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# STRATEGY OF OPERATIONAL COST EFFICIENCY THROUGH THE UTILIZATION OF ENERGY SAVING LAMP IN GREEN ACCOUNTING PERSPECTIVE

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***Abstract.*** In an entity, special attention is needed, especially related to operational costs, especially recurring costs such as electricity costs in an effort to achieve efficiency to achieve the company's stated goals.
This study aims to explore the impact of replacing energy-saving lamps on a company's efficiency and environmental cost stability, especially those related to cost reduction in a green accounting perspective.
Method: This study uses a quantitative descriptive approach with a literature review approach to analyze the impact of replacing electrical energy economically on operational cost stability, especially in a green accounting perspective.
Findings: The application of green accounting emphasizes cost management that not only focuses on economic efficiency, but also considers sustainable environmental impacts.
The results of the study indicate that the use of lamps with energy-saving technology has a significant impact on reducing energy costs directly and supporting economic sustainability through the application of green accounting in achieving a sustainable green economy.
Strategic Recommendations: Green accounting is not just an accounting practice, but also a business strategy in strengthening the company's reputation by integrating environmental sustainability principles into healthy accounting practices.

Keywords : Efficiency , Green Accounting , Costs Environment , Green Economy

## INTRODUCTION

Optimization in matter use energy electricity For for efficiency in operational activities company the more important along with existence regulation increase rates base electricity . This is due to, along with the walk time material fuel used For generator electricity the more thinning . Problems This is one of reason Why savings energy must applied (Baskoro et al, 2021). One of the sectors that use energy in a way Keep going continuously is sector explanation. According to the IEA (2020), the use of lights conventional , such as light incandescent and neon lights , are not efficient because of donate about 15% of total consumption global energy in its use .

Hanani et, al. (2021) stated that based on results energy audit research to buildings, housing and industry , still Lots found that use light conventional Still used For system the lighting . Besides that , effort this can also influential to sustainability environment in the future . Because that , use support the savings program energy and decline greenhouse gas emissions glass , then step important like replacement light conventional become light economical energy such as LED is one of the solution in handle waste energy and emissions carbon (Zhou et al., 2019).

Advantages LED lights compared light conventional is besides seen more efficient compared to light conventional in matter use energy , LED lights have age use more long so that can reduce cost operational in term long and of course at a time can support step savings energy in a way significant ( Mimouni et al., 2020). And what's more most important is step the very contribute big to decline emission carbon which is one of the global efforts in matter handle change climate (IEA, 2020).

Along with increasing awareness to importance guard sustainability environment , companies start implement green accounting concept . Concept This focus on things like management costs and associated impacts direct with management environment , including efficiency energy , reduction waste and use source Power natural on base responsibility (Hassan et al,. 2021). In context this , replacement light efficient economical energy No only part from objective in matter realization stability cost environment , but it is also one of the aspect important in matter management source Power on base responsibility in sustainability environment (Rizwan & Ghaffar, 2019).

Influence replacement light economical energy to stability cost environment very relevant in context of one implementation of green accounting, because company of course need evaluation impact term long on expenditure cost energy and management waste ( Mimouni et al., 2020). Efficiency level energy from LED lights of course can cut fluctuation cost operational related with consumption energy , so that stability cost environment can created more Good from previously than moment use light conventional . Besides that , reduction emission The carbon produced is also related direct with cost related compliance to regulation an increasingly environment tight ( Hasaan et al., 2021).

A number of study previously show that benefit replacement light efficient economical energy in context subtraction cost energy and stability cost environment be one of the implementation of green accounting is very relevant and is step best in give benefit economy in a way term long for company . Research it is also appropriate with effort implementation principle sustainability in practice accounting , which is not only can increase Power competition company , but also contribute in matter preservation environment (Zhou et al., 2019). Above base that , research This aiming For analyze how far is the replacement LED lights can influence stability cost environment in green accounting perspective .

