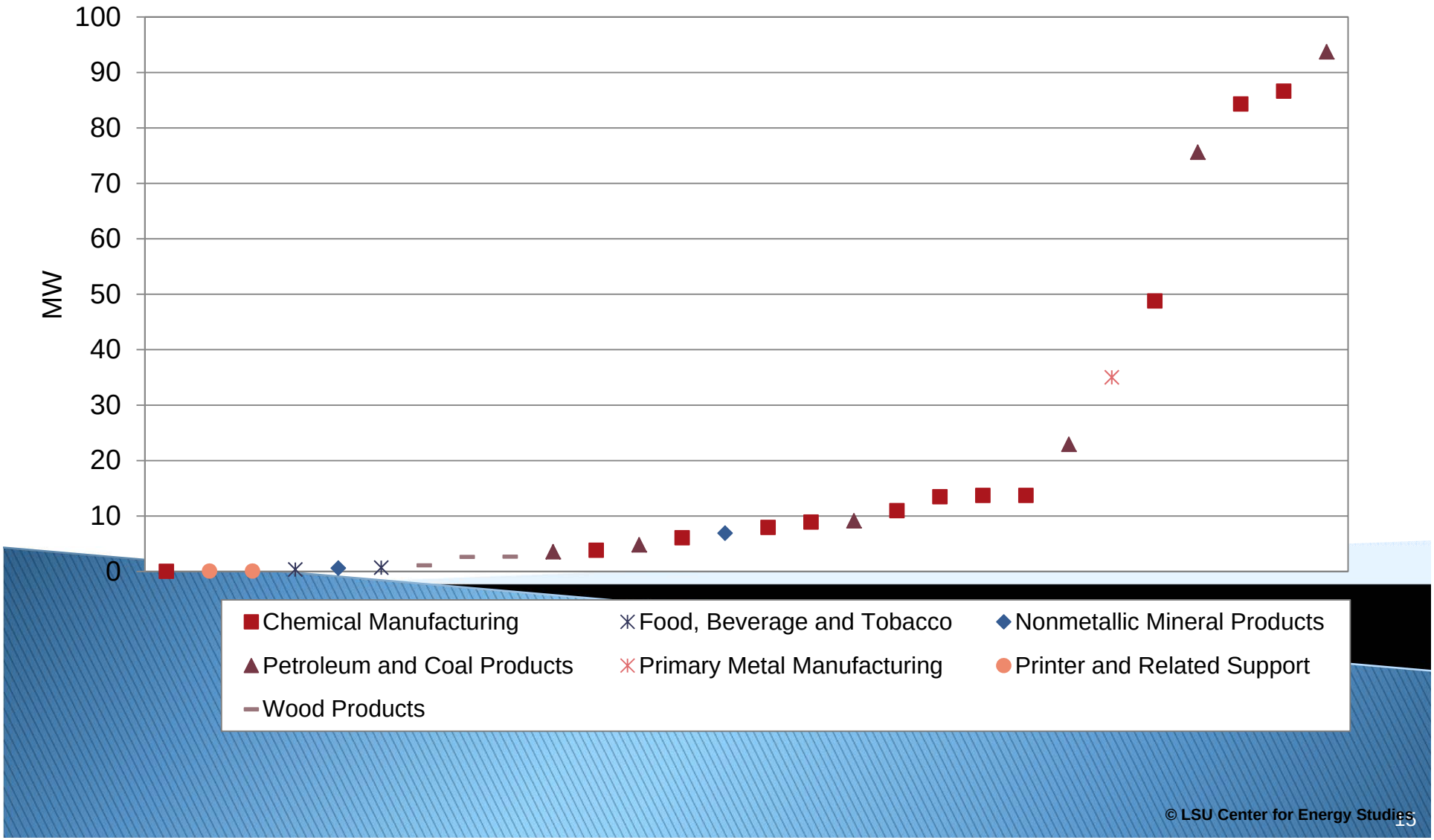
NAICS	Category	Number of Facilities	Electric Use (MWh)	Average Electric Usage (MWh)	Electric Demand (kW)	Average Electric Demand (kW)	Boiler Fuel (MMBtu)	Furnace Fuel (MMBtu)
311-312	Food, Beverage and Tobacco	12	101,133	8,428	15,144	1,262	763,682	481,637
313-314	Textile Mills	-	-	-	-	-	-	-
315	Apparel Manufacturing	-	-	-	-	-	-	-
321	Wood Products	5	141,319	28,264	16,954	3,391	704,101	749,489
337	Furniture and Related Products	-	-	-	-	-	-	-
322	Paper Manufacturing	3	13,595	4,532	2,208	736	33,194	63,397
323	Printer and Related Support	4	6,784	1,696	1,049	262	-	23,663
325	Chemical Manufacturing	42	6,322,795	150,543	741,598	17,657	100,566,995	127,951,718
324	Petroleum and Coal Products	11	1,904,636	-	219,538	-	17,793,514	25,173,321
326	Plastics and Rubber Products	2	53,679	26,840	6,298	3,149	-	152,982
316	Leather and Products	-	-	-	-	-	-	-
327	Nonmetallic Mineral Products	2	65,791	-	7,530	-	-	1,830,284
331	Primary Metal Manufacturing	4	360,461	-	42,056	-	39,942	1,699,779
332	Fabricated Metal Products	1	3,533	3,533	606	606	-	8,000
333-334	Machinery and Electronics	4	56,355	14,089	9,013	2,253	-	146,905
335	Electrical Equipment and Appliances	1	17,489	-	2,802	-	-	100,000
336	Transportation Equipment	1	37,394	37,394	4,280	4,280	158,040	-
339	Misc	-	-	-	-	-	-	-
Total		**92**	**9,084,963**	**98,750**	**1,069,076**	**11,620**	**120,059,468**	**158,381,176**

