

# RIPPLE ENGLISH

## ACTIVE LEARNING PROGRAM

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Workbook for:  
“The Future of Energy”

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また、数日置いてから再度解き直すのも効果的です。答えを記憶してしまっているかもしれませんが、**回答の根拠をなぞりながら繰り返し解くことで有効な復習になります！**



## The Future of Energy

1. One of the biggest challenges for humanity in the 21st Century is to provide sufficient energy to guarantee the prosperity of a population of 10 billion, while addressing the crises of climate change and an ecosystem collapse. As soon as you start investigating this matter, you might be overwhelmed by the complexity and the scale of this issue. Every possible solution has its own flaws and strengths, and they often make intricate **trade-offs**. It requires long-term strenuous effort and a global alliance of all nations and related institutions. Paradoxically, however, **if you feel overwhelmed, you are on the right path.** There will never be an easy solution, nor a perfect answer. We need to have courage to accept the complicated reality, as well as perseverance to continuously work on the problem. Hopefully more people properly recognize the importance and complexity of this problem without overly expecting technologies and leaning towards ideologies. That is only beginning to truly solve the problem.

- (1) The word “trade-off” in the passage is closest in meaning to
  - A. Competition for commercial advantage
  - B. Nations or regions with trade relationship
  - C. Compromise between conflicting benefits or advantages
  - D. Obstacle to achievements

- (2) Which of the following text best expresses the essential information in the highlighted sentence?

**if you feel overwhelmed, you are on the right path.**

- A. It's natural to give up because the problem is too complex.
- B. Most people lack proper understanding on this issue.
- C. We need to imagine how horrible the possible outcome is going to be.
- D. We cannot solve the problem without recognizing its difficulty.

2. Probably bioethanol makes the best case to understand the complexity of energy problems. Bioethanol is a biofuel produced through the fermentation of various organic materials, primarily from sugarcane and corn. It is expected to serve as a carbon-neutral substitute for fossil fuels, since the carbon released during combustion was originally the one absorbed from the atmosphere by plants. Airplanes and ships cannot be powered by batteries, so some form of clean liquid fuel is essential.
3. But it is often criticized for several reasons. First, it's a trade-off between food production and energy. When grains are used for biofuels, it obviously reduces food supplies and leads to food price spikes. Is it acceptable to drive up the price of food for the poor?
4. Second, bioethanol has extremely poor cost-effectiveness. When we evaluate a certain energy source, we need to examine its energy profit ratio, or EPR; how much energy is gained from the energy invested. For example, oil consumes energy for drilling, refining, and transporting, but we can produce far more energy than the energy invested. The EPR of oil is around 6. In other words, for each unit of energy spent, we get six times the energy in return. Production of bioethanol also requires some input of energy, such as the use of chemical fertilizers and refinement, and EPR is estimated to be about a loss of 0.9. It is like investing \$100 to get \$90. If we produce fertilizers for bioethanol by burning oil, using oil directly is clearly more efficient than using it to get bioethanol.

- (3) According to paragraph 2, which of the following is NOT true?
  - A. Bioethanol can reduce the carbon in the atmosphere.
  - B. Some kind of liquid fuel is indispensable.
  - C. Bioethanol is made from agricultural products.
  - D. Combustion of bioethanol emits carbon.
- (4) According to paragraph 3, bioethanol is criticized because
  - A. it has a single exclusive problem.
  - B. it competes against food security.
  - C. providing food for the poor should definitely be prioritized.
  - D. grains are in short supply.
- (5) According to paragraph 4, what is the problem with bioethanol?
  - A. Production of bioethanol requires chemical fertilizers.
  - B. Bioethanol is more expensive than oil.
  - C. Oil is far cleaner than bioethanol.
  - D. We need to spend more energy in its production than we can eventually gain.

5. Talking about energy is virtually equal to talking about the economy. We cannot discuss the future of energy without taking the market principle into account. Despite a variety of concerns about fossil fuels, we are still largely dependent on them primarily because they are so inexpensive. This might be hard to believe, but oil is actually cheaper than a soft drink. The price of oil is constantly fluctuating, but it has been usually less than \$1 per liter. This is partly because its external costs, such as those resulting from environmental damage, are not reflected in the oil price.
6. Customers prefer less expensive products, and so do companies. It is unrealistic to go around each and every consumer, persuading them to examine the carbon footprint of products and choose eco-friendly ones even if they are expensive. Rather, we should create a market condition where people voluntarily and willingly take preferable actions. In the past, we've moved from one source of energy to another because the new one was cheaper and more powerful. For example, when we stopped burning firewood and started using coal, it was because coal provided a lot more heat more efficiently than wood. If products with high carbon emission are costly, both consumers and businesses will spontaneously avoid them. What we truly need is two kinds of innovation: technological innovation to make sustainable energy cheaper, such as improving the efficiency of solar power generation, and policy innovation to make carbon-emitting energy more expensive, including a carbon tax.