## LITERATURE REVIEW

Efficiency energy interpreted as one of the method savings energy optimally in matter its use For reach desired results . According to the International Energy Agency (IEA, 2020), efficiency energy is various effort in matter reduce consumption energy without must reduce quality and quantity of output

to be produced . The achievement efficiency energy in sector lighting can seen in use technology light economical Power like LED lights , which can consume energy Far more A little than light conventional which already There is previously .

**Types Lights and Efficiency Energy**

The lights that often used For lighting generally diverse like light incandescent , neon lights and LED lights . Lights incandescent and fluorescent lamps are categorized light conventional because of can consume more Lots energy than light economical energy like LED lights , even though the lumens of light produced equivalent ( Rahmadhani et al, 2022).

Light incandescent including one of type frequent lights used by the sector industry and trade , but light type This including to in the least light efficient in use energy . Because according to the International Energy Agency (IEA, 2020), around 90% of energy used For turn on light incandescent precisely changed become hot , isn't it only light solely . Because of that that , light This enter to in light with waste energy .

Furthermore There is neon lights , lights type This often found its use For office and space public others . Lights This more efficient compared to with light incandescent However related efficiency energy light type This Still lost Far when compared to with LED lights . According to Zhou (2019), neon lights contain material chemistry dangerous like substance mercury which makes more difficult in the recycling process he repeated .

Final is LED (Light Emitting Diode) lights , lamps type This own level efficiency more energy tall compared to with light type conventional . Lamp type This can produce light with same intensity with light incandescent or neon, but with savings more energy good . According to Mimouni (2020), LED lights only consume 80% more A little energy compared to with consumption energy in the lamp incandescent or neon for produce intensity equal light .

**Influence Replacement Light to Subtraction Consumption Energy**

In matter subtraction consumption energy , replacement light conventional become LED lights proven can reduce waste energy in a way significant . According to the IEA (2020), the sector lighting is contributor use energy of total consumption global energy by 15% due to use the lights are still on No efficient . With existence replacement light conventional with LED lights , waste energy expected decrease to the figure is 50%-70% depending from type light What will replaced .

Besides things that have been mentioned above , replacement light conventional with LED also contributing in reduce load on the network electricity , because use LED lights no only can reduce waste energy , but proven energy the heat produced is also only a little bit . This is aiming in reduce need cooling in the room that also takes up consumption energy more continued (Hassan et al., 2021).

**Influence Replacement Light to Subtraction Carbon Emissions**

Use light efficient economical energy , in particular LED lights , have significant impact No only in matter subtraction consumption energy but also in subtraction emission carbon in a way direct . Replacement light conventional with LED assist reduce emission house gas glass , because LED lights reduce consumption energy that is partly big Still originate from source energy fossils , which are one of the contributor main to greenhouse gas emissions glass , in particular carbon dioxide ($CO_2$), which plays a role big in global warming and change climate . In terms of overall , transition to LED lights all over the world can play a role big in effort mitigation change climate , considering sector lighting donate part big of total consumption global energy (Nugroho and Pamudito ., 2024).

According to research conducted by Zhou et al. (2019), replacement light conventional with LED lights all over the world can reduce CO2 emissions up to billions of tons per year . In term length , replacement light conventional with LED can be one of effective and easy solution implemented For lower footsteps global carbon . Reducing dependence on energy produced from source that is not renewable help repair quality air , which in turn will increase health public .

**Impact Economy from Replacement Light Economical Energy**

Besides give impact positive to environment , replacement light conventional with light efficient economical energy like LED also provides benefit significant economy in term long . One of the profit main LED lights are Power hold the far longer than light conventional , which is direct reduce cost maintenance and costs replacement lights . LED lights , which can endure up to 25,000 hours or further more durable compared to light the only glow endure approximately 1,000 hours (Zhou et al., 2019).

