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# Innovations in Rural Broadband for Inclusive Telecom Growth

Jan 22, 2014

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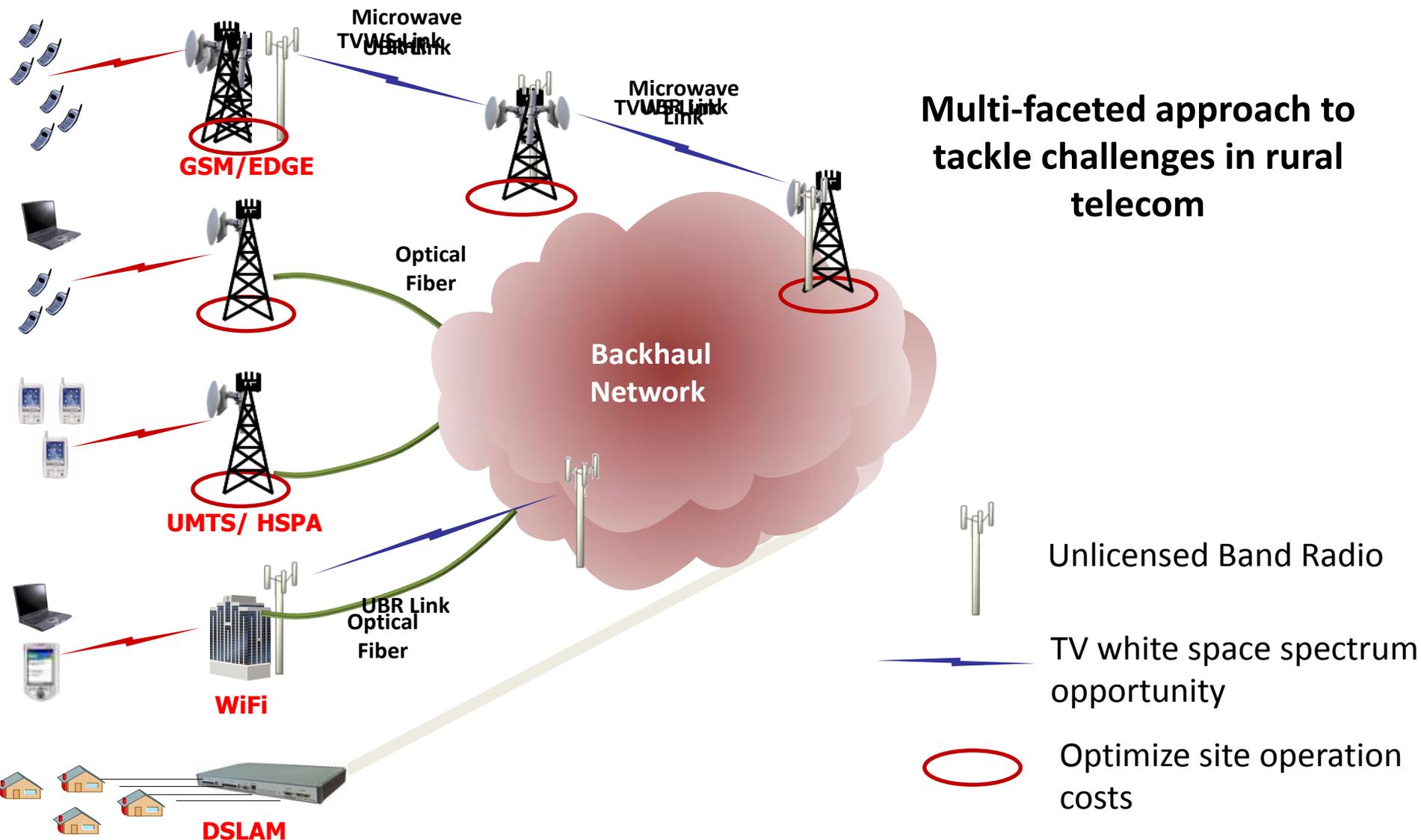
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TICET: Tata Teleservices IIT Bombay Center for Excellence in Telecommunications