Summary of Potential Louisiana CHP Market by NAICS

Of the 92 facilities identified in Phase 2, just 28 have been deemed cost-effective. Again, most of these are from the chemical and petroleum refining sectors with a combined total of almost 510 MW of load, or 90 percent of the overall market not already supplied by CHP.

NAICS	Category	Number of Facilities	Electric Use (MWh)	Average Electric Usage (MWh)	Electric Demand (MW)	Average Electric Demand (MW)	Boiler Fuel (MMBtu)	Furnace Fuel (MMBtu)
311-312	Food, Beverage and Tobacco	2	7,496	3,748	1,059	530	43,072	44,395
313-314	Textile Mills	-	-	-	-	-	-	-
315	Apparel Manufacturing	-	-	-	-	-	-	-
321	Wood Products	3	49,319	16,440	6,424	2,141	261,730	165,118
337	Furniture and Related Products	-	-	-	-	-	-	-
322	Paper Manufacturing	-	-	-	-	-	-	-
323	Printer and Related Support	2	1,777	889	202	101	-	5,362
325	Chemical Manufacturing	12	2,550,214	212,518	298,704	24,892	28,411,835	34,271,393
324	Petroleum and Coal Products	6	1,820,658	303,443	209,860	34,977	17,422,593	12,549,190
326	Plastics and Rubber Products	-	-	-	-	-	-	-
316	Leather and Products	-	-	-	-	-	-	-
327	Nonmetallic Mineral Products	2	65,791	32,896	7,530	3,765	-	1,830,284
331	Primary Metal Manufacturing	1	300,000	300,000	35,014	35,014	-	1,092,500
332	Fabricated Metal Products	-	-	-	-	-	-	-
333-334	Machinery and Electronics	-	-	-	-	-	-	-
335	Electrical Equipment and Appliances	-	-	-	-	-	-	-
336	Transportation Equipment	-	-	-	-	-	-	-
339	Misc	-	-	-	-	-	-	-
Total		**28**	**4,795,256**	**171,259**	**558,793**	**19,957**	**46,139,230**	**49,958,242**

Distribution of Potential Louisiana CHP Market, Electric Demand



CHP Policy Issues

CHP developers and utilities have considerable differences of opinion in CHP policy issues that became more divergent during the merchant power development period of the past decade.

From a CHP-developers perspective, past CHP policy/market barriers have historically centered around the same three primary problems:

(1) lack of price transparency (on CHP market/utility sales);

(2) having an **open and objective transmission operations**, planning, and longer-run development process;

(3) lack of market institutions to support expanded sales of CHP output into wholesale markets.

