

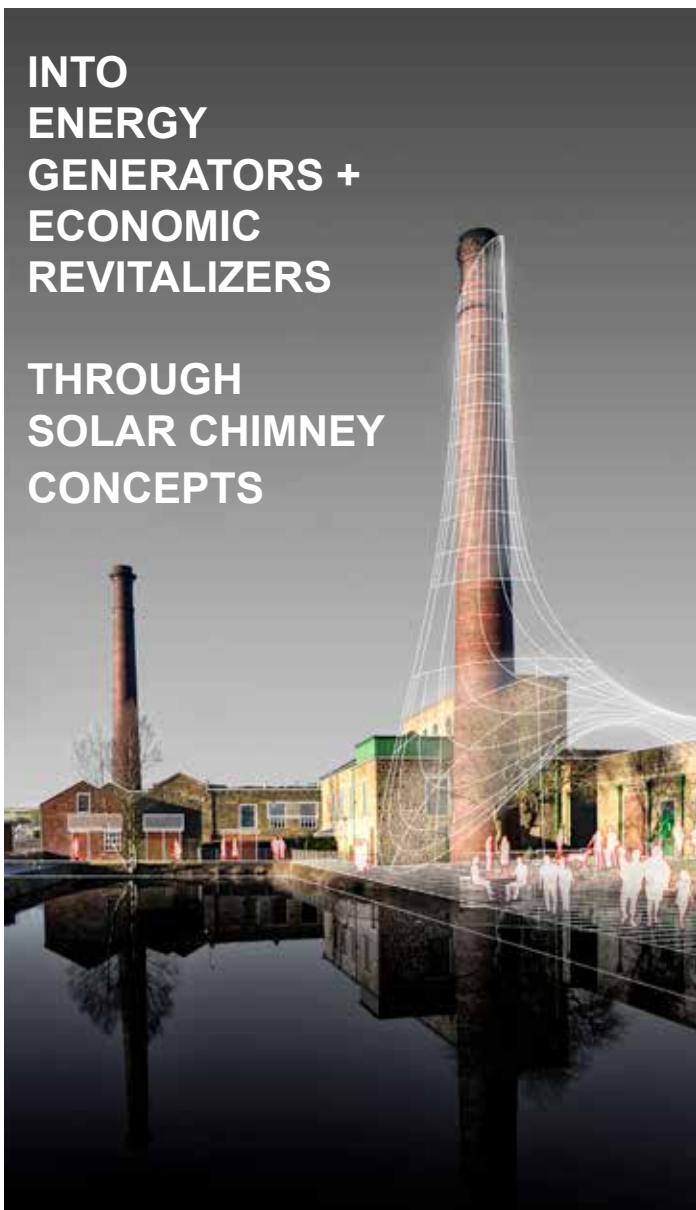
Ongoing Research

# TOWERPOWER

REPURPOSING  
OBSOLETE FACTORY  
CHIMNEY COMPLEXES

INTO  
ENERGY  
GENERATORS +  
ECONOMIC  
REVITALIZERS

THROUGH  
SOLAR CHIMNEY  
CONCEPTS



sigus@mit.edu  
Sinead C. Cheung / Scheung@mit.edu

WORLDWIDE TOWER POWER  
POLLUTION AND OBSOLESCENCE



THIRD WORLD - Bangladesh, etc.

FIRST WORLD - England, etc.

## **AN OVERLOOKED OPPORTUNITY** **The repurposing of abandoned factories** **and chimney complexes**

As the post-industrial world moves forward into a new era, a patchwork of now-defunct centers of heavy industry and manufacturing complexes from the mid-20th century struggle to adapt to a variety of changed economic and social conditions. One increasingly sees abandoned tall chimney complexes, and one increasingly reads of factories being functionally phased out from environmental concerns as more efficient, less polluting sources are sought. Consequently one sees much abandonment of the infrastructure that once served as an economic stimulus to the urban areas. Overtime these areas become 'sore points' in deteriorated urban areas, expensive to remove and in general have often become elements anchoring blight and decay in many urban regions.

Many of these chimney-industrial complexes remain active and are commercially viable in Third World countries. However, many of the regions are faced with a contradiction between meeting the population's energy, production, or economic needs, and meeting the demands of international institutions and actors for 'greener' and carbon conscious technologies. Further maintenance of these chimneys and factories come with high environmental-social costs and economic inefficiencies. At the same time, neither is it feasible for such particular countries to transition from current cruder outdated, but cheaper, energy production to a 'greener alternative'. Countries locked under this dilemma also face an insecurity of "falling behind". Thus, producing 'leap-frogging' emulations in development policies and infrastructures that are, more often than not, unsustainable in the long run.

## **SCIENCE/TECHNOLOGY/INNOVATION** **The merging and application of 20th century** **technology with 21st innovation**

What is the one of the most significant overlooked opportunities that can be addressed using science, technology, innovation and/or strategic partnerships (STIP)? We contend post-industrial urban regions, and the industrial corridors of underdeveloped/ developing countries are often overlooked. Further, renovating these particular complexes into commercial sites through the merging of solar and turbine technology, one could begin to introduce sustainable energy that could serve adjacent to the present infrastructure.

