試 験 科 目 名 Subject
科目名　地域・都市計画 (英文)　Regional & Urban Planning

受験番号 Examinee's Number	M

広島大学大学院先進理工系科学研究科（博士課程前期）入学試験問題（2026年10月入学,2027年4月入学）
Entrance Examination for Master's Course (October 2026 Enrollment, April 2027 Enrollment),
Graduate School of Advanced Science and Engineering

＜注意事項＞
1)　日本語または英語のどちらで解答してもよい。

＜Notice＞
1)　You can answer either in Japanese or English.

Choose and answer two out of the three questions.

Question 1

Due to continued population migration and urbanization, cities are increasingly facing challenges such as air pollution, energy scarcity, and the growing impacts of global warming. Renewable energy has the potential to address some of these challenges; however, its deployment also faces limitations in terms of energy supply, reliability, and integration into urban systems. Against this background, answer the following questions:

1.1) Explain the potential advantages and disadvantages of using renewable energy technologies to address urban energy scarcity. Discuss possible pathways for city planners to achieve carbon neutrality.

1.2) The transportation sector accounts for a significant share of total urban energy consumption. The sector is undergoing a transition from conventional fuel-powered vehicles to electric vehicles (EVs). From a planning perspective, cities need to develop adequate infrastructure to support this transition. From a consumer perspective, citizens need to be encouraged to adopt EVs. Explain the possible policy interventions to promote the widespread adoption of EVs. Discuss at least two measures in detail, considering relevant aspects such as policy feasibility, potential responses from citizens, and how the effectiveness and impacts of these policies may change over time.

Question 2

Nowadays, many smart city concepts are being developed and delivered in the form of services. In the energy sector, companies offer electricity contracts at different prices depending on the proportion of energy generated from renewable sources. This provides consumers with multiple options when choosing a monthly energy contract, allowing them to select the share of renewable energy they are willing to purchase.
At the same time, households are increasingly using smart meters and associated mobile applications that enable consumers to monitor their energy consumption at a high temporal resolution, or even in real time. Such information may influence consumers' energy-use behavior and encourage them to modify their consumption patterns. Based on the above background, answer the following questions:

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2.1) Discuss the extent to which households may be willing to adopt energy contracts with different prices based on the share of renewable energy. Explain the possible factors influencing people's willingness to adopt such contracts. Discuss how different price levels may affect the adoption rate of renewable energy contracts.

2.2) Increased visibility of household energy consumption through smart meters and mobile applications may encourage consumers to change their energy-use behavior, although the extent of change may vary considerably across households. Discuss the factors that may influence household energy-use behavior. Identify and explain at least three important factors, discussing why they are relevant, how they may affect energy-use behavior, and how their effects may vary depending on household characteristics and structure.

Question 3

One of the important principles in urban planning is the human-centered approach, which emphasizes the active involvement of people in the planning process because urban development projects can directly affect residents' living environments, daily lives, and well-being. There are various ways to involve citizens in urban planning. For example, planning agencies may invite residents to evaluate proposed planning scenarios and provide feedback and suggestions. Alternatively, agencies may simply provide residents with basic information about a project, which represents a relatively low level of citizen participation. Different levels of citizen engagement require different levels of effort and resources from planners, but greater participation may contribute to plans that better reflect the needs and preferences of local communities. Based on the human-centered approach and the concept of citizen participation described above, answer the following questions:

3.1) Discuss the advantages and disadvantages of involving citizens in urban planning. You may select a specific urban planning project as an example and explain how citizens could be involved and what aspects of the project they could contribute to.

3.2) Explain how you would apply the concept of citizen participation to your proposed master's research topic or an urban planning project. First, clearly describe the background and research question or planning problem. Then, explain how and at what stages you would involve citizens, including the methods you would use and the expected benefits.

試 験 科 目 名 Subject
科目名　交通工学 (英文)　Transportation Engineering

受験番号 Examinee's Number	M

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次の 4 問のうち 2 問を選択して解答せよ。
Choose and answer two of the following four questions.

問 1. 次の文章を読み，後の問いに全て答えよ。用いた式・根拠を示すこと。

Question 1.　Read the following passage and answer all the questions that follow. Show the equations and reasoning used.