According to Palaloi (2018), duration usage these older LED lights means that its users No need often replace lights , so that reduce frequency expenditure For purchase light new . Besides that , because LED lights reduce need For replacement routine , cost power work done For installation and maintenance lights can also minimized . In a larger scale large , such as in the sector commercial or industry , thing This can reduce cost operational in a way significant . With subtraction cost significant energy , company can allocate funds that were previously used For bill electricity to other more profitable investments productive , as well as support policy sustainability they . This is No only profitable in a way economic , but also helpful company For reach objective friendly environment and improve efficiency operational in a way overall .

LED lights only consume more energy a little , means bill electricity will also Far more low . With however , even though price LED lights maybe A little more expensive up front , savings gained from use more energy efficient and reduction cost maintenance can produce return higher investment (ROI) fast in term long . This make LED lights as a very good choice economical , especially for company , agency public , and home the stairs you want reduce expenditure energy and costs operational they (Syam et al., 2020).

**Influence to Policies and Regulations Environment**

According to Hassan (2021), in several countries replacement light conventional with LED even has become an integral part of policy government For reach objective subtraction consumption energy and emissions carbon . In the European Union , for example , strict regulations related efficiency energy and reduction emission carbon has push use LED lights in various sector , starting from housing , building commercial , up to lighting road general . European Union has apply policies that facilitate transition to LED lights with give incentives and subsidies for sector public and private . This also includes replacement light road with more LEDs economical energy , which is expected can reduce consumption energy in a way significant throughout city large and rural areas . With steps this , the European Union No only focus on reduction cost energy , but also on achieving emission targets more carbon low in effort For achieve net-zero emissions by 2050 .

Temporary that , in Indonesia, although implementation LED lights still be at the stage early , trend use LED light start show positive developments . Increasingly Lots designed project For replace light conventional in buildings government and facilities public , like at home sick , school , and office government . Projects This No only aiming For reduce cost operational and expenditure energy , but also for support policy government in realize development sustainable . Although challenge in implementation Still there is , like limitations budget and infrastructure that has not been evenly , steps

This show Indonesia's commitment to reduce footsteps carbon and increase efficiency energy , along with global efforts in overcome change climate ( Syarif et al., 2024).

According to Rauf (2023), the steps taken by the European Union and Indonesia indicate that use LED lights are not only problem efficiency energy , but also part from strategy more wide For reach sustainability and acceleration transition to economy low carbon . With the more many countries implement policy similar , transition to technology economical energy like LED will play role important in reduce global emissions and achieve objective development sustainable throughout the world .

## METHOD

Study This use approach descriptive quantitative with a literature review approach to analyze impact replacement light economical energy to stability cost operational , in particular in green accounting perspective . The method used in study This is studies literature and secondary data analysis from various relevant sources like review theoretical , study cases , and results analysis research that measures influence replacement light to savings energy as well as impact environment . This process allow researcher For dig more information deep and comprehensive about connection between efficiency energy and sustainability environment in green accounting context .

Data collected in study This covering information about savings energy , cost related operations with lighting , and analysis costs and benefits in green accounting context based on published articles . Research This also examines How policy sustainable accounting can support the retrieval process more decisions friendly environment , with consider aspect efficiency energy and its impact to sustainability company .

## RESULTS AND DISCUSSION

Green accounting is a draft accounting guidelines to principles that support sustainability environment to in every practices accounting ( Ghozali , 2021). Concept This aiming For do recording , measuring and reporting impact activity company to environment about management source Power nature and effort company in reduce carbon gas emissions and maintaining sustainability environment life .

According to Susanto and Hasibuan (2019) , they are of the opinion should company No only focus report condition profit make a loss but also must report involvement activity company in matter efficiency use energy , management sector waste along with use material friendly standard environment and easy recycled repeat . This is very expected can help making good decision and more responsible to impact environment .

According to Mulyadi and Setiawati (2019) stated that in Green accounting context , implementation in matter replacement light conventional become LED lights are one of the form draft accounting which is direct considered as investment friendly environment . Green accounting will take notes activity the as form achievement company in matter savings energy , reduction cost operational related savings energy , as well as recording subtraction carbon emissions as part from effort company in matter guard sustainability environment life ( Ghozali , 2021).