- (6) According to paragraph 5, we have been using fossil fuels because
- A. they are cheaper than a soft drink.
  - B. we have been ignoring their impact on the environment.
  - C. they have high energy densities.
  - D. they are affordable.
- (7) According to paragraph 6, what do we need to solve the problem?
- A. Each citizen has to be conscious of the environment.
  - B. Eco-friendly choices have to be economical as well.
  - C. We need to invest in installing a lot more solar panels.
  - D. We have to create a condition where destructive actions are legally punished.

7. As of 2023, there is no perfect solution to energy problems. Renewable energy sources, particularly solar and wind power, are considered to be the favorites, but they have inherent disadvantages. The prominent downside is that they are weather-dependent sources of energy. Obviously, solar panels and wind turbines cannot operate during the night and on windless days, respectively. Seasonal variations also pose serious challenges. The amount of sunlight that hits the earth's surface varies across the four seasons, and the variation depends on how far the place is from the equator. Parts of Canada and Russia get about 12 times less sunlight in winter than in summer.
8. While the supply from the renewables dramatically fluctuates, electricity demand is relatively stable. In order to fill those gaps, either we have to use other reliable sources complementarily, such as thermal or nuclear power, or to store electricity in batteries. The latter is extremely costly. Imagine a hypothetical future where Tokyo gets all its electricity necessary from wind and solar power alone. One August, Tokyo is hit by a massive typhoons that last for three days. They cannot harness solar energy during the storm, and the winds are so strong that they will rip the wind turbines apart if they aren't shut down. How many batteries would they need in order to power Tokyo for three days, until the typhoon passes and they can utilize solar and wind power again? The answer is more than 14 million batteries; more storage capacity than the world produces in seven years. The purchase cost will be about ¥3 trillion (\$27 billion) annually, averaged over the lifetime of the batteries.
9. Considering the cost of batteries, we will have to utilize thermal or nuclear power to adjust the fluctuation of solar and wind, which poses the next question of whether to choose the risk and cost of carbon emission or those with preserving spent nuclear fuel. The energy issue always involves trade-offs between various factors such as environmental impacts, reliability, generation costs, and so on.

- (8) According to paragraph 7, what is the problem with renewables?
- A. They generate too much energy in summer.
  - B. Their output is unstable.
  - C. They cannot operate in windless days.
  - D. They produce less energy than thermal power plants.
- (9) In paragraph 8, all of the following are implied, EXCEPT
- A. We need some backup of renewables.
  - B. The existing power supply, such as thermal and nuclear, are reliable sources.
  - C. The battery solution is probably unrealistic.
  - D. Given the rapidity of technological development, renewables are promising.
- (10) According to paragraph 9, we need to consider all of the following, EXCEPT
- A. What could complement the instability of renewables?
  - B. Which is more harmful: carbon emissions or spent nuclear fuel?
  - C. How can we provide energy reliably and sustainably?
  - D. How can we persuade people who oppose nuclear power?

10. Nobody wants to experience 2020 again. Due to the COVID-19 pandemic, we were confined to our homes, a lot of businesses went bankrupt, and millions of people lost their jobs. Despite all this agony, the **suspension** of economic activities led to only a 4.5% decrease in carbon emissions compared to the previous year.
11. The implication is that the energy issue cannot be solved by simple saving efforts alone. Of course, it is important to cut down on waste. But it will never be enough. Rather, we will need more energy consumption in the future. The world population is going to reach 10 billion, and a billion people still don't have reliable access to electricity. There is a strong correlation between a country's per capita income and the amount of energy used by its people. As humanitarian duties, we have to provide reading light to study in the evenings, refrigeration to store vaccines, and infrastructure to ensure clean and cheap water for all of us on this planet. The world requires more energy so that all of us thrive, including the poorest, but we need to do this without releasing any more greenhouse gasses.
12. This is impossible with existing technologies. Therefore, we have to invest more resources into Research and Development, specifically to improve the capacity and cost performance of batteries, increase the efficiency of renewables, make nuclear fusion commercially viable, establish a smart grid that enables efficient redistribution of power within a community by monitoring energy demand and supply, and so on.
13. At the same time, a number of studies suggest that our well-being and income do not correlate beyond a certain point. Sufficient energy supply is essential to ensure the welfare of us all, but abundant consumption of energy does not necessarily make us happier. Therefore, human society needs to mature in two ways; technological maturity to power everyone reliably and sustainably, and psychological maturity to find happiness out of what we already have.