都市街路の 1 車線が、自由流速度 $u_f = 60$ km/h、渋滞密度 $k_j = 150$ veh/km、容量（停止線における飽和交通流率に等しい）$q_c = 1{,}800$ veh/h の三角形基本図（図 1）で表されるとする。この車線が信号交差点に流入する状況を考える。信号のサイクル長は $C = 90$ 秒、有効青時間は $g = 54$ 秒である。車両は $q_1 = 900$ veh/h の一定の割合で到着する。

A single lane of an urban arterial is described by the triangular fundamental diagram shown in Figure 1, with free-flow speed $u_f = 60$ km/h, jam density $k_j = 150$ veh/km, and capacity (equal to the saturation flow rate at the stop line) $q_c = 1{,}800$ veh/h. The lane approaches a signalized intersection operated with a cycle length $C = 90$ s and an effective green time $g = 54$ s. Vehicles arrive at a constant rate $q_1 = 900$ veh/h.

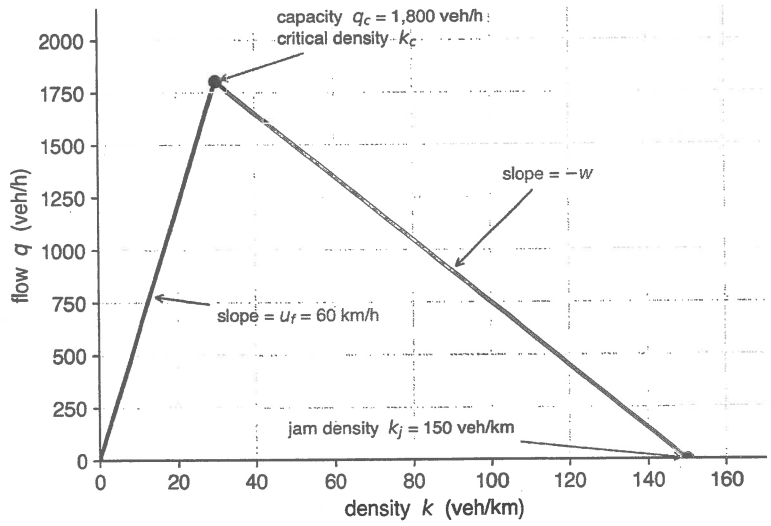


図 1. 車線の三角形基本図／Figure 1.　Triangular fundamental diagram of the lane.

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(1)　この基本図の臨界密度 k_c と、渋滞流側の後退波速度 w を求めよ。また、三角形の 2 つの傾きが物理的に何を表すかを述べよ。

(1)　Obtain the critical density k_c and the backward (congested-branch) wave speed w of this fundamental diagram, and state what the two slopes of the triangle represent physically.

(2)　この流入路の容量と需要率（交通量対容量比）を求めよ。

(2)　Obtain the capacity of this approach and the degree of saturation.

(3)　赤信号の開始とともに、停止線から停止波が伝播する。停止波の速度、赤時間の終わりにおける行列長（m)、およびそのときに行列中に停止している車両台数を求めよ。

(3)　At the onset of red, a stopping wave propagates from the stop line. Obtain the speed of the stopping wave, the length of the queue in meters at the end of the red period, and the number of vehicles standing in the queue at that moment.

(4)　青信号の開始とともに、停止線から発進波が伝播する。(i) 発進波の速度、(ii) 行列の最後尾の車が動き出す、青開始からの時刻、(iii) 停止線から測った行列の最大到達距離を求めよ。

(4)　At the onset of green, a starting wave propagates from the stop line. Obtain (i) the speed of the starting wave, (ii) the time after the onset of green at which the last vehicle in the queue starts to move, and (iii) the maximum spatial extent of the queue measured from the stop line.

(5)　直近の上流交差点はこの停止線から 100 m の位置にある。行列がそこに達するかどうかと、達した場合に何が起きるかを述べよ。

(5)　The nearest upstream intersection is 100 m from this stop line. State whether the queue reaches it, and what the consequence would be.

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問 2. 次の文章を読み，後の問いに全て答えよ。用いた式・根拠を示すこと。

Question 2. Read the following passage and answer all the questions that follow. Show the equations and reasoning used.

2 つの交通事業を評価する。いずれも $t = 0$ に 1,000 億円の初期投資を要し、評価期間は 30 年、残存価値はゼロである。

Two transport projects are being appraised. Both require an initial investment of 100 billion JPY at $t = 0$ and both have an evaluation period of 30 years with no residual values.

