The Climate Reality Project
PHILIPPINES

QUANTIFYING THE EMISSIONS AND ELECTRICITY GENERATION COSTS OF THE PHILIPPINES' GREEN ENERGY OPTION PROGRAM

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I
ABSTRACT

The Green Energy Option Program (GEOP) is a pioneering market-based renewable energy mechanism in the Philippines that allows consumers to directly procure electricity from renewable energy suppliers, rather than being captive to the procurement choices of their distribution utilities. Despite strong market interest, comprehensive financial savings and emissions reduction data remain limited. To address this, we assessed 61 GEOP registered meters, spanning 2,501 meter-month observations from March 2022 to October 2025. GEOP-registered meters reduced mean monthly emissions by 87% relative to BAU (130,611 vs. 15,474 kgCO_2). One-way ANOVA on ln-transformed data confirmed the difference was statistically significant ($F_{(1,2086)}$ = 42,865, p <0.0001). Electricity generation costs were on average 29% lower under GEOP (PHP 901,724) than BAU (PHP 1,269,042), also confirmed by ANOVA ($F_{(1,2086)}$ = 117.2, p <0.0001), though cost savings varied depending on contract and load profile. GEOP demonstrates a high retention rate (97.7%) and sustained growth, highlighting its potential as a scalable and cost-effective renewable energy market mechanism. Challenges such as limited public awareness, regional disparities, and constrained renewable energy supply remain. GEOP's success illustrates the feasibility of competitive, consumer-driven renewable energy markets in Southeast Asia and offers a model for expanding clean energy access while supporting corporate sustainability goals.

Keywords: Green Energy Option Program (GEOP); carbon emissions; renewable energy procurement; electricity costs; Philippines

Photo credit: Aerial view of Raslag Solar Power Plant in Mexico, Pampanga, Philippines | MDV Edwards | Shutterstock

II
METHODOLOGY

A preliminary version of this study entitled "Enabling the Renaissance of Renewable Energy in the Philippines," was posted online in February 2025 on our organization's website. The current manuscript uses updated data through December 2025 and includes refined analyses and expanded discussion.

SAMPLE COLLECTION

Using the publicly available registry of GEOP market participants published by the Independent Electricity Market Operator of the Philippines (IEMOP), we identified 833 active GEOP-registered meters as of December 2025. This registry was used to characterize market participation, sectoral composition, and regional distribution.

Meters with less than six (6) months of participation, including those registered on or after May 1, 2025, were excluded to ensure adequate exposure to the program. Data collection concluded on October 30, 2025. After applying this eligibility criterion, 627 meters remained in the analytic population.

Of the 627 eligible meters, 445 were contacted via e-mail, telephone, or in-person outreach. 121 meters agreed to participate in an interview (19% of eligible meters). Among these, 61 meters provided complete data on electricity consumption, electricity costs, and generation rates and were included in the final analysis.

The final sample represents approximately 10% of the eligible population. Under standard assumptions for proportion estimates, this sample size corresponds to an estimated margin of error of approximately ±12% at the 95% confidence level. Participation was voluntary, and data availability depended on the voluntary disclosure of end-users. Accordingly, the findings are subject to potential non-response bias.

QUALITATIVE DATA COLLECTION

We collected qualitative data through semi-structured interviews conducted via on-site visits, online video conferencing platforms (e.g., Zoom and Google Meet), and written correspondence (e-mail). GEOP end-users were asked to provide insights on the following topics:

- Organizational background
- Motivations for participation in GEOP
- Renewable energy supplier(s)
- Changes in electricity costs following GEOP participation
- Broader organizational impacts, including business growth, employee welfare, and strategic direction
- Plans for continued participation under GEOP
- Other carbon emissions reduction or avoidance initiatives undertaken by the organization

CARBON EMISSIONS ASSESSMENT

We assessed the impact of GEOP participation on carbon emissions by modeling two scenarios: a business-as-usual scenario in which electricity is sourced from the respective distribution utility or electric cooperative, and a GEOP scenario in which electricity is supplied by registered GEOP suppliers.

Under the business-as-usual scenario, we calculated carbon emissions by multiplying each electric meter's monthly power consumption by the operating margin emission factor for the Luzon-Visayas Grid, based on the National Grid Emission Factor for 2019-2021. The operating margin emission factor accounts for all operational power plants within the grid.