- (11) The word "suspension" in the passage is closest in meaning to
- A. stagnation
  - B. interruption
  - C. prohibition
  - D. suffering
- (12) According to paragraph 11, which of the following is true?
- A. We need to reduce energy consumption at all costs.
  - B. Developing countries need to refrain from consuming more energy.
  - C. We will have to use more energy in the future.
  - D. Saving on energy is the most important.
- (13) According to paragraph 12, we need to invest in all of the following, EXCEPT
- A. Increasing the conversion efficiency of renewables
  - B. Making batteries more effective
  - C. Establishing a system to monitor wasteful use of energy
  - D. Building an infrastructure to optimize the flow of energy in a certain area.
- (14) According to paragraph 13, which of the following is true?
- A. The Energy issue requires a multifaceted approach.
  - B. Energy consumption and our well-being don't correlate at all.
  - C. Humanity is psychologically immature.
  - D. R&D is important since it's the only solution.

Answers

- (1) C
- (2) D
- (3) A
- (4) B
- (5) D
- (6) D
- (7) B
- (8) B
- (9) D
- (10) D
- (11) B
- (12) C
- (13) C
- (14) A

(1) 文中の“trade-off”と意味が最も近いのは

- A. Competition for commercial advantage (商業上の利益をめぐる競争)
- B. Nations or regions with trade relationship (貿易関係にある国または地域)
- C. Compromise between conflicting benefits or advantages (相反する利益・利点の間の妥協)**
- D. Obstacle to achievements (成果への障害)

trade off (トレードオフ) とは、一方を追求するともう一方を犠牲にしなければならない (両立できない) という二律背反の状態・関係のことを表す言葉なので、Cが正解。

(2) 下線部のエッセンスをもっともよく表しているのは?

if you feel overwhelmed, you are on the right path. (圧倒されるような気分になっているとしたら、あなたは正しい方向の道のりにある)

- A. It's natural to give up because the problem is too complex. (問題が複雑すぎるため、諦めるのは当然だ)
- B. Most people lack proper understanding on this issue. (ほとんどの人はこの問題について適切な理解を欠いている)
- C. We need to imagine how horrible the possible outcome is going to be. (起こり得る結果がどれほど恐ろしいものになるかを想像する必要がある)
- D. We cannot solve the problem without recognizing its difficulty. (問題の難しさを認識せずに問題を解決することはできない)**

段落の最後に、「これが問題を解決するための最初の一步だ」とあるので、Dが正解。Aのように、諦めろとは述べられていない。

(3) 2段落の内容に合致しないのは?

- A. Bioethanol can reduce the carbon in the atmosphere. (バイオエタノールは大気中の炭素を削減できる)**
- B. Some kind of liquid fuel is indispensable. (何らかの液体燃料は不可欠である。)
- C. Bioethanol is made from agricultural products. (バイオエタノールは農産物から作られる)
- D. Combustion of bioethanol emits carbon. (バイオエタノールの燃焼により炭素が排出される)

すでに大気中に存在する炭素を取り込み、また燃焼の際に排出する (つまりすでに大気中に存在する炭素を循環させるだけ) のがバイオエタノールなので、炭素を増やもしないが減少させるわけでもないのでAが誤り。

(4) 3段落によると、バイオエタノールが批判される理由は

- A. it has a single exclusive problem. (たった1つの問題がある)
  - B. it competes against food security. (食料確保の問題と競合する)**
  - C. providing food for the poor should definitely be prioritized. (貧しい人々への食糧提供は間違いなく優先されるべきである)
  - D. grains are in short supply. (穀物の供給が不足している)
- Cも正しいように思えるが、本文中ではそこまで言い切っていない。「貧しい人々への食料供給を危険に晒すことは許されるのか?」と問題提起しているにとどまっている。

(5) 4段落によると、バイオエタノールの問題点は?

- A. Production of bioethanol requires chemical fertilizers. (バイオエタノールの製造には化学肥料が必要だ)
  - B. Bioethanol is more expensive than oil. (バイオエタノールは石油より値段が高い)
  - C. Oil is far cleaner than bioethanol. (石油はバイオエタノールよりもはるかにクリーンだ)
  - D. We need to spend more energy in its production than we can eventually gain. (生産には、最終的に得られる以上のエネルギーを費やす必要がある)**
- この段落の主要なトピックであるEPRについて触れているDが正解。

(6) 5段落によると、我々が化石燃料を使い続けてきた理由は

- A. they are cheaper than a soft drink. (ソフトドリンクより安価だから)
- B. we have been ignoring their impact on the environment. (化石燃料の環境への影響を無視してきたから)
- C. they have high energy densities. (エネルギー密度が高いから)
- D. they are affordable. (価格がお手頃だから)**

(7) 6段落によると、エネルギー問題の解決には何が必要か?

