Available online www.jocpr.com

Journal of Chemical and Pharmaceutical Research, 2014, 6(7):1164-1167

Research Article

ISSN : 0975-7384
CODEN(USA) : JCPRC5

Research on household energy-saving and environmental protection

Liang Yanbing[1], Ma Yongsheng[2] and Zhao Shuo[3]

[1]College of Science, Hebei United University, China
[2]College of Foreign Languages, Hebei United University, China
[3]Qinggong College, Hebei United University, China

ABSTRACT

Since the reform and opening-up, China's economy is rapidly growing and has made great achievements. But at the same time, huge price has been paid in both resources and environment. If we don't accelerate economic restructuring and change of the pattern of economic growth, there will be a shortage in resources and deficiency in environmental capacity. That is what government can not afford and then economy will be difficult to sustain. Only by vigorously pursuing energy conservation and emission reduction, which can make economic growth really based on energy saving and environmental protection, can we achieve sound and rapid development in economic society. The central government has put forward clearly in the eleventh five-year plan that our country must accelerate the development of an environment-friendly society and make more efforts to protect the environment, and finally achieve sustainable development and change the pattern of economic growth. Energy-saving and cost-reducing are the key points in the eleventh five-year plan.
1. Purpose of research: The research work of this article is about evaluation of household energy saving and saving effect.
2. Idea of the model: First, we analyze the energy consumption based on the analog of a family's major domestic electric appliances of a year.

Then we establish a model with lists and plans: we calculate the total quantity of power-saving by listing and planning major domestic electric appliances of a family in one year. Then we transform the quantity to the amount of standard coal which is required in thermal power generation. And finally we work out the emission reductions of carbon dioxide and some other airborne contaminants.

Key words: energy saving and environmental protection, standard coal, emission reductions of airborne contaminants

---

INTRODUCTION

Sustainable development is the basic policy of our state. In the 11th Five-Year Plan, the goal of 10% of energy conservation and 20% of emission reduction is clearly presented. Household environmental protection plays an important role in this goal. It is greatly related to our life and is easy to keep on. Doing the work of household energy saving and environmental protection well can not only save resources , but also save some expenses for the family, which is killing two birds with one stone. One important part of household energy saving and environmental protection is saving electricity.

To design a model for energy-saving measures, we simulate a common family, select the major electric appliances, then simplify the energy consumption of these appliances, design saving methods for each appliance, and summarize the family's saving quantity on electricity for the year.

By analyzing the effect of the energy-saving plan, we calculate the total saving quantity on electricity of this family, and then transform it to the amount of standard coal which will be required if electricity is produced by thermal power generation.(standard coal means coal which contains 7000 calories per kg.(29306KJ)) . At last we work out the emission reductions of carbon dioxide and some other major airborne contaminants through analyzing data on the Internet.

ESTABLISHMENT OF MODEL

SYMBOLIC ACCOUNT

S_1: annual electricity-saving quantity of refrigerator

M_1: emission reductions of carbon dioxide

S_2: annual electricity-saving quantity of computer.

M_2: emission reductions of carbonic oxide

S_3: annual electricity-saving quantity of air conditioning

M_3: emission reductions of nitrogen dioxide

S_4: annual electricity-saving quantity of television.

M_4: emission reductions of hydrocarbon.

S_5: annual electricity-saving quantity of lighting.

M_5: emission reductions of dust.

S: annual electricity-saving quantity of all household appliances

Q: the saving quantity of coal transformed from quantity of electricity consumed in the year.

MODEL 1

(1)refrigerator. Fill in foamed plastic when there are not many materials to shorten refrigeration time. This method can save 10 kilowatt-hour of electricity per month.

(2)computer. When the computer is not working, power it off rather than keep it in a standby mode. That will save 35 kilowatt-hour for you per hour.

(3)air conditioning. If the temperature set in the room is raised from 24-26 degrees centigrade to 26-28 degrees centigrade, for users of air conditioning, 0.3 kilowatt-hour of electricity will be saved in 3 hours if the temperature of a one-hp air conditioning is raised by 1 degrees centigrade.

(4)television. A television which is in standby mode can consume 10 watt per hour on average. That is, 1000 watts can be wasted in 100 hours standby mode. So we are supposed to power off our TV sets whenever we don't use them.

(5)Lighting Lamp. An energy-saving lamp uses one-fourth the power that a bulb uses in the same condition in equal times. So we can replay bulbs with energy-saving lamp as much as possible.

Then, we can work out the total quantity of electricity which is saved by methods above in a certain period of time.

SOLUTION OF MODEL 1

(1)Annual quantity of electricity saving of refrigerator.

$$S_1 = m_1 * 12 = 10 * 12 = 120 \ \text{KWH};$$

(2)Annual quantity of electricity saving of computer(we assume that computer is left in standby mode 2 hours per day).

$$S_2 = 2 \times 365 h_2 / 1000 = 2 \times 365 \times 35 / 1000 \approx 26 \,\text{KWH};$$

(3)Annual quantity of electricity saving of air conditioning. (We assume that air conditioning is used for 4 months and is used 5 hours a day with one-degree centigrade higher than normal.)

$$S_3 = 30 \times 4d_3 = 30 \times 4 \times 0.3 = 36 \text{ KWH};$$

(4)Annual quantity of electricity saving of television. (We make the assumption that the TV set is in standby mode for 20 hours each day.)