CHP Outlook

The current Louisiana "industrial renaissance," coupled with Entergy's recent move to the Mid-continent Independent System Operator ("MISO"), should help to alleviate many of the perceived developer problems associated with in-state CHP expansion.

- Over $61 billion in industrial, energy-intensive capital expenditures ("capex"), will result in the need for considerable new generation capacity, some of which will likely be CHP-oriented.
- Having the main Louisiana industrial corridor included in the MISO footprint will help to provide:

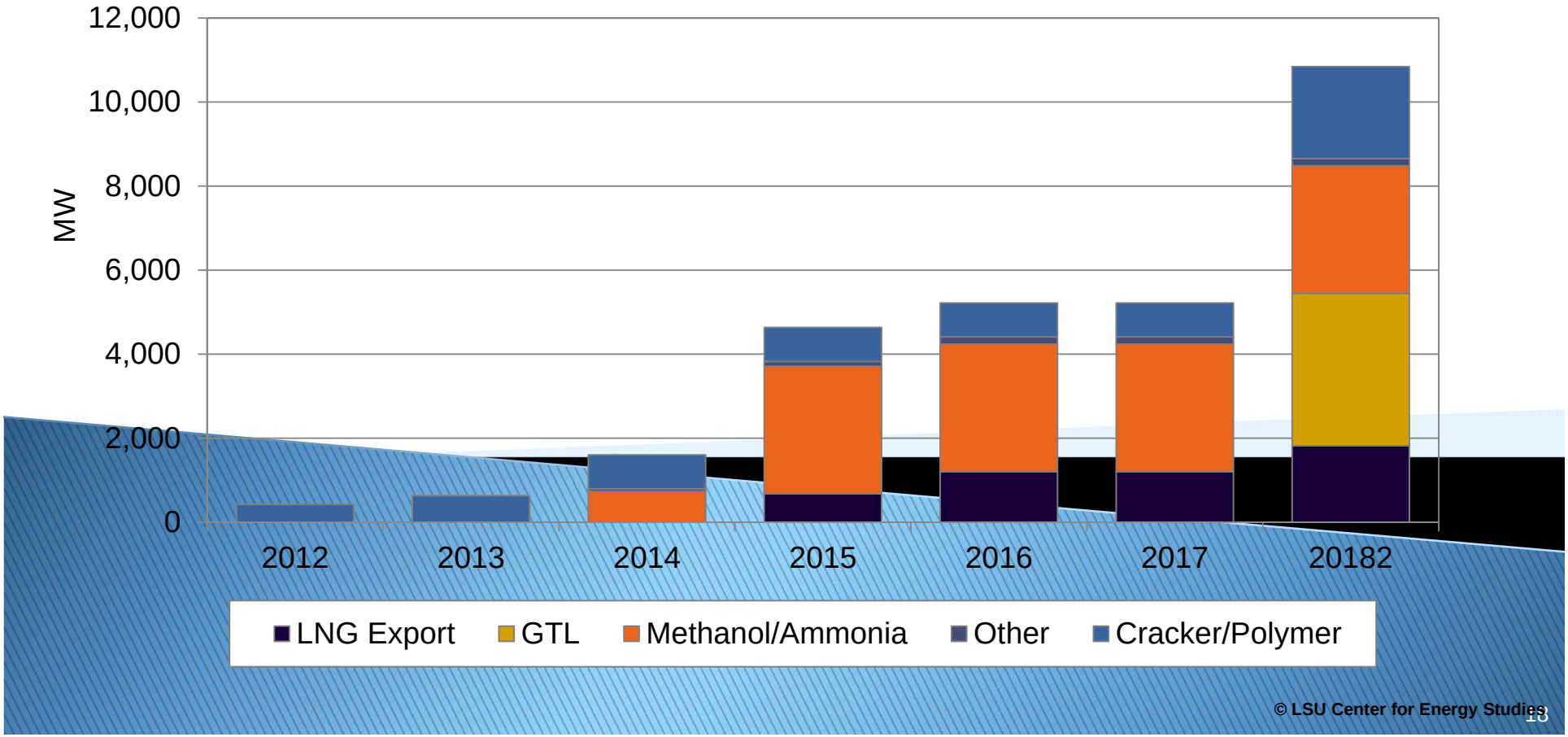
  (1) price discovery and transparency;

  (2) open access transmission operations and planning; and

  (3) greatly expanded market scope for all suppliers.

