Objective

The goal of this analysis was to determine the **ticket price that maximizes profit** for venue **V_Gamma**, using the trained crowd energy prediction model and explicitly stated business assumptions.

Business Assumptions

- Analysis is restricted to **V_Gamma**.
- Venue capacity ≈ **800 seats**.
- Fixed cost per show = **$5,000**.
- Variable cost per attendee = **$8**.
- Crowd energy affects attendance and spending behavior.
- Weather, moon phase, and band outfit are fixed to their most common values for V_Gamma to isolate the effect of ticket price.

Attendance Model

Attendance was assumed to scale with crowd energy and capped by venue capacity:

$$\text{Attendance} = \min(800,\ 8 \times \text{Crowd Energy})$$

This assumes a near-full house at very high energy levels.

Profit Formula

Revenue and cost were defined as:

$$\text{Revenue} = \text{Ticket Price} \times \text{Attendance}$$
$$\text{Cost} = 5000 + (8 \times \text{Attendance})$$
$$\boxed{\text{Profit} = (\text{Ticket Price} \times \text{Attendance}) - (5000 + 8 \times \text{Attendance})}$$

Methodology

Ticket prices were simulated in the range **$20 to $120**.
For each price point:

1. Crowd energy was predicted using the trained Random Forest model.

2. Attendance was derived from predicted crowd energy.
3. Profit was calculated using the above formula.

A profit vs ticket price curve was plotted to identify the optimal price.

Results

The profit curve increased across the tested price range and peaked at the upper bound.

- **Optimal Ticket Price: $120**
- **Maximum Expected Profit: ≈ $63,192 per show**

Interpretation

For V_Gamma, the model predicts that crowd energy remains sufficiently high even at premium ticket prices. As a result, increased per-ticket revenue outweighs the reduction in attendance, making higher prices more profitable within the tested range.

Since the maximum profit occurs at the upper bound, exploring prices beyond $120 may reveal a global optimum, but this was outside the scope of the current analysis.