Under the GEOP scenario, supplier-specific emission factors were applied to the same monthly consumption data. When supplier-specific emission factors were not publicly available, the emission factor for geothermal power plants operated by the Energy Development Corporation, a registered GEOP supplier, was used to provide a conservative estimate.

ELECTRICITY GENERATION COST ASSESSMENT

The impact of GEOP participation on electricity generation costs was analyzed using the same BAU and GEOP scenarios. Under the BAU scenario, generation costs were calculated by multiplying each meter's monthly electricity consumption by the corresponding distribution utility or electric cooperative's monthly generation rates.

Under the GEOP scenario, generation costs were computed using the generation rates provided by GEOP suppliers. Other cost components, including distribution, transmission, and taxes, were assumed to remain constant across scenarios and were therefore excluded from the analysis.

DATA ANALYSIS

Data analysis was conducted using R 4.4.1. We used one-way analysis of variance (ANOVA) to determine whether carbon emissions (kgCO_2) and electricity generation costs significantly differed between the business-as-usual and GEOP scenarios, and Tukey's honestly significant difference test post-hoc analysis.

Emissions data were analyzed in two ways: (i) natural log transformation (ln(x + 0.01)) was applied to satisfy normality assumptions for statistical tests, and (ii) descriptive statistics are reported as arithmetic means in original units (kgCO_2) based on the raw monthly data per meter.

In compliance with RA 10173 or the Data Privacy Act of 2012, all GEOP-registered meters were anonymized. Each alphabetic code represents a unique organization, while numeric identifiers denote individual GEOP-registered meters.

Photo credit: Aerial view of Geothermal Power Plant in Mindanao, Philippines | MaryTraveller | Shutterstock

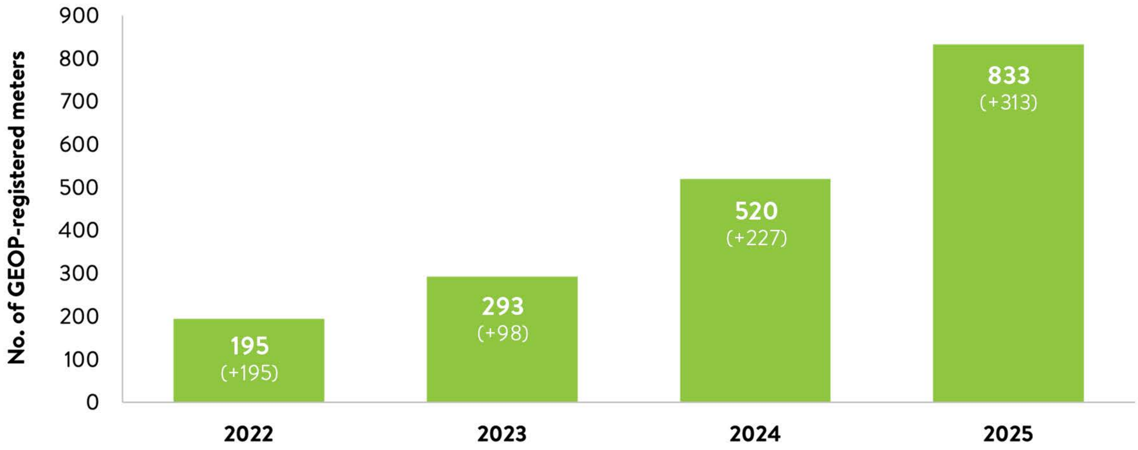
III

RESULTS

PARTICIPATION TRENDS OF GEOP-REGISTERED METERS

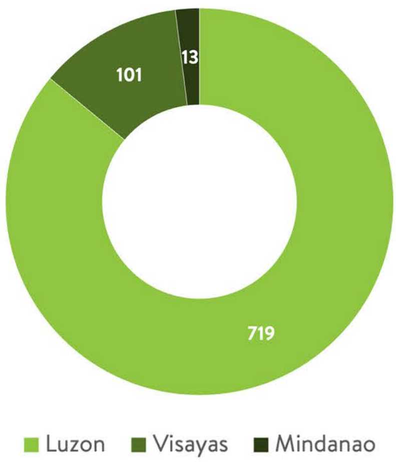
Since its launch, GEOP has registered a total of 853 electric meters, of which 833 remain active, alongside 21 renewable energy suppliers and 1 local retail electricity supplier. Annual registrations totaled 195 in 2022, 98 in 2023, 227 in 2024, and 313 in 2025 (Figure 1). Participation retention has been high, with only 20 end-users exiting the program, resulting in a retention rate of 97.7%.

