Date of Hearing: April 23, 2025

ASSEMBLY COMMITTEE ON UTILITIES AND ENERGY
Cottie Petrie-Norris, Chair
AB 1095 (Papan) – As Amended April 21, 2025

SUBJECT: Data centers: waste heat energy

SUMMARY: Qualifies waste heat capture and conversion technologies used at data centers for the Climate Catalyst Program administered by the California Infrastructure and Economic Development Bank (IBank).

EXISTING LAW:

1) California Global Warming Solutions Act of 2006, directs the California Air Resources Board (CARB) to achieve emissions reductions and to complete a scoping plan for achieving those reductions. (Health and Safety Code § 38560)

2) Creates the Climate Catalyst Revolving Loan Fund Program at the IBank and prescribes which projects are eligible for funding within the program. (Government Code §§ 63048.9-63048.100)

3) Establishes the Waste Heat and Carbon Emissions Reduction Act, which aims to promote the development of efficient combined heat and power systems that utilize waste heat to generate electricity and thermal energy. Encourages CHP systems with a generating capacity of up to 20 megawatts, provided they meet specific efficiency and emissions standards. (Public Utilities Code §§ 2840–2843)

FISCAL EFFECT: Unknown. This bill is keyed fiscal, and will be referred to the Assembly Committee on Appropriations for its review.

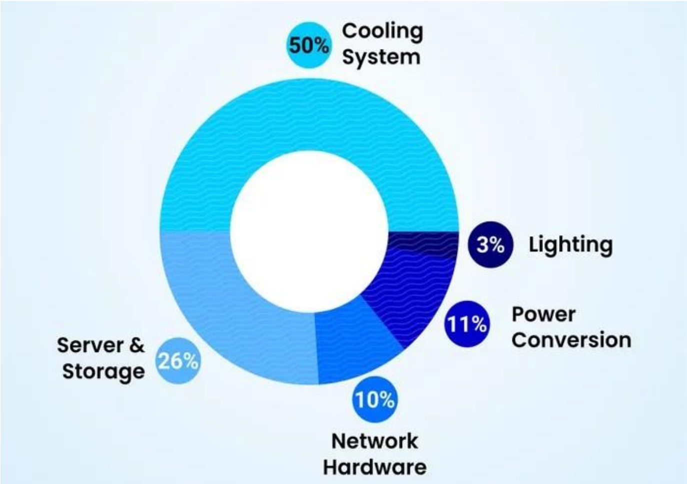
CONSUMER COST IMPACTS: Unknown, likely negligible for the broader population.

BACKGROUND:

What is Waste Heat Recovery? – Waste heat recovery is the process of capturing and reusing the heat generated in industrial processes that would otherwise be lost to the environment. This approach enhances energy efficiency and reduces fuel consumption, leading to cost savings and lower greenhouse gas emissions. Waste heat can be recovered from sources such as exhaust gases from furnaces, gas turbines, and engines, as well as from cooling water and other heated industrial streams. Implementing waste heat recovery systems has become increasingly important in energy-intensive industries like cement, steel, glass, and chemical manufacturing, where significant energy losses occur.[1] Beyond environmental benefits, waste heat recovery contributes to improved sustainability and competitiveness in industrial operations.[2]

How do Data Centers and Artificial Intelligence Use Energy? – Data centers are facilities that house large volumes of high-performance computers, information technology, storage systems, and computing infrastructure. They are crucial for maintaining internet-based communications and providing services such as cloud-based computing, training and inference of artificial intelligence algorithms, as well as mining for cryptocurrency. There are multiple parts of the data center that consume energy, with the primary consumption found in the servers and storage, as well as the cooling system, as shown in Figure 1.[3]

Figure 1: Parts of a data center that use energy.[3]



Artificial intelligence (AI) models are trained on datasets to recognize certain patterns and make decisions without human intervention. This training can take anywhere from hours, up to months. To generate more sophisticated models, the size of the datasets increase, as does the demand for computational resources (measured in floating point operations per second or FLOPS). As training compute demand grows, the need for larger data centers and the requirement for more energy grows as well.

Current predictions around growth in AI and data centers have led some to believe that there is an inappropriate hysteria around the future energy demands in the industry. Some scholars note that similar concerns were voiced in the 1990s but that technological advances prevented the predicted energy crunch.[4,5] Advances in efficiency are likely to change the AI landscape through new model design, innovations in chip and hardware efficiency, and better cooling technologies.[6,7,8,9] The release of the AI model DeepSeek, which required significantly less computing power to train, supports the possibility that energy costs in training AI may not