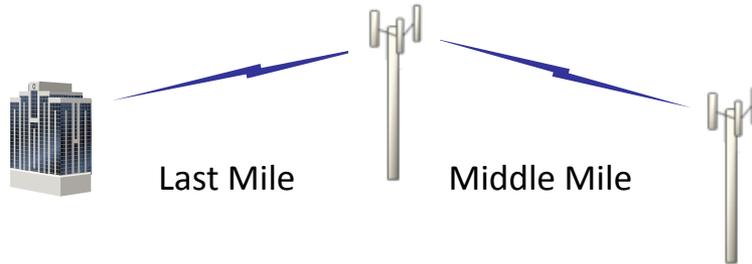
# TICET Innovations

Low Cost Technology Solutions for Rural Telecom



# Project 1: Unlicensed Band Radio

Technology for last and middle mile wireless connectivity



## Modified WiFi technology for long distance use (upto 30km)

- 1 Field tested with leading operator
- 2 Customization possible in software stack, allowing greater control over QoS and performance
- 3 Easy integration with several low cost readily available hardware, ready to deploy solutions available
- 4 Ideal solution to extend reach of NOFN network to rural areas



# Project 1: Unlicensed Band Radio

## Advantages

### Wifi Characteristics

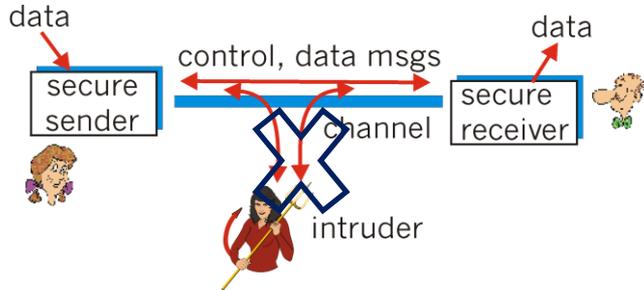
- Inexpensive radio (<\$30)
- Low power (<10 W)
- License free band
- Typically designed for Indoor



### Innovations

- Optimized MAC for outdoor point to point link
- Interference management
- Multi-Hop Links
- TDMA as against CSMA
- Robust development to allow easy licensing

Homegrown software stack prevents backdoor attacks



**Robust solution for last & middle mile connectivity**

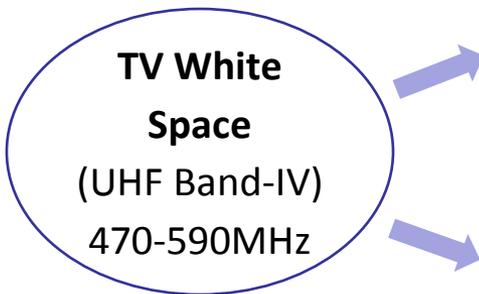
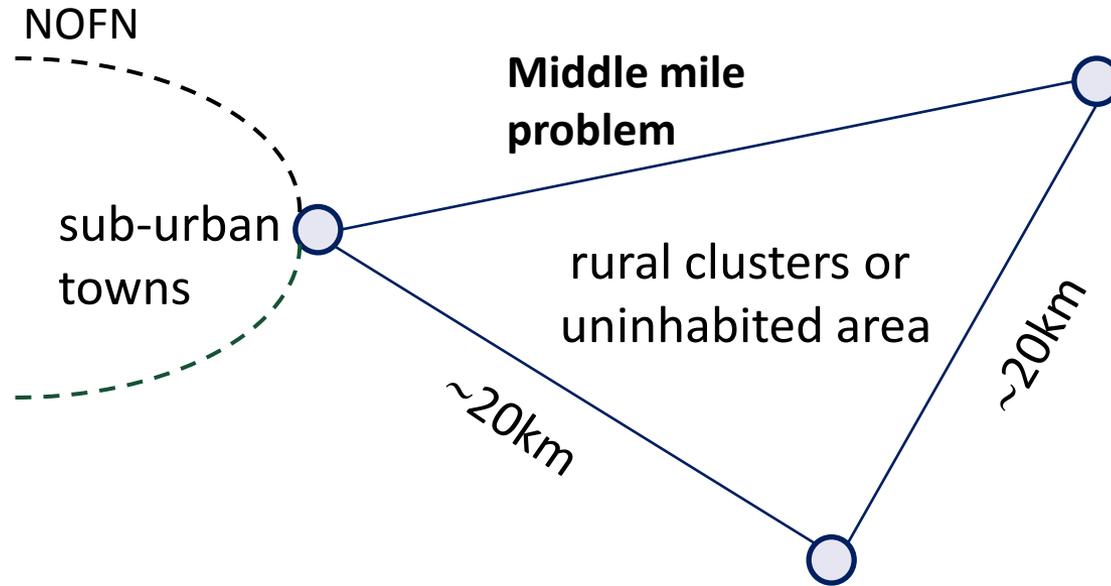
Low  
Capex  
Opex