Figure 1. Number of GEOP-registered meters from March 2022 to December 2025. Data from the Independent Electricity Market Operator of the Philippines Inc. registry.



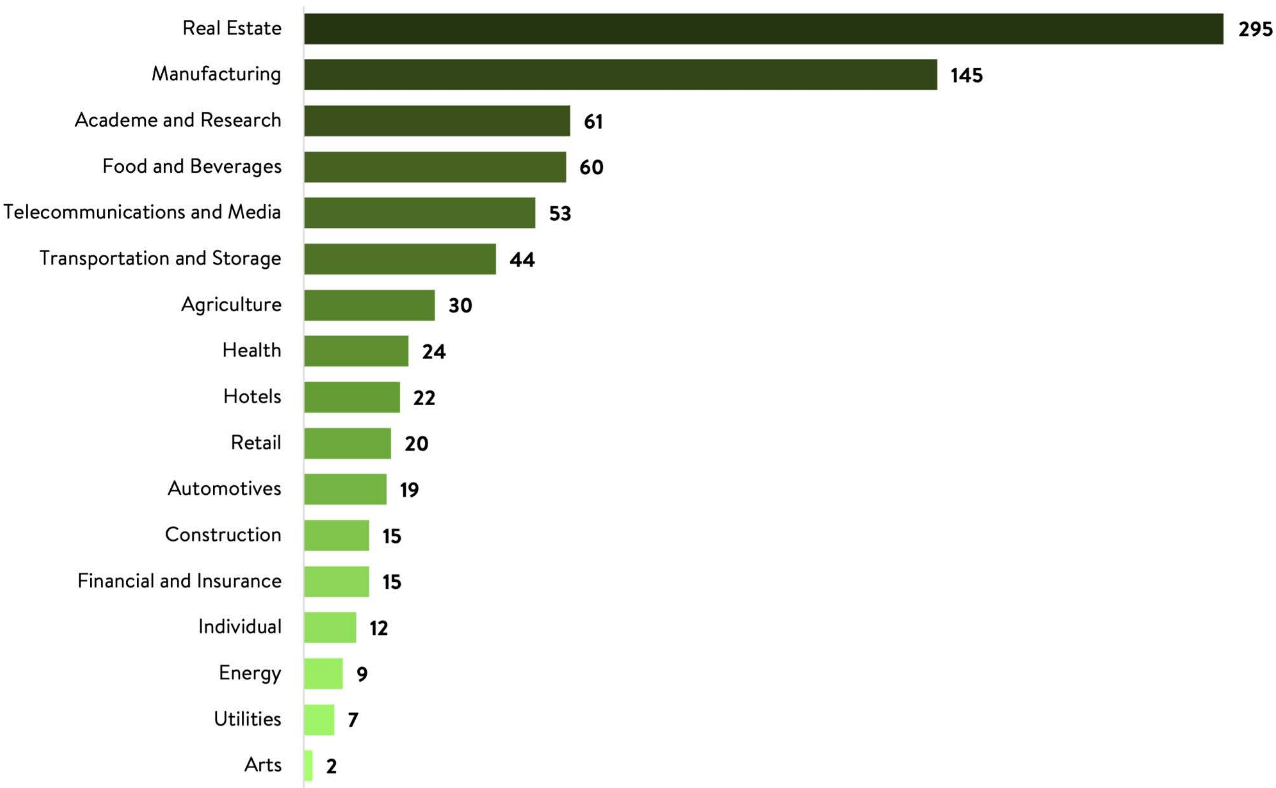
In terms of geographic distribution, 86% of GEOP-registered meters are located in Luzon, 12% in Visayas, and 2% in Mindanao (Figure 2). Approximately 50% of meters are situated in the National Capital Region. The IEMOP registry categorizes locations only by island group; therefore, more precise regional breakdowns are not available.

