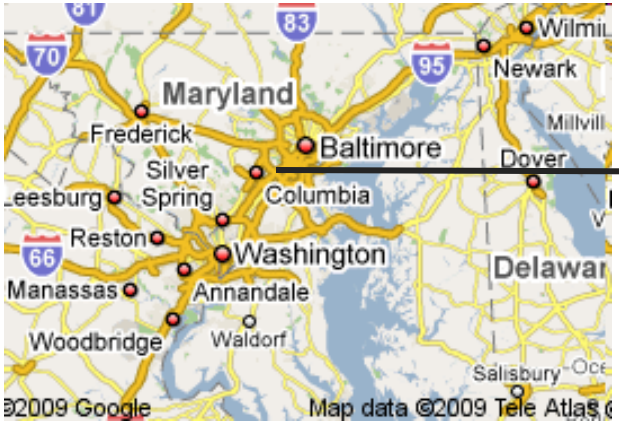
Tools for Opportunity Assessment and Feasibility Analysis

Surya Raghu
Entrepreneurship for Scientists and Engineers

ICTP, Trieste
March 30 - April 4, 2016



© S. Raghu

About Me

Ph.D. Mechanical Engineering
Academics – State University of New York, Stony Brook
Industrial Scientist – Automotive and Consumer Products
6 Products: Invention to commercialization
Entrepreneur: Started Advanced Fluidics (Small Company) in 2001
Training: ET^3 International (Non-Profit Organization)

© S. Raghu

About ET^3 International and Advanced Fluidics

ET^3 International
Entrepreneurship and Research Commercialization Training and Consulting

Advanced Fluidics LLC
Research and Product Development in
1. Aerospace Sciences – Aerodynamics, combustion
2. Micro/Nanofluidics/nanotech-based biosensors
3. Medical Instrumentation
4. Technology Roadmap Development and Training

© S. Raghu

Opportunity Identification, Assessment and Feasibility Analysis

Outline

Technology Road Maps
Technology Mind Maps
Technology Intersect Maps
Technology Forecasting

Finding Opportunities

Assessment and Feasibility Analysis

Filtering your ideas

Conclusions

© S. Raghu

"Opportunity is missed by most people because it comes dressed in overalls and looks like hard work"