Recording savings energy in report finance aiming For show contribution company about responsibility company in matter subtraction carbon emissions and management source Power natural to impact environment ( Ghozali , 2021). In addition that , the company can also report What just impact financial from activity savings energy that is done related subtraction cost operational from replacement LED lights are one of the form use more technology efficient .

Following This is steps in recording in terms of green accounting related with savings summarized energy based on results study previously :

1. Do measurement savings energy use technology efficient ( for example replacement light conventional to LED lights ) that are calculated in unit energy (kWh) which is then converted to in nominal terms that can be reported in report finance .
2. Recording Cost Investment on purchase LED lights as asset term length which is one of the implementation in use technology economical energy .
3. Companies can report activity replacement LED lights as effort savings energy and its impact to subtraction carbon emissions in report Corporate Social Responsibility (CSR) as form from commitment company in guard practice friendly business environment .
4. Companies can do recording analysis Cost-Benefit from replacement LED lights that can show benefit influence subtraction cost operational on savings energy in term long .

**Supporter recording management investment and savings energy in Green accounting concept**

1. Net Present Value (NPV)
   Based on study above , NPV is the method used in evaluate eligibility investment replacement light conventional become LED lights based on difference between mark Expected Cash Inflow with Invested Cash Outflow with Discount Rate desired return in expected period .
   Formula NPV :
   $$\mathrm{NPV} = \sum \left( \frac{\mathrm{CF_t}}{(1 + \mathrm{r})^{\mathrm{t}}} \right) - \mathrm{I_0}$$
   Parameters :
   $\mathrm{CF_t}$= Cash inflow in the yeart
   r= Discount Rate
   t= Year
   $\mathrm{I_0}$= Initial Investment
   If the NPV value produces mark positive , that's why investment replacement light the considered worthy Because mark benefit term long more big than total cost value project , purchase as well as maintenance issued .
2. Internal Rate of Return (IRR)
   Based on study above , IRR is the method used in evaluate how much efficient a investment green related replacement light become LED lights inside give information about level return from desired investment company .
   Formula IRR :
   $$\mathrm{NPV} = 0 = \sum \left( \frac{\mathrm{CF_t}}{(1 + \mathrm{IRR})^{\mathrm{t}}} \right) - \mathrm{I_0}$$
   Parameters :
   $\mathrm{CF_t}$= Cash inflow in the yeart
   IRR= Rate of Return
   t= Year
   $\mathrm{I_0}$= Initial Investment
   If the IRR value is greater tall than level the return so investment green the rated profitable .
3. Life Cycle Costing (LCC)
   Based on study above , LCC is a method For calculate the total costs incurred during asset the Still have a life time , in matter This is start from cost investment beginning in purchase LED lights , cost operational LED lights , cost maintenance related operational LED lights , as well

as costs incurred at the time the LED lights need replaced or thrown away after expired life time . The result LCC value of this LED lamp Then compared to with LCC usage light conventional and known that the LCC of LED lights is more low than LCC lights conventional .

Formula LCC :

LCC= Cost Investment Initial+Cost Operational + Cost Maintenance-Saving

parameters :

Cost Initial Investment = Costs incurred from purchase and replacement light conventional become LED lights

Cost Operational = Costs incurred during use LED lights inside matter use energy , power Work maintenance and costs other related use LED lights .

Cost Maintenance = Costs incurred For maintenance LED lights in life time and repair if broken and dead when Already expired life time .

Savings = Value of benefits generated from use LED lights , such as mark savings from use energy and value subtraction cost maintenance.

4. Payback Period (PP)

   Based on study above , the Payback Period is a the method used For show how long will it take For return mark investment beginning based on mark savings and cash flow generated from use the LED lights .

   Formula PP:

$$\text{PP} = \frac{Initial\ Investment}{Annual\ Cash\ Inflow}$$

   Parameters :

   Initial Investment = Amount from cost purchase LED lights with cost installation LED lights (total cost) project ).

   Cash Inflow Annual = Difference cost operational used when Still use light conventional with after replace LED lights inside category profitable .