By modifying abandoned chimneys using 'solar chimney' concepts, one can tap the energy potential using turbines driven by augmented updraft in the chimney. Stand-alone chimneys as they exist now do not have insufficient inherent draft, however, by augmenting this draft with a solar capture 'apron', obsolete industrial factories and chimney complexes can make an effective generator of energy when coupled with a turbine to generate electricity. The proven 'solar chimney' concept offers the potential of a wide variety of benefits in energy, urban revitalization, and architecture.

Overall, this 'Tower Power' approach offers environmental advantages in reuse, recycle, and repurposing.



As the solar apron (glass collector) is heated, driving the updraft within the chimney. By inserting a turbine within the chimney, one can utilize the energy generated.

**STRATEGIC PARTNERSHIP**  
**Pairing technology and innovation with a**  
**multi-stakeholder**  
**private-public partnership**

It is critical to understand that technology is not a one-stop solution, nor is it a panacea. Therefore, strategic partnerships should be coordinated with the implementation phase of this concept. As the technology will introduce a new energy industry sector into the region/country, a three-pronged partnership with universities, government and private sectors is suggested in order to develop policies that would encourage equity in the growth and opportunity.

Ideally, the three-pronged partnership would take the form of a multi-stakeholder partnership platform. With every actor being a stakeholder, the policies and agreement created are not only sustainable but it will set the stage for future transparency in future agreements.

**WORLDWIDE OPPORTUNITY**  
**A concept applicable internationally**

The framework of the Tower Power concept is international in scope. The project is applicable to both First World and Third World countries, specifically within areas developed around a previous industrial corridor. Although the research initiative originated from the United States within the New England regions with its large areas of abandoned industrial factories along the main rivers, the benefits and applicability of our concept provide equal benefit in Third World situations.

The Merrimack River Valley in the US, and Dhaka, Bangladesh, illustrate the diversity of this approach and its applicability to each country's developmental needs.

### *First World: The Merrimack River Valley, Massachusetts US*

Massachusetts was once the center of textile production in the United States. Since its de-industrialization in the 1930s, it has been described as an “a depressed industrial desert” as early as 1931. After a series of urban revival in most parts of the region, much of its post-industrial areas were able to recover and find other sources for economic stimulus. Under strict Massachusetts law, most of the buildings and post-industrial estates remain protected under the state’s conservation laws and remain as historical landscape. Thus, leaving a series of abandoned chimney networks and factory-complexes that remain either unused, or potentially renovated for other productive purposes.

However, upon research, the former industrial corridors – the Merrimack corridor in the New England, and the Blackstone River corridor among others, have the potential to essentially make the two regions exemplary candidates for a TowerPower approach. This relatively ‘free non-polluting energy’ could once again become new economic drivers and the factory buildings make attractive sought after office space. Moreover, many cities offer preservation grants for the repurposing of the abandoned tall chimney complexes, potentially making this economically very attractive..



**Lowell, Massachusetts, on Merrimack River  
Approximately 10 industrial complexes**

### *Third World: Dhaka, Bangladesh*

The capitol, Dhaka, of Bangladesh has a highly polluting traditional brick making industry. Bricks are a key construction material, and large numbers of brick kilns exist – World Bank estimates indicate around 5000, and the industry is expected to continue to grow at a rate of 6% despite serious environmental concerns.

The World Bank, among others, has embarked on programs to end the traditional methods of burning brick and promote alternative more modern – and expensive – methods.

One alternative is to close kilns for failure to cope with pollution issues, eliminating 200 – 350 laborers each kiln. Regulations indicate that kilns need to be 120 feet, which make them very difficult and costly to move. Repurposing overcomes the concerns without added costs.

A repurposed kiln would offer energy for alternative small industry development, offering employment and industrial products. Undoubtedly training would be required, but this is parallel to current programs in Bangladesh. It remains to be seen what industries develop to replace the brick manufacturers but with inexpensive (free?) power, options are unlimited.



**Brick kilns located in Dhaka, Bangladesh, near the Karnatail River. The kilns tend to locate in ‘clusters’ which when repurposed may become a ‘mini-industrial park’, driven by the essentially free energy.**

Many other Third World – and First World! - countries have generally similar condition, where the TowerPower concept could be applied. Although the large clusters of factories with chimneys are not that widespread, many ‘single chimney’ factories are common, generally from obsolete industries for example, sugar production

## **TAKEAWAYS**

As the information technology revolution continues to grow, the further away do these industrial-chimney complexes remain economically viable for majority of the countries around the world. The TowerPower innovation utilizes existing sustainable technology and merges with ones that have grown obsolete over the years or desirable to close because of pollution. Overall, technological advancement promotes conservation of materials and resources, introducing an energy technology concept that is integrated to the infrastructure of the urban areas, producing sustainable infrastructure that would match to increasing urbanization and trending climate changes in high solar radiance, and efficient use of valuable limited land-space. Aside from the sustainability perspective, the TowerPower concept provides employment opportunities, an economic stimulus to depressed urban areas, increasing value of real estate through the re-modification of factory-complexes, and contributes to a form of development that serves as a framework for enabling the concept to be customizable country-by-country.

## **RESEARCH STATUS**

The research is ongoing, with current focus on detailed technical specifications – the turbine specifications and the design of the ‘hot air capture’ apron. A chimney is being sought as a ‘proof of concept’.

For more information:

sigus@mit.edu  
RGoethert@mit.edu  
scheung@mit.edu