Broadband for SME's and rural government bodies

# Project 2: TV white space for middle mile connectivity

## Introduction



Sparse television activity as analog TV gradually fades out

Good propagation characteristics & low infrastructure cost

## Challenges

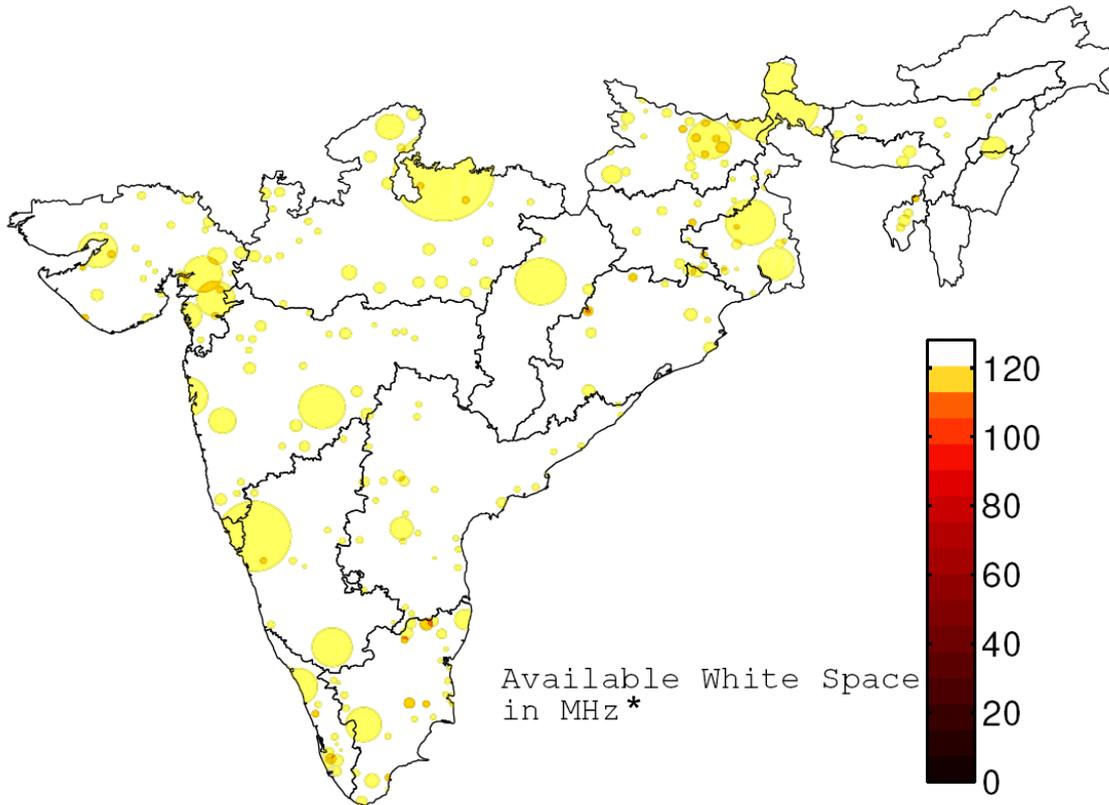
- 1 **Optical Fibre:** High CAPEX, Low ROI especially in difficult terrains
- 2 **Cellular:** Diminishing ARPU, high licensing cost
- 3 **Unlicensed WiFi(2.4GHz):** Poor propagation & coverage in NLOS
- 4 **2.4GHz Saturation**