- 事業 X（道路容量の改善）：1〜30 年の各年に 150 億円の便益。
- 事業 Y（沿線開発を伴う鉄道）：1〜10 年の各年に 50 億円、土地利用が調整される 11〜30 年の各年に 220 億円の便益。
- Project X (road capacity improvement): benefits of 15 billion JPY per year in years 1–30.
- Project Y (transit-oriented rail line development): benefits of 5 billion JPY per year in years 1–10, rising to 22 billion JPY per year in years 11–30 as land use adjusts.

年金現価係数／Annuity factors　$a(r, n) = \Sigma\,(1 + r)^{-t}$　$(t = 1, \ldots, n)$

r	$a(r, 10)$	$a(r, 30)$
2 %	8.983	22.396
4 %	8.111	17.292

(1)　社会的割引率を 4 % として、各事業の便益の現在価値、純現在価値、費用便益比を求め、どちらを採択すべきかを述べよ。

(1)　At a social discount rate of 4 %, obtain the present value of benefits, the net present value and the benefit–cost ratio of each project, and state which project should be selected.

(2)　社会的割引率を 2 % として同じ計算を行え。今度はどちらを採択すべきかを述べ、便益の時間的分布の観点から順位が入れ替わる理由を説明せよ。

(2)　Repeat the calculation at a social discount rate of 2 %. State which project should now be selected, and explain why the ranking changes in terms of the time profile of the benefits.

(3)　X 国では評価期間が長くなるほど低くなる割引率（たとえば 0〜10 年は 3.5 %、以降は段階的に低下）を採用している。逓減割引率が何を意図したものかを簡潔に説明し、上の 2 事業のどちらがこの方式で有利になるかを述べよ。

(3)　Country X applies a discount rate that declines with the time horizon (for example 3.5 % for years 0–10 and lower rates thereafter). Explain briefly what a declining discount rate is intended to achieve, and state which of the two projects above would be favored by such a schedule.

(4) 費用便益分析は、事業の社会的効率性を評価する有用な手法である一方、それだけでは事業の望ましさを十分に判断できない場合がある。その理由を、費用・便益の分配や貨幣換算が困難な影響などに言及しながら簡潔に説明せよ。また、費用便益分析の結果を実際の政策決定に用いる際に、どのような点を併せて考慮すべきか述べよ。

(4) Cost–benefit analysis is a useful tool for assessing the social efficiency of a project, but it may not by itself provide a sufficient basis for determining whether a project is desirable. Briefly explain why, referring for example to the distribution of costs and benefits and to impacts that are difficult to monetize. Also state what should be considered alongside the results of cost–benefit analysis when making an actual policy decision.

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問 3. 以下の問いに全て答えよ。用いた式・根拠を示すこと。
Question 3. Answer all of the following. Show the equations and reasoning used.

(1) 道路混雑が外部性である理由を説明せよ。また、混雑した道路に追加的な 1 トリップが行われる場合の私的限界費用と社会的限界費用の違いを説明せよ。
(1) Explain why road congestion is an externality, and explain the difference between the private marginal cost and the social marginal cost of an additional trip on a congested road.

(2) 最適な混雑料金をどのように設定すべきかを説明し、それを課すことで、利己的な経路選択・トリップ選択が社会的に最適な選択と一致する理由を説明せよ。
(2) Explain how the optimal congestion charge should be determined, and why imposing such a charge makes selfish route and trip choices coincide with the socially optimal ones.

(3) 単純な混雑課金と比べて、受容性を高めるためにどのような制度上の工夫が考えられるか。一つ具体例を挙げ、その工夫がなぜ受容性を高めると考えられるかを説明せよ。
(3) Compared with a simple congestion charge, what institutional arrangement could make congestion pricing more acceptable? Give one specific example and explain why it would improve its acceptability.

(4) 現実には、すべての道路に最適な混雑料金を課すことができるとは限らず、課金されない代替経路の存在や公共交通容量などの制約がある。このような制約の下での「次善（second-best)」の混雑料金とは何かを説明し、理想的な混雑料金（first-best）と比べて、どのような点を考慮して料金や制度を設計する必要があるかを論じよ。
(4) In practice, it may not be possible to impose optimal congestion charges on all roads, because of constraints such as untolled alternative routes and limited public transport capacity. Explain what "second-best" congestion pricing means under such constraints, and discuss what needs to be considered when designing the charge or scheme compared with first-best congestion pricing.