- A. Each citizen has to be conscious of the environment. (国民一人一人が環境を意識する必要がある)
- B. Eco-friendly choices have to be economical as well. (環境に優しい選択は、経済的である必要もある)**
- C. We need to invest in installing a lot more solar panels. (もっと多くのソーラーパネルを設置するために投資する必要がある)
- D. We have to create a condition where destructive actions are legally punished. (私たちは破壊行為が法的に処罰される条件を作らなければならない)

(8) 7段落によると、再生可能エネルギー源の問題点は?

- A. They generate too much energy in summer. (夏の発電量が大きすぎる)
- B. Their output is unstable. (出力が不安定だ)**
- C. They cannot operate in windless days. (無風の日には作動できない)

D. They produce less energy than thermal power plants. (火力発電所よりも生産するエネルギーが少ない)

天気・季節両方の影響によって発電量が一定でないことについて述べているBが正解。Aは太陽光の季節の影響についてしか述べておらず(さらに冬の発電量が少ないことについて言及しているので夏が多すぎるとは行っていない)、Cは風力についてしか言及していない。

(9) 8段落で示唆されていないのは

A. We need some backup of renewables. (再生可能エネルギーにはバックアップが必要だ)

B. The existing power supply, such as thermal and nuclear, are reliable sources. (火力発電や原子力などの既存の電源は安定性に信頼が置ける電力源だ)

C. The battery solution is probably unrealistic. (バッテリーによる解決策はおそらく非現実的だ)

**D. Given the rapidity of technological development, renewables are promising.** (技術開発の速さを考えると、再生可能エネルギーは有望だ)

本文は再生可能エネルギーに振り切るのであれば併用が必須となるバッテリーの技術的な限界や価格的非現実性について述べているので、Dが誤り。

(10) 9段落によると、考慮すべき事項として述べられていないのは？

A. What could complement the instability of renewables? (再生可能エネルギーの不安定性を何で補うか)

B. Which is more harmful: carbon emissions or spent nuclear fuel? (二酸化炭素排出と使用済み核燃料のどちらがより有害か)

C. How can we provide energy reliably and sustainably? (エネルギーを確実かつ持続的に供給するにはどうすればよいか)

**D. How can we persuade people who oppose nuclear power?** (原発に反対する人々をどう説得すればよいか)

Bの内容については問うているが、「原発を使うべきであるから反対派を説得しなければならない」ということは述べていない。

(11) 分中の“suspension (一時停止、中止)”と意味が最も近いのは

A. stagnation (停滞)

**B. interruption (停止、中断、妨害)**

C. prohibition (禁止)

D. suffering (苦しみ)

(12) 11段落の内容に合致するのは？

A. We need to reduce energy consumption at all costs. (私たちは何としてもエネルギー消費を削減する必要がある)

B. Developing countries need to refrain from consuming more energy. (発展途上国はさらなるエネルギー消費を控える必要がある)

**C. We will have to use more energy in the future.** (将来的にはより多くのエネルギーを使用する必要があるだろう)

D. Saving on energy is the most important. (エネルギーの節約が最も重要だ)

(13) 12段落によると、投資が必要な対象として述べられていないのは

A. Increasing the conversion efficiency of renewables (再生可能エネルギーの変換効率の向上)

B. Making batteries more effective (バッテリーの性能の向上)

**C. Establishing a system to monitor wasteful use of energy** (エネルギーの無駄使いを監視するシステムの確立)

D. Building an infrastructure to optimize the flow of energy in a certain area. (特定の地域のエネルギーの流れを最適化するためのインフラの構築)

C: 本文では「無駄遣いの監視」とは言っていない。Dはスマートグリッドの話の言い換えである。

(14) 13段落の内容に合致するのは？

**A. The Energy issue requires a multifaceted approach.** (エネルギー問題には多面的なアプローチが必要だ)

B. Energy consumption and our well-being don't correlate at all. (エネルギー消費と私たちの幸福にはまったく相関関係がない)

C. Humanity is psychologically immature. (人類は精神的に未成熟だ)

D. R&D is important since it's the only reliable solution. (研究開発は、唯一の解決策であるため重要だ)

技術面、精神面両方での成熟を提案している本文の内容を「多面的なアプローチ」と言い換えているAが正解。B: ある程度までは相関することが述べられているので誤り。C: 未熟であるとは言っていない。D: 技術面、精神面両方での成熟を提案しているため、唯一ではない。