Community and Renewable Energy Economic and Management

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Abstract
Energy resources are a large powerhouse that is needed in daily life. The Royal Thai Government has taken measures to change the use of crude oil into other type of resources such as natural gas, solar energy and wind energy because all of them are less polluting than other fuels. According to the important role of gasoline in economy, this research would like to know the sensitivity of the demand for gasoline to price changes. In the finding, the demand of gasoline would sensitive to price changes because gasoline become the essential for transportation which all people have to travel every day for work, school, business and traveling. There are seven kinds of gasoline in the market; Benzene or Gasoline 91, Gasohol 91, Gasohol95, Gasohol E85, Gasohol E20 and Diesel. In the paper, it will focus on Benzene, Gasohol E20 and Diesel. Benzene is the gasoline which contains less addition and it is suitable for high quality and high-performance engine cars. Gasohol E20 is the petroleum added with ethanol as alternative additives. This kind of gasoline is proper for normal car or medium range. Actually, Diesel almost use in Trains, buses, pickup and trucks which usually use for business. All of gasoline is more useful to the economy on the growth However, if it is too expensive for demand spending, it should have something for replacing. The project should be tested in this research about "Renewable Energy Management for Community" expressing via objective: to analyze the costs and benefits of using biodiesel in the community. The findings are the best case as a result of the decrease in cost of biodiesel showing the cost of construction and renovation of biodiesel plants has decreased. The Benefit-to-Cost Ratio is 2 times and the IRR is 47.47 % per annum. While the worst case. When there is an increase in cost of biodiesel equipment costs, the cost of construction and renovation of biodiesel plants has increased 12 % which it will increase the investment cost of the project to 197,600 Baht. When analyzing the cost and benefits of the project, the project will have a net present value (NPV) of 128,829.86 Baht which is a benefit to cost. The Benefit-to-Cost Ratio is 1.64 times and the IRR is 35.62 % per annum. Then, it can claim that the "Renewable Energy Management for Community" project is still worth the money. This is an important part of the decision to invest the project in other communities. Therefore, it is a reflection of the choice for society in the community. Moreover, the Department of Energy and Provincial Office can use as a guideline to draft a plan for development of other communities. This will lead to the selection of communities that is being ready to form the next village headmen and villager's prototype community.
Keywords: Biofuel, Biomass, Cost Analysis, Return, Community

Introduction

Almost every activity on the planet today is involved in energy, especially with the use of electricity because the energy is an important part for life. Personal activities of each individual are involved with the energy since one has woken up in the morning till the evening such as cooking food or relaxing by opening the air condition. The highlight building at the workplace also requires an elevator. So, if the power will be reduced till the stage is called crisis, it is called "shortage" in supply for economic perspective. At that stage, everyone must be in the bad condition and cannot do daily activities anymore. Therefore, the gasoline is being referred as a key factor in driving the economy for many countries around the world expressing like gasoline prices back to 2017 shown as below.

Table 1 Gasoline prices

2017	Hi-Premium-Diesel S	Hi-Diesel S	Gasohol E85	Gasohol E20 S	Gasohol 91	Gasohol 95	NGV
30/12	31.11	27.24	20.69	25.49	27.73	28.00	13.37
23/11	30.52	26.84	20.89	25.79	28.03	28.30	13.51
26/10	29.52	25.84	20.09	24.59	26.83	27.10	13.64
29/09	29.92	26.24	20.49	25.39	27.63	27.90	13.51
30/08	28.72	25.04	20.29	24.69	26.93	27.20	13.24
22/07	28.52	24.84	19.59	23.59	25.83	26.10	13.42
24/06	27.22	23.54	18.99	22.59	24.83	25.10	13.08
31/05	28.82	25.14	19.89	24.39	26.63	26.90	13.10
27/04	25.24	19.79	24.59	26.83	27.10	27.13	-
29/03	24.74	19.39	24.09	26.33	26.60	13.25	-
23/02	26.64	20.14	25.39	27.63	27.90	12.69	-
19/01	26.44	19.94	25.19	27.43	27.70	12.60	-

Source: Bangchak.co.th (Unit: Baht/Kilogram)