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問 4. 次の文章を読み，後の問いに全て答えよ。必要に応じて、具体例や根拠を示すこと。
Question 4. Read the following passage and answer all the questions that follow. Give specific examples and justification where appropriate.

交通計画では、従来、パーソントリップ調査など、計画・分析を目的として収集されたデータが広く用いられてきた。近年ではこれに加え、GPS 軌跡、交通系 IC カードの利用履歴、ETC 2.0、携帯電話の位置情報、映像データなど、日常的なサービスや活動を通じて蓄積されるデータ（パッシブデータ）も利用されるようになっている。
Question 4. Transport planning has traditionally relied on data collected specifically for planning and analysis, such as person trip surveys. More recently, passively generated data from everyday services and activities—such as GPS trajectories, transit smart-card records, ETC 2.0 data, mobile-phone location data, and video data—have also become increasingly available.

(1) 計画・分析を目的として収集されるデータと、パッシブデータの違いを説明せよ。それぞれについて二つの例を挙げ、どのような情報が記録されるかを述べよ。
(1) Explain the difference between data collected specifically for planning and passive data. Give two examples of each and describe what information is recorded.

(2) パッシブデータから直接得られる情報と、直接は得られない情報を説明せよ。また、GPS 軌跡を例として、トリップ目的や交通手段をどのように推定できるかを述べ、その推定結果が旅行者への直接的な質問から得られる情報とどのように異なるかを説明せよ。
(2) Explain what information can and cannot be obtained directly from passive data. Using GPS trajectories as an example, describe how trip purpose and travel mode can be inferred, and explain how such inferred information differs from information obtained by directly asking travelers.

(3) パッシブデータは非常に多くの観測を含む場合でも、必ずしも対象とする人口全体を代表しているとは限らない。その理由について具体例を挙げて説明し、このようなカバレッジや代表性の問題が交通計画の分析結果にどのような影響を与えるかを述べよ。
(3) Even when passive data contain a very large number of observations, they do not necessarily represent the entire population of interest. Explain why, using specific examples, and discuss how problems of coverage and representativeness may affect the results of transport planning analyses.

(4) パッシブデータを公共の交通計画に利用する際には、プライバシーや本人同意などに関する問題が生じる可能性がある。公共主体がこのようなデータを利用する際に満たすべき条件や配慮すべき事項について、自らの考えを理由とともに述べよ。
(4) The use of passive data in public transport planning may raise issues such as privacy and informed consent. Explain, with reasons, what conditions or safeguards should be required when a public agency uses such data.

試 験 科 目 名 Subject
科目名　建築・都市環境学 (英文)　Building and Urban Environmental Science

受験番号 Examinee's Number	M

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次の５問のうち４問を選び解答せよ。
Choose and answer four out of the following five questions.

問題１．建物周辺の気流に関する以下の問題に答えよ。
Question 1. Answer the following questions concerning air flow around a building.

（１）独立した中高層の建物に正面から風があたった場合の建物周辺の気流のパターンを図示して説明せよ。
Explain air flow patterns around an isolated mid-to-high-rise building by illustrating a figure when it receives the wind from the front side.
（２）よどみ点の大まかな位置とその特徴を説明せよ。
Explain the approximate position of a stagnation point and its characteristics.
（３）上記の建物周辺の風圧分布を気流のパターンと関係づけて論ぜよ。
Discuss the distribution of wind pressures around the aforementioned building in relation to the air flow patterns.

問題２．接触冷却に関する以下の問題に答えよ。
Question 2. Answer the following questions concerning conductive cooling.

（１）室内での人体への接触冷却について説明せよ。
Explain conductive cooling for the human body indoors.
（２）接触冷却を用いた具体的な冷却方法を例示せよ。
Provide specific examples of cooling methods utilizing conductive cooling.
（３）上記の冷却効果を最適化する方法と適用にあたって生じうる問題を説明せよ。
Explain how to optimize the aforementioned cooling effect and the potential issues that may arise during its application.

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問題３．温熱適応行動に関する以下の問題に答えよ。
Question 3. Answer the following questions concerning thermal adaptative behaviors.

（１）Figure 1 を用いて温熱適応行動のメカニズムを説明せよ。
Explain the mechanism of thermal adaptive behaviors using Figure 1.
（２）皮膚周辺の血流のコントロールが温冷感に与える影響について論ぜよ。
Discuss the effects of skin blood flow regulation on thermal sensation.
（３）社会・文化的要因が温熱適応行動に与える影響について論ぜよ。
Discuss the impacts of socio-cultural factors on thermal adaptive behaviors.