[1] United States Department of Energy. (2008). *Waste Heat Recovery: Technology and Opportunities in U.S. Industry*. and Saidur, R., Rezaei, M., Muzammil, W. K., Hassan, M. H., Paria, S., & Hasanuzzaman, M. (2010). Technologies to recover exhaust heat from internal combustion engines. *Renewable and Sustainable Energy Reviews, 16*(8), 5649–5659.
[2] Zhang, H., Zhang, D., Cai, W., & Liu, M. (2017). Waste heat recovery research – A review of recent developments and future prospects. *Energy Procedia, 105*, 1987–1992.
[3] Wu, Jiahong, Yuan Jin, and Jianguo Yao. "EC 3: Cutting cooling energy consumption through weather-aware geo-scheduling across multiple datacenters." *IEEE Access* 6 (2017): 2028-2038.
[4] Masanet, Eric, et al. "Recalibrating global data center energy-use estimates." Science 367.6481 (2020): 984-986.
[5] Shayle Kann, "A skeptic's take on AI electricity load growth", *Latitude Media*. March 6, 2025.
[6] Google, "Announcing Trillium, the sixth generation of Google Cloud TPU," May 14, 2024
[7] Shayle Kann, "Can chip efficiency slow AI's energy demand?" *Catalyst*, July 18, 2024
[8] Kylie Foy, "New tools are available to help reduce the energy that AI models devour" *MIT News*, October 5, 2023.
[9] Aljbour, Jordan, Tom Wilson, and P. Patel. "Powering Intelligence: Analyzing Artificial Intelligence and Data Center Energy Consumption." EPRI White Paper no. 3002028905 (2024).

continue to grow as expected.[10] Recent studies have also shown that if demand response and load flexibility programs are implemented at data centers, peak loads on the grid can be avoided.[11]

Barriers to Data Center Waste Heat Recovery – Data centers consume vast amounts of electricity, much of which is converted into heat that is typically expelled through cooling systems. Instead of wasting this thermal energy, waste heat recovery systems can redirect it for useful purposes such as heating nearby buildings, providing hot water, or powering absorption chillers for additional cooling at the data center. For example, district heating networks can integrate recovered heat from data centers to supply residential or commercial heating, significantly reducing reliance on fossil fuels. [12] With increasing global demand for digital services, optimizing data center energy use through waste heat recovery not only lowers operational costs but could also contribute to climate goals by reducing total carbon emissions.[13]

Carbon Catalyst Program – The Carbon Catalyst Program is intended to provide financial support for infrastructure projects that work toward the State's climate goals. The Climate Catalyst Act,[14] passed in 2020, established the Climate Catalyst Revolving Loan Fund to be administered by IBank. This fund is available to Climate Catalyst Projects, defined broadly as any in-state improvement that furthers the state's climate goals.[15] Statute has added specificity to this broad mandate by identifying sustainable vegetation management and forestry practices,[16] agricultural improvements,[17] electric transmission projects,[18] and projects that can draw down federal dollars[19] as eligible funding recipients. As of January 23, 2025, the U.S. Environmental Protection Agency deposited $446,257,500 into the Climate Catalyst Fund at IBank as part of the federal Inflation Reduction Act of 2022.

COMMENTS:

1) *Author's Statement.* According to the author, "Assembly Bill (AB) 1095 is a pivotal step toward enhancing California's clean energy innovation. This bill will make data centers that pursue waste heat conversion technologies eligible for financing under the state's Climate Catalyst Program. With data centers accounting for a significant portion of the state's energy consumption and their waste heat largely going untapped, AB 1095 provides an innovative solution by encouraging the recycling of this otherwise wasted energy. By supporting investment in projects where data center operators repurpose their waste heat, this bill not only incentivizes energy efficiency but also aligns with California's broader climate goals of decarbonization and reducing greenhouse gas emissions. The proposal is timely, as it aligns with the growing demand for cloud

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[10] Guo, Daya, et al. "Deepseek-r1: Incentivizing reasoning capability in llms via reinforcement learning." arXiv preprint arXiv:2501.12948 (2025).
[11] Norris, Tyler, et al. "Rethinking Load Growth: Assessing the Potential for Integration of Large Flexible Loads in US Power Systems." (2025).
[12] Van Heddeghem, W., Lambert, S., Lannoo, B., Colle, D., Pickavet, M., & Demeester, P. (2014). Trends in worldwide ICT electricity consumption from 2007 to 2012. Computer Communications, 50, 64–76.
[13] Masanet, E., Shehabi, A., Lei, N., Smith, S., & Koomey, J. (2020). Recalibrating global data center energy-use estimates. Science, 367(6481), 984–986.
[14] Government Code § 63048.9-63048.100
[15] Government Code § 63048.92(b)
[16] Government Code § 63048.93 (f)(1)
[17] Government Code § 63048.93 (f)(2)
[18] Government Code § 63048.93 (f)(3)
[19] Government Code § 63048.93 (f)(4-5)

services and regenerative AI technologies, ensuring that California remains at the forefront of clean energy advancement while effectively addressing the energy needs of the future."