   If the value of the PP more small than length of time the project is running when replacement light or reach point break-even (BEP), then the payback period is considered profitable in term long .

5. Profitability Index (PI)

   Based on study above , PI is number ratio used For evaluate eligibility investment green in matter replacement light conventional become LED lights . The concept of PI measuring profit relatively from cost incurred on replacement the LED lights .

   Formula PI :

$$\text{PI} = \frac{\text{NPV} + \text{Investasi Awal}}{\text{Investasi Awal}}$$

   Parameters :

   NPV = Amount mark difference between mark Expected Cash Inflow with Invested Cash Outflow with Discount Rate desired return in expected period .

   Initial Investment = Amount mark cost incurred For installation LED lights .

   If PI produces PI>1, then project replacement light with the LED lights worthy implemented Because will produce more benefits Good based on results savings energy and costs operational .

Study Widiastuti (2023) stated that that study with do analysis measurement and calculation cost on consumption Power electricity second type lamp ( lamp conventional with LED lights ) which

include ; measurements consumption Power electricity , measurement Power burden electricity installed , calculation cost operational , calculation cost purchase and installation and BEP and its benefits with NPV feasibility . Produce savings in consumption energy electricity lighting in the building USTJ Flats , namely TL36W lamp + Ess 20W consumes 32,775 KWh / month with cost electricity per month Rp. 38,173,216, while Ledtube 18W+LED Ess 9W only of 8,984 KWh / month with cost electricity per month Rp 10,440,728. Efficiency cost electricity generated by 365.6%. With age use LED lights 9-10 years , while TL lamps only last 3-7 years .

Research by Edi Muljo (2022) states that that study with do analysis measurement and calculation cost replacement light road from SON 250W lamp with 16 points become 120W LED lights as many as 26 points to efficiency cost electricity consumed on Dr. Wahidin Street, Semarang . Producing with the same light lumens , for replace light SON 250W road only need replaced with light 120W LED path . However cost operational that can streamlined very Far from previously Rp 2,080,368/ month to Rp. 998,576/ month .

Research by Arief Suwandi & Ferry Fardian (2016) stated that that study with do analysis costs incurred and value economic benefits obtained from use LED lights at PT Total Bangun The Kingdom Tbk use BEP and ROI analysis between 135 pcs 18W and 36W fluorescent lamps with LED lights as many as 80 pcs. Produces cost purchase light normal only Rp. 3,195,000 more cheap compared to LED Rp. 14,000,000 but what is sought is mark investment . The difference cost electricity used is Rp. 8,414,441 which is also the BEP for returning capital for 1.5 years more . Assuming a 10- year LED lamp life time , total efficiency from BEP to damaged is an ROI of 52.59%.

Research by Hari Wijaya et, al. (2019), states that that study with do analysis cost savings with Life Cycle Cost, Pay Back Period, Net Present Value, Internal Rate of Return, and Profitability Index parameter methods to replacement top LED light supply components Electricity Consumption, Energy Saving, Bill Saving and Operating Cost at BRI Denpasar Bali bank. Resulting in with replacement light existing use LED lights have obtained Energy Saving of 11,309.49 kWh/ month , so that Bill Saving generated Rp 12,632,700/ month . LCC LED lamp Rp 708,032,535 longer and more efficient compared to LCC lamps existing . PBN, NPV, IRR and PI values also support mark the .

Research by Supriyo et, al. (2022), states that that effort savings energy without costs can also be done with method implementation zero investment. With do analysis cost procurement LED lights as replacement light existing , difference cost usage electricity , and the difference Power electricity on the RAB with the Gramedia Matraman building . Resulting in calculation cost procurement LED lights Rp. 392,540,000, difference efficient Power electricity 920.32 Kwh / day with cost electricity per month to Rp 19,082,160. Savings operational per month amounting to Rp. 55,218,960 can be obtained cover instalment to the bank Rp. 36,000,000 per month so that achieved zero investment for 8 months.