TV white space perfect solution for middle mile connectivity problem in rural areas

# Project 2: TV white space for middle mile connectivity

## Spectrum availability in UHF Band-IV

### UHF Band-IV (470-590MHz)



\* Path loss evaluated using Okumura-Hata model and protection/pollution viewpoint as per Mishra-Sahai'09

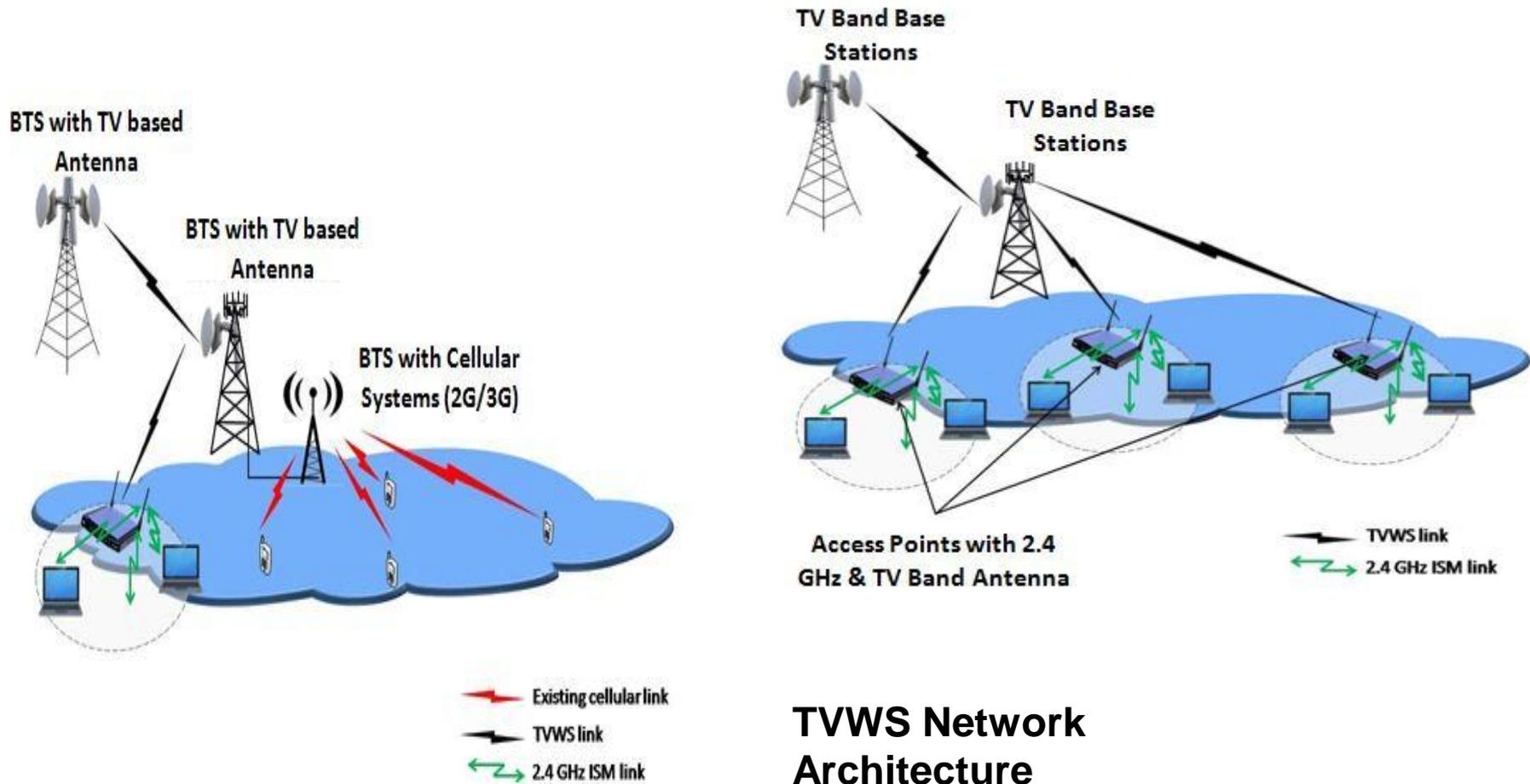
**Our analysis reveals about 100MHz unused in UHF Band-IV**