In different countries around the worldwide such as United State, United Kingdom, Belgium, Sweden, France, Australia, or even Germany, biodiesel has been used for a long time. Two per 98 proportions between biodiesel refineries and diesel fuel are used to produce biodiesel production. The five biodiesel blends for 95 diesel fuel making biodiesel production have been added to biodiesel 40 used in the public transport of France. (Energy Policy and Planning Office, Ministry of Energy, 2017). In Thailand, the demand for cars is growing every year. Each car requires gasoline to drive. If the gasoline in Thailand is not enough to meet the unlimited requirements of the whole country, the proportion of imported will be considered to be in a very high percentage. (Energy Policy and Planning Office, Ministry of Energy, 2017). Then, considering the national agenda for the policy on renewable energy used the government has been trying to support the production and the promotion of renewable energy. It is evident that efforts to develop biofuels and biomass encourage the use of renewable energy at all levels, ranging from household to village also toward to national level, with appropriate incentives. Trying to get the transportation sector to use the natural

gas system, in addition, the research is in the development of alternative energy in many forms. If one thinks carefully, the result will show that. There is another type of energy that is no less important than electricity, coal, and natural gas. It is also known as the natural energy that exists in this world for more than hundreds of millions of years. But it has been overlooked that the real world of natural energy is considered to be a great and enormous energy, and is never lost in the world unless the world is quenching cold. That energy is that Dr. Somporn, Deputy Director of Academic Resources Center Prince of Songkla University's Solar Project is based on the concept that in the near future, Thailand will face the problem of shortage of electricity and oil. Solar energy is considered as a clean alternative energy used in the activities of the service. The production and installation of electrical equipment to illuminate the facade of the service center instead of electricity. It is considered as a model for dissemination of solar energy. (Department of Educational Technology, Resource Center Prince of Songkla University, 2017). But the promotion of solar power generation for distribution to the state is still of high value today, especially in terms of funding needed to install solar panels. Therefore, the distribution of benefits may be concentrated only in a particular group (Chanovit, 2014).

However, the alternative clean energy that is used to replace oil in countries around the world is "biodiesel", which is the most used in Germany, United States and France respectively in top rank. Biodiesel consumption in the world is on increasing in demand every year. In the near future, the volume is adjusted to almost half of the production and consumption. Thailand's "biodiesel" to be sold must comply with the announcement of the government in 2007, which will be used in two formulas. There are two ways to use it. Biodiesel B5 is used for cars and biodiesel B100 or commonly called. "Biodiesel Community", which is filled with purple, is applied to agricultural engines. PTT Energy Technology Research Institute (2007) is at Wang Noi district Ayutthaya Province. Comparison of the advantages of using biodiesel in terms of sulfur dioxide toxicity, ozone depletion, small particulates, carbon monoxide, hydrocarbon and the exhaust from the engine, biodiesel is considered as a very environmentally friendly energy source compared to diesel. From the agricultural wastes, His Majesty King Bhumibol Adulyadej has commemorated that fat in the kitchen can be used as a fuel for cars, which is the same type of oil as diesel used in the future replacing import of oil from abroad in large numbers each year. On December 4, 2005, King Rama IX initiated the government's promotion of alternative energy. Especially, it is focused on using biodiesel. Because biodiesel is a source of energy that can be easily found in Thailand. Because Thailand is the land of agricultural raw materials used to be the part making biodiesel which it can be able to make an extra income for farmers as a supplementary occupation and create the security for saving of farmers in each community sustainable. (Office of Energy Policy and Planning, 2017).

Therefore, the development of alternative energy from the residual resources within the community such as soybean, coconut fiber, corn, sugar cane and rice straw can create a source of energy called "fuels" for the development of alternative energy in the community as sustainable self-reliance. The objective is to analyze the costs and benefits of using biodiesel in the community. The coming section is literature review following by methodology, discussion, conclusion and policy implication.