Figure 2. Geographic distribution of GEOP-registered meters per island group from March 2022 to December 2022. Data from the Independent Electricity Market Operator of the Philippines Inc. registry.



The real estate sector accounts for the largest share of GEOP-registered meters, with 295 meters (35%). This is followed by manufacturing (145 meters, 17%), academe and research (61 meters, 7%), food and beverages (60 meters, 7%), and telecommunications and media (53 meters, 6%). Each remaining sector constitutes less than 5% of the total registered meters (Figure 3).

Figure 3. Industry distribution of GEOP-registered meters from March 2022 to December 2025.



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ELECTRICITY CONSUMPTION OF GEOP-REGISTERED METERS

Monthly electricity consumption of GEOP-registered meters was concentrated in three ranges: less than 74,900 kWh, 75,000–149,999 kWh, and 150,000–224,999 kWh (Figure 4a). Assuming a 720-hour month, meters consuming less than 74,999 kWh per month are below GEOP's 100 kW threshold. Reported consumption may not reflect peak usage months. Some meters falling below the 100 kW threshold could be part of aggregated arrangements, which, while not explicitly provided for in the current GEOP rules, are permitted under certain provisions of the Energy Regulatory Commission (ERC) for aggregated loads.

The distribution of power consumption was non-normal; therefore, a natural log transformation was applied (Figure 4b). This transformation satisfies the normality assumption required for parametric statistical analyses, including t-tests and one-way ANOVA.

Figure 4a. Power consumption distribution of GEOP-registered meters.

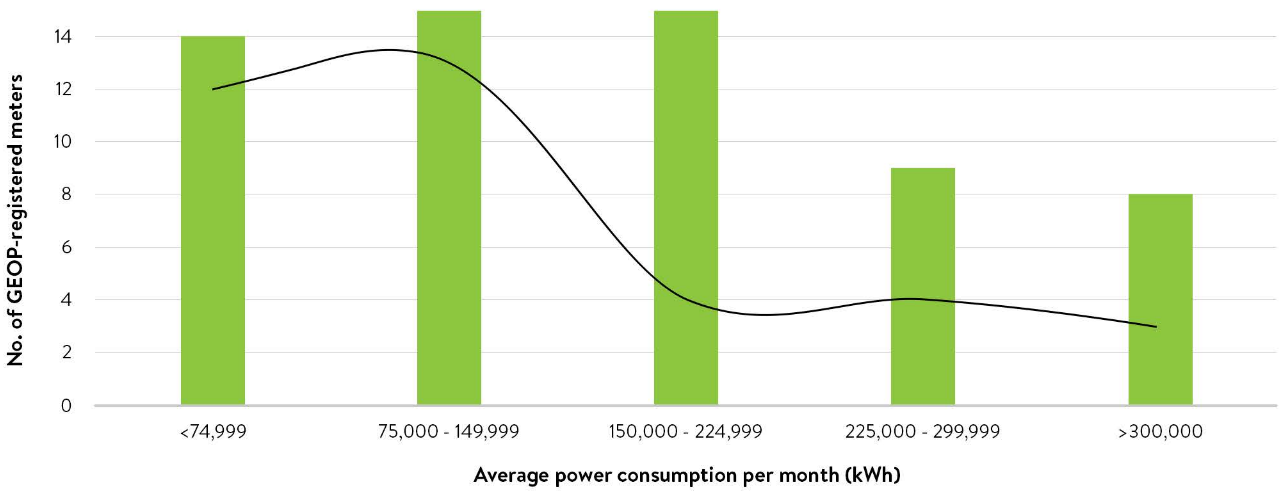
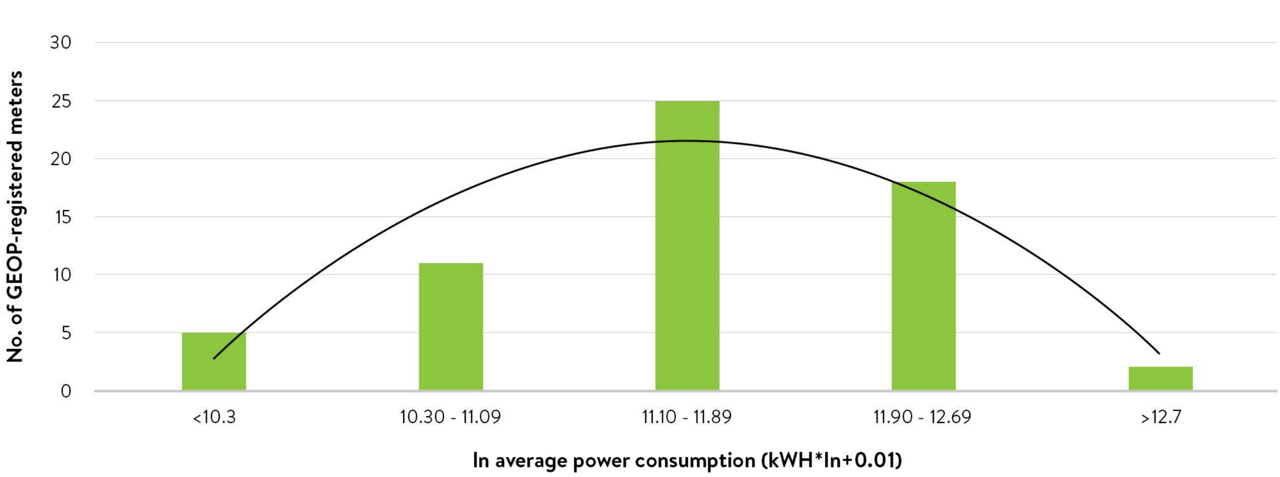