### Band Characteristics

- 1 Primary user:  
Doordarshan  
373 transmitters overall
- 2 15 channels of 8MHz each
- 3 At any place at least 12 out of 15 channels are always available
- 4 Better propagation characteristics than existing unlicensed band
- 5 Potential for secondary use through cognitive radio technologies

# Project 2: TV white space for middle mile connectivity

## Middle-mile mesh network in TV white spaces



Wide band in Sub-1 GHz band significantly reduces deployment and operating costs as fewer towers required for coverage and relay

# Project 2: TV white space for middle mile connectivity

## Global scenario and way forward

### Global Scenario

#### US

- FCC allowed use through unlicensed devices (2008)
- Multiple third party to maintain white space database
- Guidelines in place for devices

#### UK

- OFCOM framing rules for use by unlicensed devices
- 470-790 Mhz targeted for WiFi devices
- 3<sup>rd</sup> party database providers

#### Japan

- NICT developing cognitive radio and dynamic spectrum access technologies
- 'Examination team for new radio usage vision' setup

### Way Forward

#### Regulation

1. Categorize sub-1 GHz spectrum as:
  - Licensed
  - *Lightly Licensed\**
  - Unlicensed
2. Develop regulatory model/fair sharing mechanism for licensing regimes

#### Technology Development

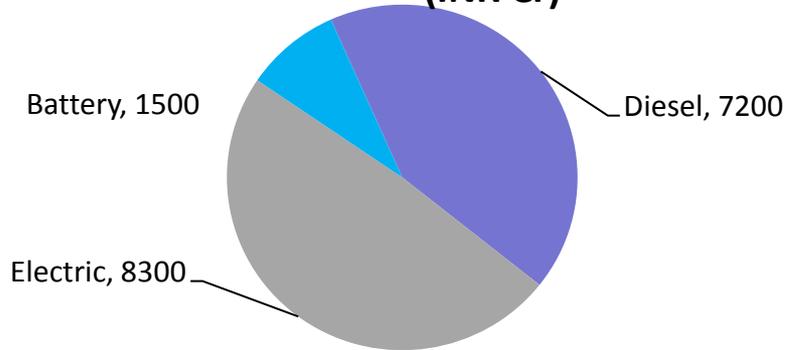
1. Facilitate deployments for low cost broadband technologies in 470-585 MHz band
2. Develop test-bed and conduct field trials
3. Frequency harmonization with ROW

# Project 3: Cost Optimization at Cellular Tower Sites

Energy cost key bottleneck to telecom growth

## Estimated Annual Power & Fuel Expense

(INR Cr)



Total P&F Expense for 400K sites: 17,000cr

### Rural Telecom

- High CAPEX involved in rollout
- Poor grid availability results in high operating costs

