# Research Paper: Vortex-Induced Vibration (VIV) Energy Harvesting

## Title: A Bladeless Approach to Urban Wind Energy

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### 1. Abstract

This research paper explores the harvesting of kinetic energy from wind using non-rotating structures. By utilizing the principle of Vortex-Induced Vibration (VIV), mechanical energy can be captured through structural resonance and converted into electrical power via electromagnetic induction.

### 2. Physical Principle: Vortex Shedding

Vortex shedding occurs when a fluid (air) flows past a bluff body (cylindrical mast). This creates alternating low-pressure zones, causing the body to move periodically. The shedding frequency is governed by the Strouhal number (St). Resonance is achieved when the natural frequency of the mast matches the shedding frequency.

### 3. Proposed Design & Components

- The Oscillator: A vertical mast made of lightweight carbon-fiber.
- Elastic Base: A precision spring system to allow controlled oscillation.
- Generator: A series of Neodymium magnets passing through copper coils to produce current.

### 4. Strategic Advantages

- Zero Noise Pollution: No high-speed rotating blades.
- Wildlife Safe: Does not pose a threat to birds or bats.
- High Density: Masts can be placed closer together than traditional turbines.
- Urban Integration: Ideal for rooftops and smart city infrastructure (NEOM Case Study).