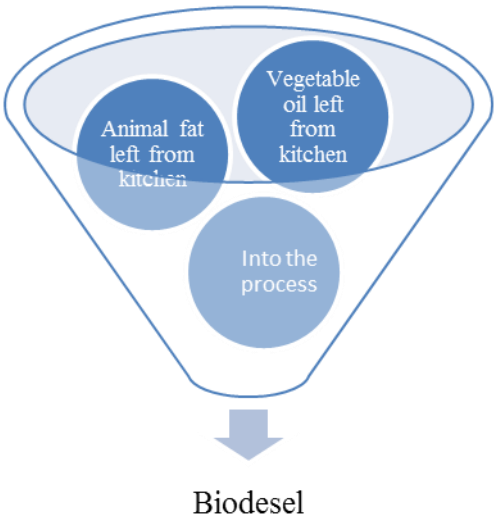
Literature Review

Energy is involved everywhere in the world making us convenient. Many resources can bring up energy. Plant can also be the one of resources producing the energy to create the electricity. Today, the energy that people use coming from many resources is such as oil, natural gas and coal. In this modern era, many current choices of energy are mentioned. One of the popular cites be “Biodiesel”. It is developed to replace the diesel. In terms of policy,

especially the renewable energy, government support for producing biodiesel and use it as alternative energy acting for the national energy security. Thirty-two years ago, His Majesty the King Rama IX had tested by using some of agricultural crops as raw materials for the production of renewable energy to help Thai community be self-reliant. His idea came up because during that period there was the problem on the crops' prices be depressed affecting to especially the low-income people such as farmers' income dropped. So, the Majesty wanted to find the way for releasing the suffering of farmers. He realized that in Thailand there are many plants that can be used to produce biodiesel such as palm oil, jatropha, peanuts, sesame, sunflower, castor oil, soybean, coconut, algae, but the palm oil is the main plant that can be used as a raw material suitable for biodiesel production in Thailand because the palm oil is a plant that can grow well in hot and humid weather. It is also used as a source of food in the households such as vegetable oil, butter, milk and soap. The life of palm is about 20 years. After the third year onwards can start used to produce the product till the maximum after the 10th year. The product will decrease respectively after 11 years. In addition, the fence plant such as jatropha, is available as a minor role besides palm oil. Jatropha is good in the rainy season and will mature within two months. It can be used as a substitute for diesel in agricultural machinery.

In a community, members can use the oil from the left over of cooking in the house. Through the process it can be produced as "Esther" which it is considered to be very close to diesel. It means Esther can replace the diesel. It is known in worldwide as "Biodiesel". The remaining about eleven liters of vegetable oil is used to extract about one liter of biodiesel. From the above, it can help to reduce the amount of waste that pollutes the Thai community as the further result.

Scope of the study



Measuring the Value of Economic Projects: This is an important indicator of investment decision. It can show the sequence of projects before making decision on the investment. It is generally measured through three indicators: 1) Net Present Value (NPV): Calculation is the difference in the present value of expected revenue each year throughout the life of the project and the present value of expenditures (Hardacer, Hurnie, Anderson, and Lien, 2004), 2) Benefit-Cost Ratio (B/C Ratio): The reason for the investment decision is when the cost-benefit ratio is greater than or equal to one. If the number is less than one, do not invest in the project. Considering the numerical value between the present value of revenue over the life of the project divided by the present value of the cost over the life of the project, 3) Internal Rate of Return (IRR): Used for feasibility analysis. The project is a long-term capital

budgeting tool because the value reflects the return on investment at par. This is compared to the interest rate or financial cost or project cost that is greater or less than the interest rate or financial cost. (Lee, Boehlje, Nelson, and Murray, 1980; Warren, 1982; Illes, 2002; Ross, Westerfielf, and Jaffe, 2005).

Discount rate: There is a need to reduce costs and benefits in the future on time called current value. The discount factor is known as the discount rate. In calculating the present value (Present Worth), it is necessary to choose the discount rate. It is divided into three rates: a) Cutoff rate: If considered for financial analysis, it is calculated from the final cost of money to the business or the rate that the enterprise can borrow. If economic analysis is used, then the opportunity cost of capital is considered to be a reflection of social choice. b) Borrowing rate: The economic analysis that countries have to pay for projects that the country expects to borrow for investment. c) Rate of social preference. Apply to the future return to society. Typically, it is lower than the discount rate per person because social, such as public projects, has a longer duration than a private project itself (Bodie, Kane, and Marcus, 1999).

Sensitivity Measurement: It is the easiest and most widely used method to analyze uncertainty, what will be the effect on the suitability of the project ? (Cheung & Chappell, 2002). The impact is considered to be a cost and a part of the project public or private, such as the environment, society, community (Coase, 1960).