$$S_4 = 20 \times 365/100 = 73 \text{ KWH};$$

(5)Annual quantity of electricity saving of lighting lamp. Replace 5 bulbs in this family by energy saving lamps.(see chart)

location	bedroom	Living room	Washroom	kitchen
amount	$n_1 = 2$	$n_2 = 1$	$n_3 = 1$	$n_4 = 1$
Power/(W)	$P_1 = 15$	$P_2 = 25$	$P_3 = 10$	$P_4 = 15$
Working hours/(hours)	$H_1 = 4$	$H_2 = 4$	$H_3 = 2$	$H_4 = 3$

We can calculate the total quantity of electricity saved by energy saving lamps in one year: $S_5 = 3 \times 365/1000 \times \sum_{i=1}^{4} n_i P_i H_i$

$= (2 \times 15 \times 4 + 1 \times 25 \times 4 + 1 \div 10 \times 2 + 1 \times 15 \times 3) \times 3 \times 365/1000 \approx 312$ (KWH)

Then get the total quantity of electricity saved in this year.

$$S = \sum_{j=1}^{5} S_j = 120 + 26 + 36 + 73 + 312 = 567 \text{ (KWH)}$$

MODEL 2

(1)Statistics provided by NDRC (National Development and Reform Commission) shows that the amount of standard coal consumed in thermal power plants has decreased 32g from 392g in the year of 2000. By 2020 this number will reduce to 320g. [1]That means 1 kg of standard coal can produce electricity for 3 KWH. Then 2777 KWH electricity can be produced with only 1 ton of standard coal.

We can work out the amount of coal this family can save through the quantity of electricity saving which has been calculated from model one.

(2) The burning of coal can release pollutants such as carbon monoxide, nitrogen dioxide, hydrocarbon, dust and carbon dioxide which leads to green house effect. We can work out the total reduction of these pollutants based on the result we get in (1). [2]

SOLUTION OF MODEL 2

(1) Transform the quantity of electricity saving in model one into the amount of standard coal that can be saved.

$Q = S/2777 = 567/2777 \approx 102.4$ tons.

(2)Weight of different pollutants released from the burning of coal in power station boiler ：

	carbon dioxide	carbon monoxide	nitrogen dioxide	hydrocarbon	dust
power station boiler （Kg）	$m_1 = 2.493$	$m_1 = 0.23$	$m_1 = 9$	$m_1 = 0.1$	$m_1 = 11$

So the amount of carbon dioxide that can be reduced is :

$M_1 = Q * m_1 = 0.204 \times 2.493 \approx 0.51 \text{kg}$

The emission reduction of carbon monoxide is:

$M_2 = Q * m_2 = 0.204 \times 0.23 \approx 0.05\,\text{kg}$

The emission reduction of nitrogen dioxide is:
$M_3 = Q * m_3 = 0.204 \times 9 \approx 1.84\,\text{kg}$

The emission reduction of hydrocarbon is:
$M_4 = Q * m_4 = 0.204 \times 0.1 \approx 0.02\,\text{kg}$

The emission reduction of dust is:
$M_5 = Q * m_5 = 0.204 \times 11 \approx 2.24\,\text{kg}$

EVALUATION OF MODEL

This model calculates the quantity of energy saving by simulating the condition of a common family's major household appliances. Then it works out the corresponding amount of coal that is required. Next it can get the emission of carbon dioxide and finally shows us what huge effect there will be if every single family saves energy in everyday life.

CONCLUSION

We have worked out the quantity of coal required and carbon dioxide and pollutants emitted from the burning. According to the result of China's Sixth National Population Census, a population of 1370536875 in 2010, [3]we can speculate that the population now is about 1.4 billion. We assume that there are 3 members in each family, then the total quantity of electricity that is saved in China this year is 793.8 billion KWHs. It means we have saved about 286 million kg coal, which corresponds to 713 million kg carbon dioxide and 5.814 billion pollutants. With these reductions we can greatly reduce the harm to our earth caused by greenhouse effect, sulfur dioxide and dust.

REFERENCES

[1] Li Shiqi;Wu Long;JiZhijun;Chen Haiyong. The Present Situation of Energy Saving and Emission Reduction of China's Steel Industry and Its Countermeasures, *Research on Iron and Steel*,**2011**,3,1-4.
[2] Wang Weixing. An Analysis of Energy Consumption Status and Energy-saving Potential of China's Iron and Steel Industry, *China Steel* **2011**,4,19-22.
[3] Xiong Jianhua. An Analysis of the Way and Potential of Energy Conservation and and Emissions Reduction and Related Policies,*Cement Engineering*, **2008**,1,81-85.
[4] Wang Yun-Ji, Chen Philip, Jin Yu-Fang. Trajectory planning for an unmanned ground vehicle group using augmented particle swarm optimization in a dynamic environment [J]. *IEEE International Conference on Systems, Man, Cybernetics*, **2009**:4341-4346.
[5] Wei Qi, Cui Ming-Liang, Feng Yan-Ling, and others. Newly-typed High temperature erosion and abrasion experiment methods research [J*]. Chinese surface engineering*, **2010**, 23(5):17-23.
[6] Yang Ai-Min, Zhang Yu-Zhu, Long Yue. The Yang-Fourier transforms to heat-conduction in a semi-infinite fractal bar [J]. *Thermal Science*, **2013**,17(3):707-713
[7] Yang Ai-Min, Yang Xiao-Jun, Li Zheng-Biao. Local fractional series expansion method for solving wave and diffusion equations on Cantor sets [J]. *Abstract and Applied Analysis*, vol.2013 Article ID 351057, 5 pages, **2013**.