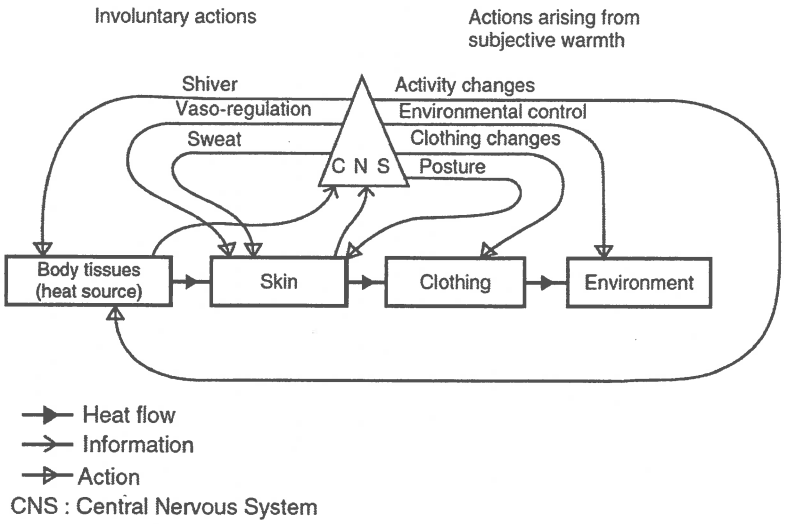


Figure 1. The thermal regulatory system.

Source: Humphreys M.A. & Nicol J.F. (2018) Chapter 10: Principles of adaptive thermal comfort, in *Sustainable Houses and Living in the Hot-Humid Climates of Asia* (Kubota et al. (Eds)), pp. 103-113, Springer.

問題４．建築群周辺の気流に関する以下の問題に答えよ。
Question 4. Answer the following questions concerning air flow around buildings.

（１）縮流効果とチャンネル効果を図示して説明せよ。
Illustrate and explain the Venturi effect and the channel effect.
（２）グロス建蔽率が同じ場合，戸建て住宅地と中高層の集合住宅地のどちらで歩行者レベルの平均風速が高くなるか。理由とともに論ぜよ。
When the gross building coverage ratio is the same, discuss whether the average wind speed at the pedestrian level is higher in detached residential areas or in mid-to-high-rise apartment blocks, and explain the reasons.
（３）建築群内の建物高さのばらつきが歩行者レベルの気流分布に与える影響を論ぜよ。
Discuss the impact of variations in building heights within a building cluster on the air flow distribution at the pedestrian level.

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問題５．世帯エネルギー消費量に関する以下の問題に答えよ。
Question 5. Answer the following questions concerning household energy consumption.

（１）世帯エネルギー消費量の典型的な影響要因を説明せよ。
Explain the typical factors affecting household energy consumption.

（２）Figure 2 は，インドネシアの主要都市内に立地する集合住宅に居住する世帯のエネルギー消費量の影響要因の構造を示している。この図を用いて，公共集合住宅と民間集合住宅の影響要因の違いとその違いが生じた背景を論ぜよ。
Figure 2 shows the structure of factors affecting household energy consumption in apartments across major Indonesian cities. Based on this figure, discuss the differences in these factors between public and private apartments, along with the underlying reasons for these differences.