Methodology

Used the questionnaire is to collect data: the community may have people who want or do not want to use alternative energy distributed in the community. This research will use the "Accidental Sampling" method to survey all 400 community members. In this case, communities with less than one year of alternative energy used will be excluded from the sample. Data collection was conducted through in-depth interviews to further research by community representatives who decided to use biodiesel alternatives. Research tools use data analysis from the questionnaire and analyze data relationships by testing statistical data including data analysis from in-depth questionnaires. The results are then analyzed for the cost and return of alternative energy using biodiesel versus the payback period, yield and cost-benefit ratio.

In this research, it is assumed that comparative analysis of costs and returns to families for normal power usage such as electricity, gas, LPG, conventional fuel comparison with biodiesel from waste oil in the community. Assuming the discount rate is 12%.

Discussion

Survey to develop biodiesel of community, Nong Chok district, Bangkok is by using the questionnaire. The questionnaire is divided into 2 types. Type 1 is a questionnaire for villagers. The content includes general information of respondents such as gender, occupation, income, biodiesel test, opinions about current energy community awareness, and future energy needs. It is also including the acceptance of alternative fuels like biodiesel from the community. An open-ended questionnaire was used to provide feedback and suggestions for community biodiesel management. Type 2 is a community leader questionnaire. It contains questions about the community's energy situation. The community energy management is used in the primary data section for the overview including cost of information from community representatives on biodiesel for community using. Collected data from relevant sources such as Department of Alternative Energy and Energy Ministry as well as relevant technical reports and journals, internet and other research sources were cited. The information was used in the secondary.

Descriptive and quantitative analysis check for seeing the background and investing in the biodiesel project of the community by using the method of economics called "Cost and Benefit Analysis" by using biodiesel cost and benefit comparison. The emphasis is on financial considerations. The other side is economic analysis community resources through the integration of economically viable biodiesel resources and reduced value from the disposable use of community-based crops, which are indirect benefits.

Type 1: Perception of alternative energy education
1.1 Gender consists of
1.1.1 Male
1.1.2 Female
1.2 Age specific the year
1.3 Educational area consists of
1.3.1 Vocational Management (Primary)
1.3.2 Vocational Management (Master)
1.3.3 Educational Technology in Vocational and Technical Education
1.3.4 Curriculum and Vocational Education
1.3.5 Science Education
1.3.6 Electrical Engineering
1.3.7 Electronic
1.3.8 Architecture
1.3.9 Agricultural education
1.3.10 Industrial Management
1.3.11 Industrial Design Technology / Industrial Products Technology
1.3.12 Applied Linguistics / English for Science and technology
1.4 Career consists of
1.4.1 Government services
1.4.2 Officers in the State Regulatory Agency
1.4.3 State enterprise
1.4.4 Private company
1.4.5 Private business
1.4.6 Studying
1.4.7 Others (specific)
1.5 Monthly income is stated in Baht

Table 2 Percentage change in Quantity and Price of Benzene

Month	**%change in Q_B**	**%change in P_B**	**elasticity of Benzene**
January	-0.0254	0.0220	-1.1545
February	0.0219	0.0170	1.2906
March	-0.0351	0.0190	-1.8474
April	0.0185	0.0170	1.0853
May	-0.0216	-0.0080	2.7000
June	0.0257	-0.0080	-3.2113
July	-0.0246	0.0090	-2.7333
August	0.0166	-0.0470	-0.3536

Table 2 (Con.)

Month	%change in Q_B	%change in P_B	elasticity of Benzene
September	-0.0095	-0.0360	0.2639
October	-0.0387	-0.0080	4.8375
November	-0.0011	-0.0050	0.2200
December	0.0682	-0.0100	-6.8200
		average elastic	**-0.4769**

2. The questionnaire about the information received from the renewable energy illustrated in the sequence of media forwarding the information to the respondents about renewable energy.
2.1 Newspaper, Weekly magazine
2.2 Television
2.3 Radio
2.4 Publications of different agencies
2.5 Exhibitions organized by public or private organizations
2.6 Electronic media (website) of various agencies
2.7 Seminars or training provided by government organizations; Private
3. A questionnaire about awareness of renewable energy indicates the level of feedback on renewable energy awareness contains 32 questions, divided into 5 levels
3.1 Score 5 Most Commented
3.2 Score 4 Very Comments
3.3 Score 3 Moderate level
3.4 Score 2 Less comment level
3.5 Score 1 Minimum level of feedback
4. Questionnaire for comments and suggestions. It is an open-ended questionnaire that asks for more ideas on why people want to gain knowledge about alternative energy.
4.1 You know about other types of renewable energy besides the above mentioned questionnaire.
4.2 What do you think on the main reason you want to know about renewable energy?
4.3 Other suggestions