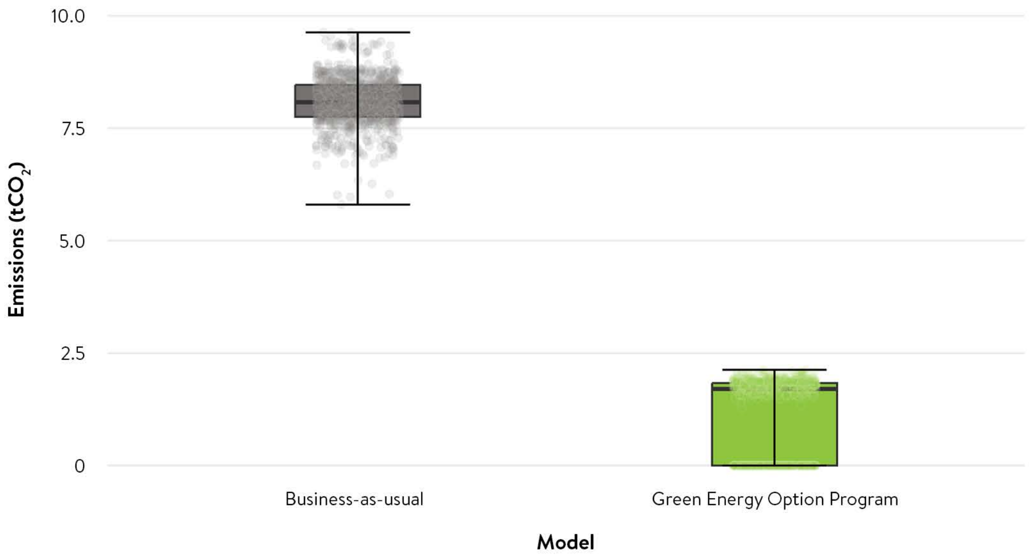
Figure 4b. Power consumption distribution of GEOP-registered meters after ln-transformation showing normal distribution.



CARBON EMISSION REDUCTIONS UNDER GEOP

Using data from 61 GEOP-registered electric meters, we quantified emission reductions under GEOP by comparing emissions from the BAU and GEOP scenarios. Since 2021, these meters have collectively reduced a total of 83,696,316 $kgCO_2$.

Figure 5. Differences in the monthly carbon emissions (calculated as ln*power consumption*emission factor) between the business-as-usual and GEOP scenarios.



Average monthly emissions per meter were substantially higher under the BAU scenario compared with GEOP. Across the 61 meters contributing a total of 2,501 meter-month observations, the mean ln-transformed emissions were 8.09 ± 0.532 for BAU and 1.12 ± 0.874 for GEOP, reflecting substantial variability among meters and months. Based on the raw data, the arithmetic means were 130,611 ± 116,270 $kgCO_2$ for BAU and 15,474 ± 21,440 $kgCO_2$ for GEOP (mean ± SD), indicating that emissions were approximately eight times higher under the BAU scenario (Figure 5).