### TRAI Guidelines on Green Telecom

- 50% of rural towers and 33% urban towers to be provided by hybrid power by 2015
- Declaration of carbon footprint (6months)

### Industry Outlook

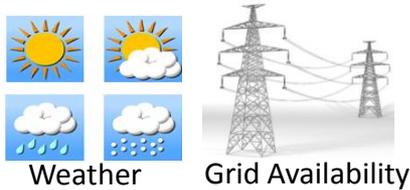
- Various technology solutions have been experimented at about 4000 sites in India (Solar/Wind/Fuel Cells)
- Huge CAPEX requirement & operational challenges cited as key bottlenecks in meeting the guidelines

### Our journey so far

- Team of researchers spent 1.5 years analyzing available and evolving technologies in the Indian context
- Collaborated with the industry to understand the associated operational and commercial challenges
- Field experience acquired in multiple circles to understand on-ground realities
- Solution developed, field tested and commercialized

# Project 3: Cost Optimization at Cellular Tower Sites

Innovative solution for 10-15% reduction in energy costs



400K telecom towers with unique characteristics



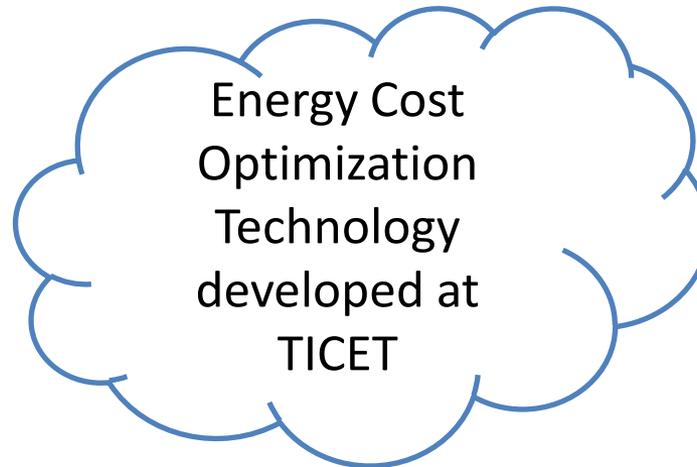
Hundreds of Existing Optimization Ideas/Initiatives



Organization's goals are a complex mix of multiple constraints

- Diesel Pilferage
- Asset Tampering
- Lack of Operational Data
- Poor Maintenance

Uncontrolled environment with major operational challenges



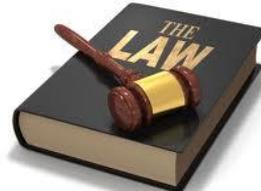
Advanced engineering capabilities required on field

# Project 3: Cost Optimization at Cellular Tower Sites

## Benefits



10-15% OPEX  
Reduction



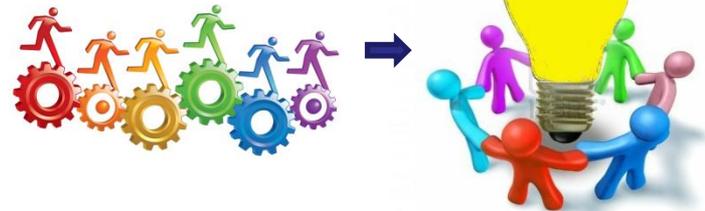
Meet TRAI guidelines  
efficiently



Green Image



Consistent Decision  
Making Process



Divert Resources to  
develop new ideas

# Project 3: Cost Optimization at Cellular Tower Sites

Ready to deploy commercial solution

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Company incubated by team with support from TCOE to commercialize this solution



- Enthusiastic response from TAIPA and COAI members
- The solution is being rolled out in over 7 circles by various operators
- Mission: Reduction of 100million liters in annual diesel consumption for the telecom industry