Table 3 Percentage change in Quantity and Price of E20

Month	%change in Q_E	%change in P_E	elasticity of E20
January	0.0042	0.0170	0.2465
February	0.0616	0.0190	3.2405
March	-0.0018	0.0180	-0.1000
April	0.0613	0.0190	3.2242
May	-0.0079	-0.0100	0.7900
June	0.0125	-0.0100	-1.2520
July	0.0152	0.0090	1.6911

Table 3 (Con.)

Month	%change in Q_E	%change in P_E	elasticity of E20
August	0.0045	-0.0280	-0.1600
September	-0.0220	-0.0080	2.7500
October	-0.0742	-0.0060	12.3667
November	-0.0571	-0.0060	9.5167
December	0.1653	-0.0110	-15.0236
		average elastic	**1.4408**

Table 4 Percentage change in Quantity and Price of Diesel

Month	%change in Q_D	%change in P_D	elasticity of Diesel
January	0.0123	0.0248	0.4960
February	0.0087	0.0000	undefined
March	0.0156	-0.0005	-31.2800
April	0.0026	0.0005	5.1600
May	-0.0079	0.0000	undefined
June	-0.0079	0.0000	undefined
July	-0.0439	0.0000	undefined
August	0.0051	-0.0219	-0.2347
September	0.0045	-0.0116	-0.3914
October	-0.0165	-0.0055	3.0000
November	0.0402	0.0184	2.1848
December	0.0484	0.0020	24.2050
		average elastic	**0.3925**

As above Tables, the price elasticity of demand for Benzene and Diesel are inelastic at 0.4768 and 0.3925. It shows the consumers will not change their consumptions much when price changes. On the other hand, the demand of gasohol E20 is elastic. The cars that use Benzene or gasoline91 are high engine and high quality. Its price is usually higher than normal cars. The owners will take a good care; moreover, they can afford it and also higher price of gasoline. So, the demand is not elastic. Similarly, the consumers of Diesel are mostly business sector that how much price going to increase, they have to use it. Conversely, gasohol E20 is the alternative fuel introduced for reduces using crude oil which also decrease cost. Most of people who change to use gasohol E20 as its price is lower that other. Therefore, its demand is sensitive to price change. From this reason, it shows that the demand for using gasoline is depending on the changing in price very fast. So, if the consumers can find some object such as Bio-Diesel for substituting, it will be useful for consumers used.

Regarding to the information above, research objective to find the cost-benefit for the bio-diesel is raised.

Table 5 Analysis of Costs and Benefits of Bio-Diesel Project on Community Projects

Cost of Biodiesel Project (Direct Cost)	**Benefit of Biodiesel Project (Direct Benefit)**
The cost of purchasing raw materials from raw materials. household	Reduce community energy costs.
Buildings and improvements to biodiesel.	
Expenditure on equipment used for making Biodiesel	

The cost analysis and financial benefits of the project is based on the case study of one small community consisting of about 150 households. In terms of cost, there will be costs of construction and improvement of buildings for biodiesel and expenses for equipment and materials used in making biodiesel, which is around 180,000 baht. The cost of purchasing raw materials from households is about 50 baht per household, which totally costs about 7,500 baht per month. In terms of reducing the cost of community energy, the project will save the cost of biodiesel by 15 baht per liter with the capacity around 1,000 liters per month. Therefore, total monthly benefit is 15,000 baht. After deducting the cost, the net benefit will be 7,500 baht per month or 90,000 baht per year. Assuming the project life of 5 years and the discount rate of 12%, the Net Present Value (NPV) is 144,429.86 baht. The Benefit-to-Cost Ratio is 1.8 times and the Internal Rate of Return (IRR) would be 41.04% per year.

Table 6 Analysis of the costs and benefits of the biodiesel project in economics (there are projects in the community.)