Research by Ni Made Karmiathi et, al. (2019), states that that with analysis economy eligibility Investment on Cash Inflow (Savings ) cost electricity, Sales emission carbon ), Cash Outflow Maintenance ) with NPV, PI, and DPP methods on replacement light mercury 250W with LED 93W on Jalan Raya Gatot Subroto Denpasar Bali. Produces Benefits obtained existence savings energy electricity 157,646.06 Kwh / year equivalent with Rp 231,310,903, and a decrease emission carbon 134.16 tons CO2/ year equivalent with Rp 57,989,743. The NPV obtained was Rp 432,105,850, PI 1.317 and DPP for 7 years 2 months more short from age project so investment considered worthy .

Research Suswitaningrum et, al. (2022), argued with do analysis from historical data bill electricity in 2019 and 2020 and regarding savings energy can achieved on the system air conditioning system lighting in Building C of the Regional Secretariat Office Semarang Regency . Recommended opportunity savings energy electricity besides with replacement of Low Watt Inverter AC , namely with replacement 40W neon TL lamp with 11W Ledbub LED and sought after mark payback period.

Produce Based on The IKE value in 2019 was 105.3607 KWh / m2 / year and in 2020 it was 123.85 KWh / m2 / year ( still in category efficient according to ASEAN-USAID in 1987). With calculation mark payback period , cost investment in low watt AC is obtained for 3.8 years with savings of 30.6%/ year , while return cost investment replacement LED lights are available for 4.3 years with savings of 16.28% per year .

Research Viandi and Ikrima Alfi (2018) stated that that with do a number of analysis including analysis financial to replacement of previous LPJU light SON-T 250W mercury , to 28W LED throughout road in Indramayu Regency For objective savings cost electricity and efficiency energy . Produce potential efficiency according to analysis financial , payback period will obtained at 5 years 3 months consequence replacement lights and savings cost electricity amount to Rp. 5,441,844,130 /year and will return cost investment project walk amounting to Rp. 29,552,125,000.00 for 13 years and 4 months .

Research Riyadi (2018) stated that with analyze energy audit results For can analyze big cost electricity consumed in Graha Building Gemstone Queen of Jakarta and evaluate How method improvement efficiency energy . Produce energy audit research at GMR namely there is waste energy when use 36W neon lamp , lamp the can replaced with LED lights that have high lux but the wattage is small . After research , the cost investment of Rp . 386,282,000 and predicted payback cost his investment will occurred in 12 months Because savings amounting to Rp. 377,561,646/ year .

Research Quinta et, al. (2018), states that with analyze cost energy in the sector lighting operational existing and for know step management cost in effort savings energy in supporting green accounting at the University Brawijaya . Produces cost consumption energy electricity existing For lighting of Rp. 5,489,744/ month . Then management cost arrange planning and control with replace light become LED and achieved savings amounting to Rp. 1,935,218/ month or about 35%. Reduction time consumption light for 2 hours is also very influential . Recommendation other is with use motion sensor devices and the use of dimmers and solar cells can add savings cost by 20%. Based on the discussion above, several things can be concluded as follows:

1. Use environmentally friendly lights have an impact on savings energy so that from a cost perspective it is more efficient from both a commercial and fiscal perspective.
2. Use environmentally friendly lighting has an impact big in subtraction carbon gas emissions which are problem main the damage global environment consequences change climate , especially since until now Indonesia has not succeeded in implementing a carbon tax.

**Strategic Recommendations**

Green accounting does not only just practice accounting , but also become one of the strategy business in strengthen reputation company with method integrate principles sustainability environment to in practice accounting . This is No only can give benefit in matter efficiency cost operational company but also contribute to welfare society and improve not quite enough answer social with guard sustainability environment For the generation that will come .

**Suggestions For Further Research**

In order for the principles of Green Accounting to become more grounded in preserving the environment while still prioritizing the efficiency aspect of an entity, research is needed. furthermore can considering aspects regulation , global trends and other aspects that can adapted and make a positive contribution.

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