*For further details please contact:*

**Optenet**

Rushabh Shah

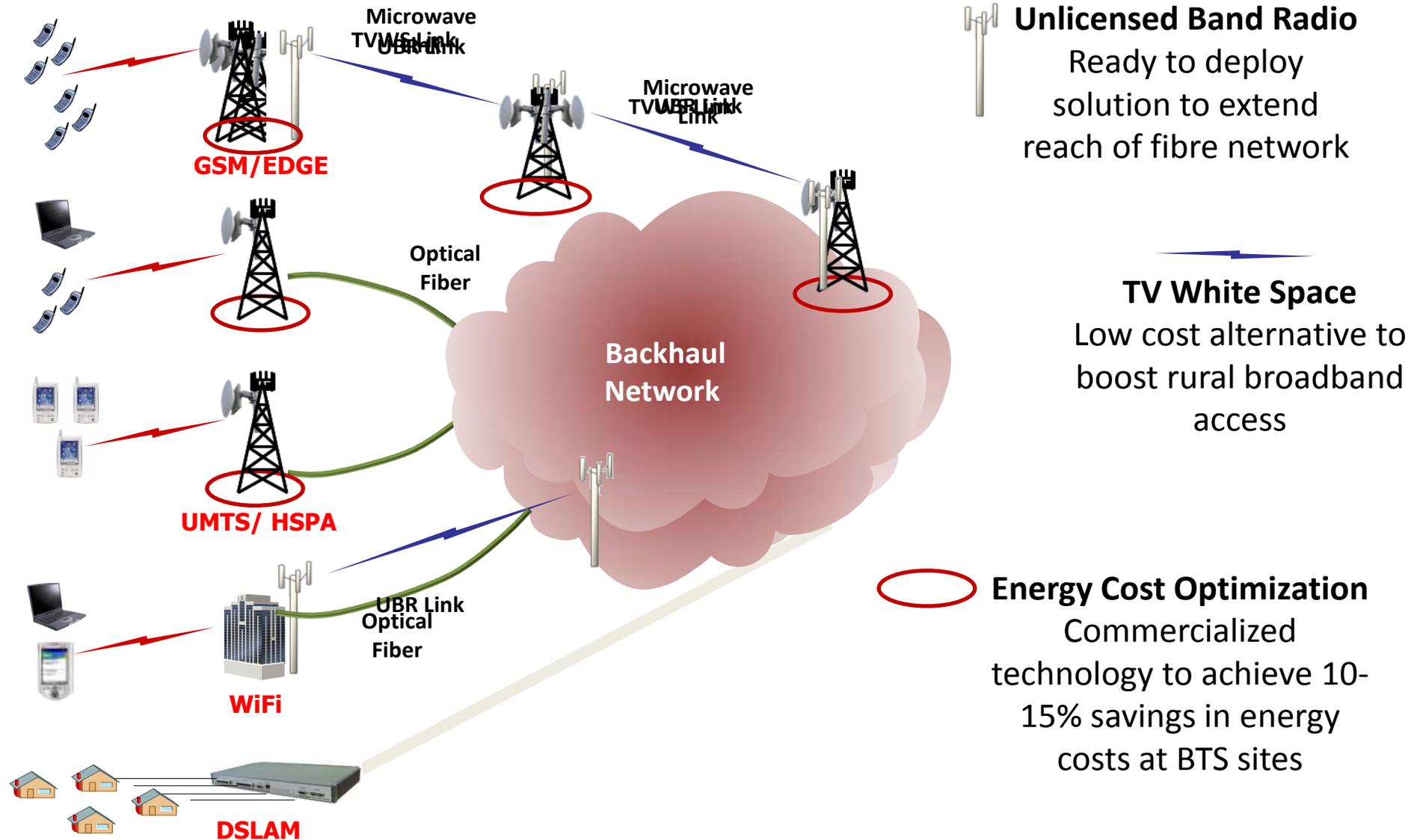
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# Summary

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**Thank you**

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