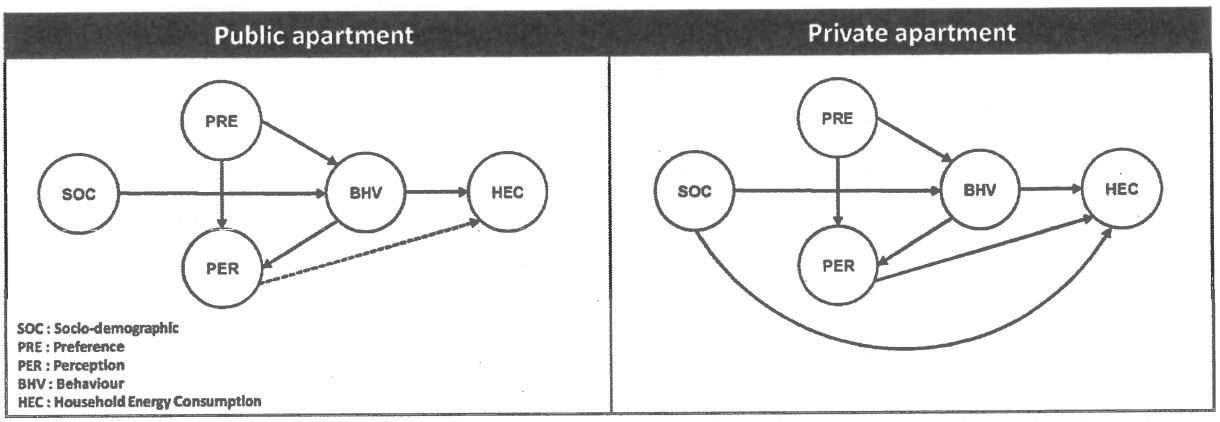


Figure 2. Conceptional diagrams of factors affecting household energy consumption in public and private apartments in Indonesia.

Source: Pratiwi, S.N., Kubota, T., Sani, H.A., Surahman, U., Alfata, M.N.F. (2026) Psychological and physiological factors influencing household energy consumption among apartment occupants in major cities of Indonesia, *Journal of Building Engineering*, 115827.

試 験 科 目 名 Subject
科目名　エネルギー技術論 (英文)　Energy Science and Technology

受験番号 Examinee's Number	M

広島大学大学院先進理工系科学研究科（博士課程前期）入学試験問題（2026 年 10 月入学,2027 年 4 月入学）
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次の 3 問にすべて答えよ。
Answer all three of the following questions.

問題「1」以下の海洋再生可能エネルギー発電技術について、その定義と発電課程の物理的メカニズムを説明せよ。
Question [1] Explain the definition and physical mechanism of the power generation process for the following ocean renewable energy generation technologies.

1）海洋温度差発電
Ocean thermal energy conversion

2）潮流発電
Tidal stream power generation

3）洋上風力発電
Offshore wind power generation

4）塩分濃度差発電
Osmotic power generation

問題「2」海洋における波力発電技術は大きく以下の 3 つに分類される。それぞれに発電技術が適用可能な環境と発電課程の物理的メカニズムを説明せよ。
Question [2] Wave power generation technologies in the ocean are broadly classified into the following three types. Explain the suitable environments for application and the physical mechanisms of the power generation process for each technology.

1）振動水柱型
Oscillating water column

2）可動体型（ポイントアブソーバー式／アッテネーター式／振動フラップ式）
Moving-body type (Point absorber/Attenuator/Oscillating wave surge converter)

3）越流型
Overtopping device

試 験 科 目 名 Subject
科目名　エネルギー技術論 (英文)　Energy Science and Technology

問題「3」西太平洋の低緯度（南北 10 度～20 度以内）に位置するサンゴ礁が発達した架空の小さな島（Fig.1 参照）を想定し、島の人々ために海洋再生可能エネルギーのみを利用した持続可能な電力供給戦略を講ぜよ。ただし、以下の気象・海象・波浪条件を考慮し、三つ以上の海洋再生可能エネルギー発電技術を利用すること。また、沿岸生態系への影響を考慮すること。

- 気候・気象：雨季と乾季の季節性が明確であり、一年中東から西へ貿易風が吹き付ける。さらに、台風も頻繁に訪れる。
- 海象：貿易風に押され、海面付近で常に強い流れが存在する。海洋温度差は常に 20 度以上。
- 波浪：貿易風と台風により常に高い波浪が発生する。さらに、遠方からの長周期のうねりが頻繁に襲来する。

Question [3] Assuming a hypothetical small island with well-developed coral reefs located in the low-latitude region of the Western Pacific (within 10° to 20° North/South latitude) (see Fig. 1), develop a sustainable power supply strategy utilizing only ocean renewable energy for the island's population. You must consider the following meteorological, oceanographic, and wave conditions and incorporate at least three distinct ocean renewable energy generation technologies. Also, consider the impact on coastal ecosystems.

- Climate & Meteorology: Distinct wet and dry seasons with trade winds blowing consistently from east to west throughout the year. Typhoons also visit frequently.
- Ocean weather: A strong, constant surface current exists driven by the trade winds. The ocean temperature difference is consistently 20°C or higher.
- Waves & Swells: Consistently high waves generated by trade winds and typhoons, alongside frequent long-period swells arriving from distant storms.



Fig. 1. A hypothetical small island in the low latitude region of the Western Pacific within 10° to 20° North/South latitude. (created on Aug. 9 by Google Gemini)