Cost of Biodiesel Project (Direct Cost)	**Benefit of Biodiesel Project (Indirect Benefit)**
The cost of purchasing raw materials from raw materials. household	The cost of biodiesel production cost savings.
Buildings and improvements to biodiesel.	The value is based on the amount of waste discharged from the community.
Expenditure on equipment used for making Biodiesel	

In the analysis of cost and economic benefits of the project, it is found that the cost of purchasing raw materials from households is about 50 baht per household, which totally costs about 7,500 baht per month. Although this is the project cost, it is the benefit of each household who will earn additional income of 50 baht per month. Moreover, it can also reduce the amount of wasted plants in the community. If this benefit is used to offset the project cost, the net benefit of the project will increase by 15,000 baht. Using the same assumption about the discount rate of 12%, the Net Present Value (NPV) is 468,859.72baht. The Benefit-to-Cost Ratio is 3.6 times and the Internal Rate of Return (IRR) would be

96.59% per year. Moreover, the researchers have conducted the in-depth interview with one household in the community. The average monthly income of this household is 15,000 baht that is from the salary of household members and the income from repairing the truck. The monthly expenditure is about 12,000 baht for food, electricity, water supplies, equipment, miscellaneous costs including energy costs. After the project, the energy cost of this household has reduced from 3,000 baht per month to only 600 baht per month, implying the cost saving of 2,400 baht per month. In addition, this household can also earn additional income from selling plants used as raw material for biodiesel production about 50 baht per month. Therefore, this household gets benefit from cost saving and additional income totally of 29,400 baht per year from this project.

After that, the sensitivity to change is analyzed. To know if the situation has changed will affect the feasibility of the biodiesel project in the community. The analysis is under extreme assumptions. Selecting the variables that are important to a few biodiesel projects has the potential to affect the net present value of a biodiesel project that has changed that. And replace the value with the largest value and the smallest value. To calculate the net present value of the biodiesel project again. To compare before and after analysis as different is as shown in the Table below.

Factor	**Best Case**	**Worst Case**
The cost of biodiesel equipment	-7%	+7%
Construction and improvement of biodiesel plant systems	-12%	+12%

The best case is a decrease in the cost of biodiesel equipment costs. The cost of construction and renovation of biodiesel plants has decreased equivalent to 12 percent. In the worst case, there is an increase in the cost of biodiesel equipment costs. The cost of construction and renovation of biodiesel plants has increased equivalent to 12 percent. In the best case, as a result of the decrease in cost of biodiesel, the cost of construction and renovation of biodiesel plants has decreased. As a result, the project cost is reduced to only Baht 162,400 when analyzing the project's cost and benefits. The project will have a net present value (NPV) of Bt162,029.86, representing a cost to income ratio. The Benefit-to-Cost Ratio is 2 times and the IRR is 47.47% per annum.

While the worst case. When there is an increase in cost of biodiesel equipment costs The cost of construction and renovation of biodiesel plants has increased. 12% will increase the investment cost of the project to 197,600 baht. When analyzing the cost and benefits of the project. The project will have a net present value (NPV) of Bt128,829.86, which is a benefit to cost. The Benefit-to-Cost Ratio is 1.64 times and the IRR is 35.62% per annum. The project is still worth the money.

Conclusion and Policy Implication

The development of alternative energy from the residual resources within the community, such as soybean meal, coconut fiber, corn, sugar cane and rice straw, can create a source of energy called "fuels" for the development of alternative energy in the community sustainable self-reliance. Objectives are **t**o study the factors influencing the decision to use alternative energy as biodiesel in addition to the cost and return factors; to study the trend of community demand for alternative energy using bio-diesel and community energy management as alternative energy to analyze the costs and benefits of using biodiesel in the community.

Academic: The principle of economic analysis and financial analysis can be applied to transform the concept of society into a community.
Policy: Use as a tool to empower and increase social welfare for the community, looking at the use of resources available in the community for maximum efficiency. It also contributes to fairness in using local resources.
Economic / Commercial: This is an important part of the decision to invest and the value of the project in the community.
Social and Community: It is a reflection of the choice of society in the community.
Department of Energy and Provincial Office can use as a guideline to draft a plan for development of other communities. This will lead to the selection of communities that are ready to form the next prototype community, the village headmen and villagers to see the comments and criticism of people in the community.

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