2) *Purpose of Bill.* According to the author, there are over 300 data centers in California supporting nearly all business and government entities. Data centers store, process, and disseminate information critical to daily operations. Data centers in California are estimated to consume approximately 2% of the state's total electricity demand, according to a 2024 report by the California Energy Commission.[20] However, some analyses suggest this figure could be as high as 10%, particularly in regions with high concentrations of data centers.[21] For instance, in Santa Clara, CA – a major hub for data centers – over 50 server farms consume about 60% of the city's electricity.[22]

   As noted above, much of data center energy consumption is converted into heat that is typically expelled through cooling systems. Instead of wasting this thermal energy, waste heat recovery systems can redirect it for useful purposes. However, one of the primary barriers to the widespread adoption of waste heat recovery in data centers is the high capital cost associated with implementing the necessary infrastructure. Installing heat exchangers, piping systems, thermal storage units, and distribution networks – especially for integration with district heating systems – requires significant upfront investment. Additionally, many data centers are not located near facilities that can readily use the recovered heat, which increases the cost of transporting thermal energy over long distances and may require retrofitting existing buildings or constructing entirely new heat networks.[23] Furthermore, the typically low-grade nature of waste heat from data centers, often below 40°C, limits its direct usability without further boosting via heat pumps, which adds both capital and operational costs. The return on investment for waste heat recovery in data centers can be slow, especially in regions with low energy prices or where regulatory incentives for energy reuse are lacking.[24] For these reasons, other efficiency measures – such as improved cooling or software solutions[25] – are often prioritized over waste heat recovery applications.

   This bill seeks to provide a financial motivation to encourage waste heat recovery applications, by adding its usage in data centers as eligible technologies within the statewide Climate Catalyst Program. As of January 23, 2025, that program had almost $450 million available, as noted above.

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[20] CEC, *Demonstration of Low-Cost Data Center Liquid Cooling;* June 2024; CEC-500-2024-061; https://www.energy.ca.gov/sites/default/files/2024-06/CEC-500-2024-061.pdf
[21] *Ibid*, in reference to a Digital Power Group report
[22] Khari Johnson, "Crackdown on power-guzzling data centers may soon come online in California;" *CalMatters;* February 18, 2025; https://calmatters.org/economy/technology/2025/02/data-center-crackdown-to-protect-california-electricity-rates/?utm_source=chatgpt.com
[23] Radmehr, A., Lou, Y., GhaffarianHoseini, A., & GhaffarianHoseini, A. (2022). Waste heat recovery from data centers: Potential, challenges, and future outlook. *Renewable and Sustainable Energy Reviews, 158,* 112088
[24] Shehabi, A., Smith, S., Sartor, D., Brown, R., Herrlin, M., Koomey, J. G., et al. (2016). *United States Data Center Energy Usage Report*. Lawrence Berkeley National Laboratory.
[25] CEC, *Enabling Energy Efficient Data Center in Smart Power Distribution Systems*; May 2024; CEC-500-2024-035; https://www.energy.ca.gov/sites/default/files/2024-05/CEC-500-2024-035.pdf?ref=implicator.ai

3) *Related Legislation.*

AB 222 (Bauer-Kahan, 2025) among its provisions, mandates that developers of artificial intelligence models report the energy used to train the model, and mandates data centers to report energy usage to the California Energy Commission (CEC). It establishes the authority of the CEC to implement efficiency requirements on data centers in the state. Status: In the Assembly Committee on Privacy and Consumer Protection after passage in this committee on April 2, 2025 on a 13-5-0 vote.

AB 1280 (Garcia, 2025) qualifies thermal energy storage, including waste heat recovery, for multiple financial incentive programs administered by the IBank, including the Climate Catalyst Program. Requires the CEC to expand programmatic language to include project labor agreements and community benefits agreements, among other additions. Status: In the Assembly Committee on Natural Resources after passage in this committee on April 2, 2025, on a 17-0-1 vote.

SB 787 (McNerney, 2025) would establish the Task Force on Industrial Policy and Clean Energy Development to identify policies and make recommendations on industrial policies that accelerate decarbonization. Status: Set for hearing on April 21, 2025 in Senate Committee on Energy, Utilities & Communications.

4) *Prior Legislation.*

AB 2109 (Carrillo) exempts large industrial customers from paying certain surcharges on their reductions in electricity if that reduction is achieved through an industrial process heat recovery technology with specified requirements. Status: Chapter 700, Statutes of 2024.

AB 2083 (Berman, 2024) requires the CEC to assess the potential for achieving an 85 percent reduction below 1990 levels in emissions from industrial heat application processes by January 1, 2045. Status: Held under submission in the Senate Appropriations Committee.

AB 841 (Berman, 2023) would have required CEC to create a roadmap for electrifying industrial processes, including processes requiring heat, as specified. Status: Held under submission in the Senate Appropriations Committee.

AB 78 (Budget), among its multiple provisions, established the Climate Catalyst Revolving Loan Fund at the IBank. This allowed the state to receive funds from non-state governmental entities and private sources to make loans for projects that further the state’s climate goals. Status: Chapter 10, Statutes 2020.

5) *Double Referral.* This bill is double referred. Upon passage in this committee, it will be referred to the Assembly Committee on Natural Resources for its review.

REGISTERED SUPPORT / OPPOSITION:

Support

None on file.

Opposition

The Utility Reform Network (TURN) – *submitted for a prior version of the measure*

Analysis Prepared by: Laura Shybut / U. & E. / (916) 319-2083