# Task 2.2 – Sustainability

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When constructing a train ticket search system for national railway services, system developers should consider the following sustainability issues:

### Energy Efficiency

The system's computational resources, such as servers and data centres, must be optimised for energy efficiency. Hardware that is energy-efficient, virtualization techniques, and effective algorithms can help reduce the system's carbon footprint. Implementing green computing practises will reduce energy consumption and maximise resource utilisation.

### Data Management

Data Management: Appropriate data management practises must be implemented in order to optimise storage and minimise superfluous data replication. Reducing redundant data storage can result in energy savings regarding storage infrastructure and cooling needs. Deduplication methods and compression algorithms can be utilised to reduce the amount of data storage required.

### Scalability

Scalability: The system should be designed to accommodate rising data and user requests volumes. Utilising scalable architecture and distributed computation techniques, the system is able to effectively manage peak loads and avoid performance bottlenecks. This scalability reduces the need for additional hardware, thereby reducing energy usage and infrastructure costs.

### Transportation Optimisation

The system's objective should be to optimise transportation routes and schedules in order to reduce total energy consumption and greenhouse gas emissions. By factoring in train occupancy, travel time, and network congestion, the system can recommend more environmentally friendly travel options, such as routes with fewer transfers or reduced energy consumption.

### Renewable Energy Integration

Railway services can implement renewable energy sources to fuel their computational infrastructure. The system's energy consumption can be aligned with sustainable practises by partnering with renewable energy providers or investing in on-site renewable energy generation.

Data Accuracy and Predictive Analytics

For efficient train ticket searches and route planning, accurate and current data is essential. To provide consumers with the most trustworthy and accurate information, the system should incorporate real-time data from sensors, IoT devices, and other sources. Utilising predictive analytics techniques, it is possible to forecast demand and optimise train schedules, thereby reducing energy waste and emissions caused by inefficient operations.

### Awareness and Changes in User Behaviour

The system can also play a role in promoting sustainable behaviour among users. By providing information on sustainable travel options, carbon footprint calculations, and/or incentives for selecting greener routes, the system can encourage users to make environmentally responsible decisions. This can have a positive effect on the long-term viability of national railway services.

These considerations are consistent with the principles of computational sustainability, which seeks to employ computational techniques to address environmental and societal challenges. National railway services can contribute to reducing energy consumption, minimising carbon emissions, and promoting sustainable transportation by implementing sustainable practises into the design and administration of the train ticket search system.