**Cost-Benefit Analysis of Optimization Approaches**

**Title:** *Financial Impact Assessment of 5G Optimization Strategies*

**A. Objective**

Evaluate and quantify the operational expenditures (OPEX) and capital expenditures (CAPEX) associated with various optimization techniques to guide investment decisions.

**B. Cost Categories**

| **Category** | **Details** | **Estimated Cost Drivers** |
| --- | --- | --- |
| **CAPEX** | Hardware upgrades (RAN, core), new servers | Equipment procurement, installation, licenses |
|  | Software acquisition and customization | AI/ML platforms, orchestration tools |
|  | Network infrastructure expansion | Fiber deployment, data center upgrades |
| **OPEX** | Network operation and maintenance | Staffing, energy consumption, SLA management |
|  | Cloud and data storage costs | Pay-per-use model or reserved instances |
|  | Training and change management | Staff training, process updates |
|  | Vendor support and licensing fees | Annual contracts, software updates |

**C. Benefits Quantification**

| **Benefit Type** | **Description** | **Quantitative Impact** |
| --- | --- | --- |
| **Improved Throughput** | Higher data rates reduce congestion | +15-25% capacity increase |
| **Energy Savings** | Power optimization reduces consumption | ~10-20% reduction in energy costs |
| **Reduced Downtime** | Faster fault detection and resolution | 30-50% decrease in outage durations |
| **Operational Efficiency** | Automation reduces manual interventions | 20-30% lower OPEX for network operations |
| **Customer Experience** | SLA improvements and reduced churn | 5-10% increase in customer retention |

**D. Financial Model**

* **Scenario Analysis:**
  + *Baseline:* Current network operations without optimization.
  + *Option 1:* Partial AI-assisted tuning with manual oversight.
  + *Option 2:* Full automation with AI-driven parameter control.
* **Net Present Value (NPV):** Calculate NPV over 5 years for each option.
* **Return on Investment (ROI):** Estimate payback period based on cost savings and revenue uplift.
* **Sensitivity Analysis:** Vary key assumptions like energy prices, customer growth, and capex inflation.

**E. Summary Table Example**

| **Metric** | **Baseline** | **Option 1** | **Option 2** | **Notes** |
| --- | --- | --- | --- | --- |
| Initial CAPEX (USD million) | 0 | 15 | 30 | Equipment + software |
| Annual OPEX (USD million) | 50 | 40 | 35 | Energy, maintenance |
| Estimated Energy Savings (%) | 0 | 10 | 20 | Reduced power consumption |
| SLA Improvement (%) | 0 | 5 | 10 | Impact on churn |
| Payback Period (years) | N/A | 3.5 | 2.0 | Based on cash flows |