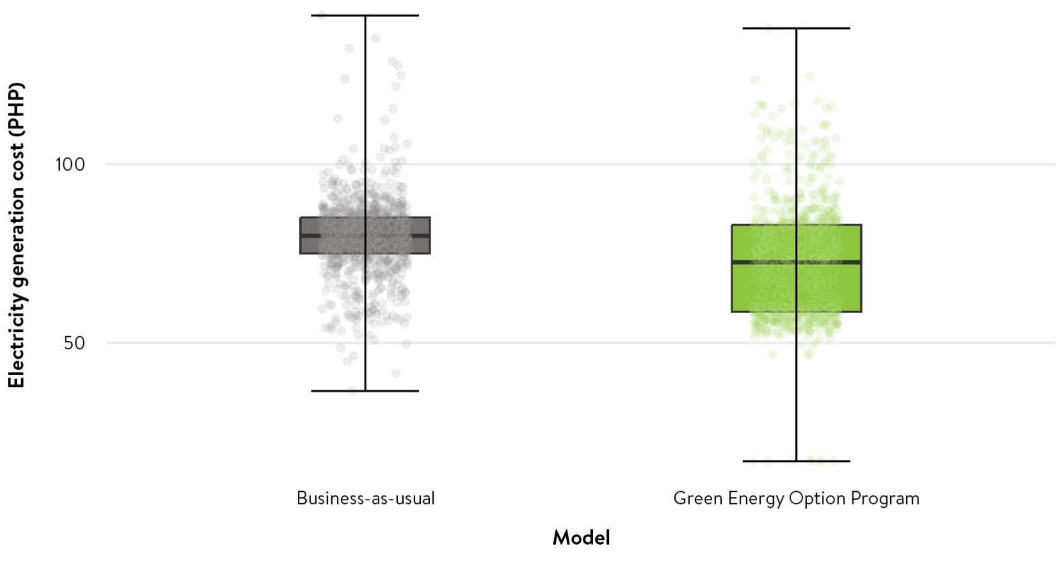
One-way ANOVA on the ln-transformed data revealed a highly significant difference between BAU and GEOP scenarios, $F_{(1,2086)} = 42,865$, $p < 0.0001$. Post-hoc Tukey's Honestly Significant Difference (HSD) test confirmed this result ($p < 0.001$). These findings indicate a substantial reduction in emissions associated with participation in GEOP.

ELECTRICITY GENERATION COSTS REDUCTIONS UNDER GEOP

Similarly, using data from 61 GEOP-registered electric meters, we quantified electricity generation cost savings under GEOP by comparing electricity generation costs between the BAU and GEOP scenarios. On a per-meter basis, observed cost savings ranged from 0.5% to 78%. Conversely, some meters experienced increased electricity generation costs after switching to GEOP, with losses ranging from 1% to 55%.

Average monthly electricity generation costs per meter were higher under the BAU scenario compared with GEOP. Across the 61 meters, which contributed a total of 2,501 meter-month observations, the mean ln-transformed electricity generation costs were 79.7 ± 10.7 for BAU and 72.5 ± 16.4 for GEOP, reflecting substantial variability among meters and months. Based on the raw data, the arithmetic mean monthly costs were PHP 1,269,041.5 ± 1,129,220.6 under BAU and PHP 901,723.7 ± 804,514.1 under GEOP (mean ± SD), indicating that electricity generation costs were approximately 1.4 times higher under the BAU scenario (Figure 6).

Figure 6. Monthly differences in electricity generation costs (calculated as ln*power consumption*generation rates) between the business-as-usual and GEOP scenarios.



One-way ANOVA conducted on the ln-transformed electricity generation cost data revealed a statistically significant difference between BAU and GEOP scenarios, $F_{(1,2086)} = 117.2$, $p < 0.0001$. Post-hoc Tukey's Honestly Significant Difference (HSD) test confirmed this result ($p < 0.001$), indicating a significant reduction in electricity generation costs associated with participation in GEOP.

IV
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Photo credit: NorthWind wind farm in Bangui, Ilocos Norte, Philippines | Perfect Lazybones | Shutterstock

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