Electric Capacity by Sector and Online Date

Capacity requirements associated with all currently-announced projects would come close to doubling in-state generation capacity. All of this capacity has the technical capabilities for CHP development. The extent of CHP development will be a function of final project development, which is unknown at this time.

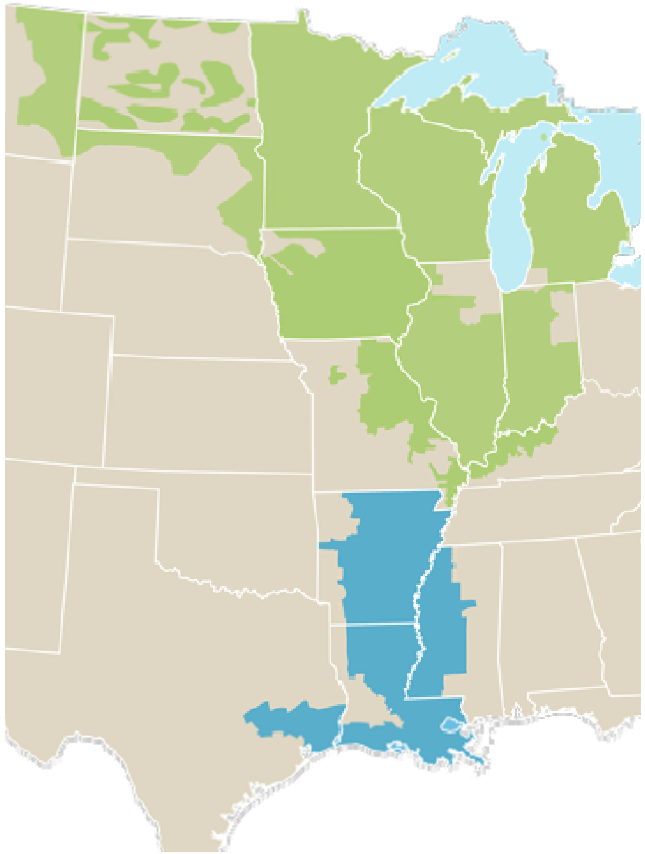


Potential Economic Impacts/Benefit: Construction, State

Not quiet as clear will be the additional power/gas requirements for all the new residential and commercial activities supporting development/operation. Should elevate regional usage trends relative to national averages and provide for additional opportunities to sell currently-underutilized CHP capacity to host utilities.

	Construction Impacts									
	Total	2011	2012	2013	2014	2015	2016	2017	2018	2019
Output (million $)										
Direct	$ 17,080.2	$ 4.4	$ 1,715.4	$ 2,458.1	$ 3,535.5	$ 3,765.0	$ 3,764.9	$ 1,696.2	$ 140.7	$ -
Indirect	$ 2,742.2	$ 0.7	$ 275.4	$ 394.6	$ 567.6	$ 604.5	$ 604.4	$ 272.3	$ 22.6	$ -
Induced	$ 5,315.3	$ 1.4	$ 533.8	$ 765.0	$ 1,100.2	$ 1,171.7	$ 1,171.6	$ 527.9	$ 43.8	$ -
Total	**$ 25,137.6**	**$ 6.4**	**$ 2,524.6**	**$ 3,617.7**	**$ 5,203.3**	**$ 5,541.1**	**$ 5,540.9**	**$ 2,496.4**	**$ 207.0**	**$ -**
Employment (jobs)										
Direct	115,726	30	11,623	16,655	23,955	25,510	25,509	11,493	953	-
Indirect	18,500	5	1,858	2,662	3,829	4,078	4,078	1,837	152	-
Induced	47,241	12	4,745	6,799	9,779	10,414	10,413	4,692	389	-
Total	**181,468**	**47**	**18,225**	**26,116**	**37,563**	**40,001**	**40,000**	**18,022**	**1,495**	**-**
Wages (million $)										
Direct	$ 5,566.6	$ 1.4	$ 559.1	$ 801.1	$ 1,152.3	$ 1,227.1	$ 1,227.0	$ 552.8	$ 45.8	$ -
Indirect	$ 804.7	$ 0.2	$ 80.8	$ 115.8	$ 166.6	$ 177.4	$ 177.4	$ 79.9	$ 6.6	$ -
Induced	$ 1,493.1	$ 0.4	$ 150.0	$ 214.9	$ 309.1	$ 329.1	$ 329.1	$ 148.3	$ 12.3	$ -
Total	**$ 7,864.5**	**$ 2.0**	**$ 789.8**	**$ 1,131.8**	**$ 1,627.9**	**$ 1,733.6**	**$ 1,733.5**	**$ 781.0**	**$ 64.8**	**$ -**

MISO Integration: Competitive Wholesale Market Changes/Benefits



- There are a number of wholesale market benefits that can arise from the expansion of MISO to the Gulf Coast that include:
- Greater power generation market efficiencies.
- The ability to move highly-efficient and environmentally-friendly natural gas fired generation into an area historically dominated by coal-fired generation.
- Greater market scope opportunities by providing lower-cost, highly efficient natural gas generators easier access to quickly growing mid-western electric power markets.

Source: Entergy.

Policy Summary

- **Projected industrial development** is large and unprecedented and will create **new opportunities for CHP**.
- The **"multiplier" impacts** associated with this economic activity and its impacts on electricity use are not often considered but **could move** what has been **flat to decreasing power and gas use upward** for smaller use customer classes (**increasing the opportunities for CHP off-system sales**).
- **Environmental regulations** will **preference more gas**: **movement to MISO** will facilitate the **movement of gas-by-wire**, including (new/existing) CHP-based gas-by-wire.
- **MISO will provide** better price and transmission **planning transparency** and will likely lead to a **considerable re-investment in transmission assets opening up historic bottlenecks** that have restricted past CHP output flows.
- History shows how quickly **reserve/capacity margins can evaporate**: **new economic growth could result in the need for capacity quickly.**

Conclusions

- Louisiana has a long historic with CHP development. Over 24 percent of all in-state generation capacity is CHP-based.
- Some additional industrial plants have the technical capability for CHP (~1,500 MW), while a smaller number of plants have the ability to cost-effectively generate CHP-based electricity (~600 MW), but for some reason, are not employing this potential efficiency opportunity. Thus, most of those facilities that can cogenerate, do.
- Considerable future CHP opportunities given $61 billion in new industrial capex: results in estimated power requirement of close to 10 GW (assuming all is developed).
- MISO integration will likely eliminate decades-old issues associated with price discovery; transmission operations/planning transparency; and market scope.
- The future looks very bright for the operation of existing CHP, and the development of new CHP, in Louisiana.

US DOE Support for CHP

Better Buildings Accelerator: Combined Heat and Power for Resiliency

- The **Combined Heat and Power (CHP) for Resiliency Accelerator** will support and expand the consideration of CHP solutions to keep critical infrastructure operational every day and night regardless of external events

NEW RELEASE -- U.S. DOE ANALYSIS: COMBINED HEAT AND POWER (CHP) TECHNICAL POTENTIAL IN THE UNITED STATES

- http://www.energy.gov/sites/prod/files/2016/04/f30/CHP%20Technical%20Potential%20Study%203-31-2016%20Final.pdf

Other Actions that may Support CHP

2015 Highway Bill (FAST ACT)

- Contains **provisions dealing with Energy Security** and requires the **Secretary** of the US **Department of Energy** to Study and Report to Congress. The Report will **assess the US energy security posture**, identify **metrics for evaluating energy-related a**ctions with respect to their effects on energy security, and include an **implementation strategy** for ensuring that metrics are applied consistently throughout government.

- **EPA Combined Heat and Power (CHP) Partnership**

New CHP Study by LSU Center for Energy Studies

- **Update prior work** on assessing current state of CHP technical/cost-effectiveness potential given the industrial/petrochemical expansions
- **Examine** the degree to which CHP can assist in facilitating **electric system resiliency and reliability**
- **Degree to which CHP** could be **used as part of a compliance option** for meeting **potential regulatory requirements** such as those contained in the Environmental Protection Agency's Clean Power Plan

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