-- Thomas Edison

© S. Raghu

Sustainable Development Goals

https://sustainabledevelopment.un.org/post2015/transformingourworld

© S. Raghu

Examples of innovative ideas

http://www.un.org/sustainabledevelopment/energy/

© S. Raghu

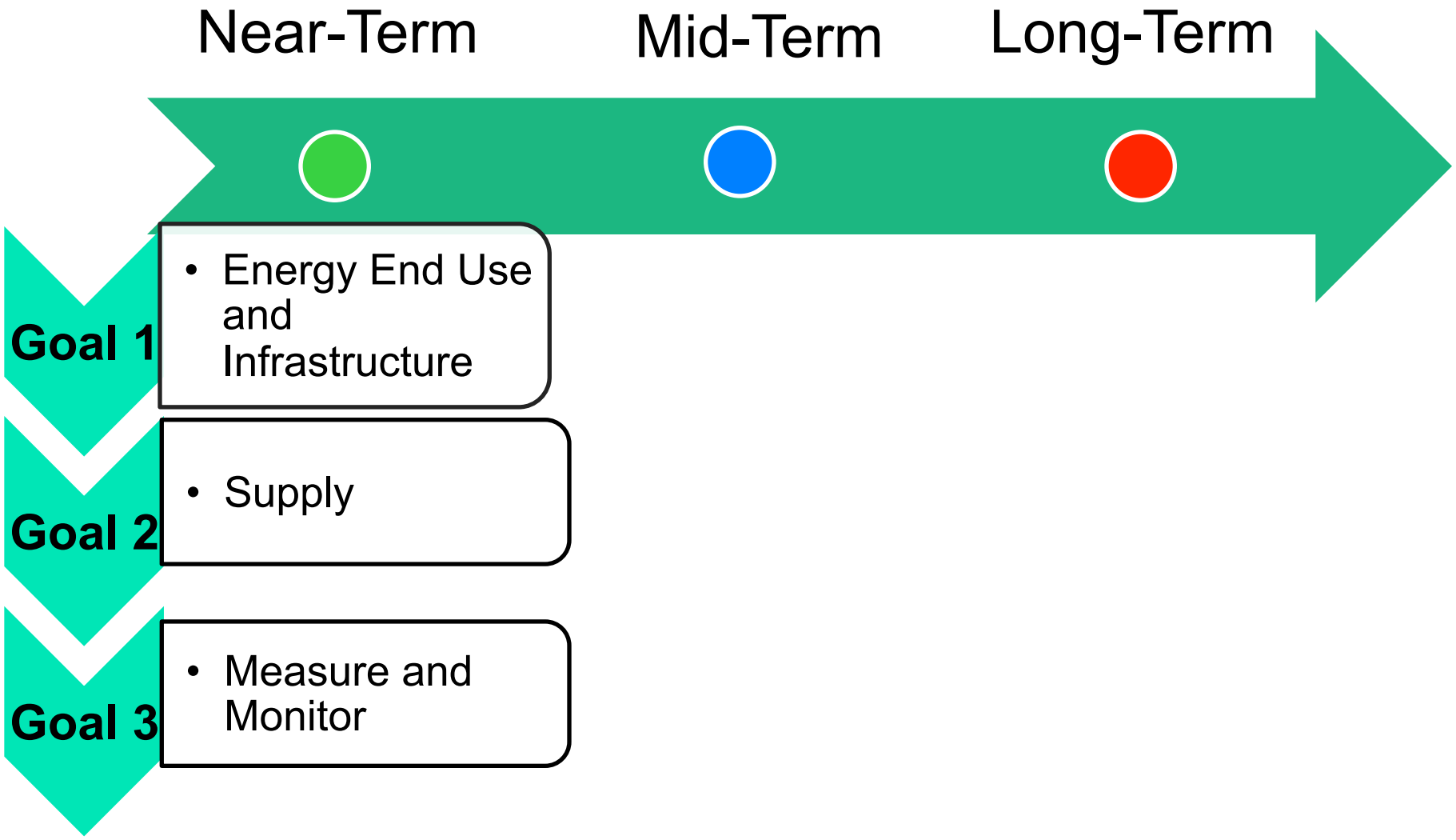
Technology Roadmaps

Technology Roadmap

– shows us opportunity for inventions in selected fields.

© S. Raghu

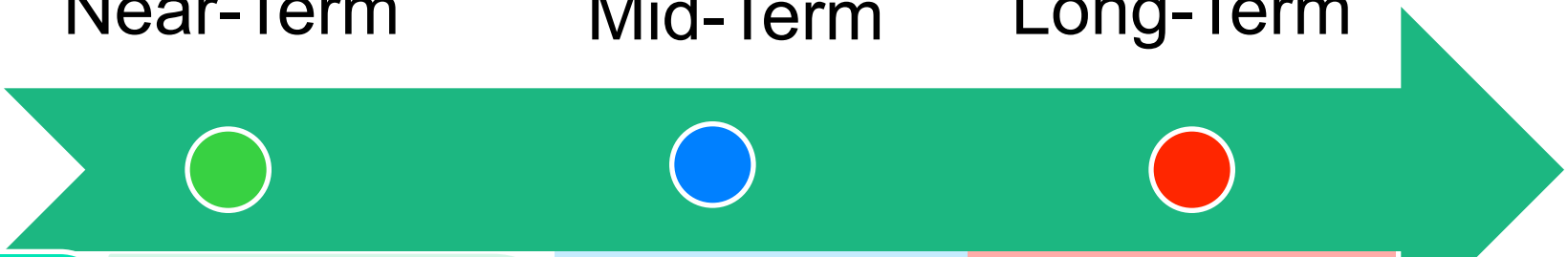
Technology Road Map –Climate Change



© S. Raghu

Technology Road Map

http://www.climatetechnology.gov/library/2006/testimony20sep2006.htm



GOAL 1
Energy End Use and Infrastructure

Near-Term
- Hybrid Vehicles
- Plug-ins
- Hi-Performance integrated homes
- High-efficiency appliances
- High-efficiency boilers and combustion systems
- High-temperature superconductivity demonstrations

Mid-Term
- Fuel cell vehicles and hydrogen fuels
- Low emission aircraft
- Solid-State lighting
- Ultra-efficient HVACR
- Smart buildings
- Transformational technologies for energy-intensive industries
- Energy storage for load leveling

Long-Term
- Widespread use of engineered urban design and regional planning
- Energy managed communities
- Integration of industrial heat, power, process and techniques
- Superconducting transmission and equipment

Your niche?

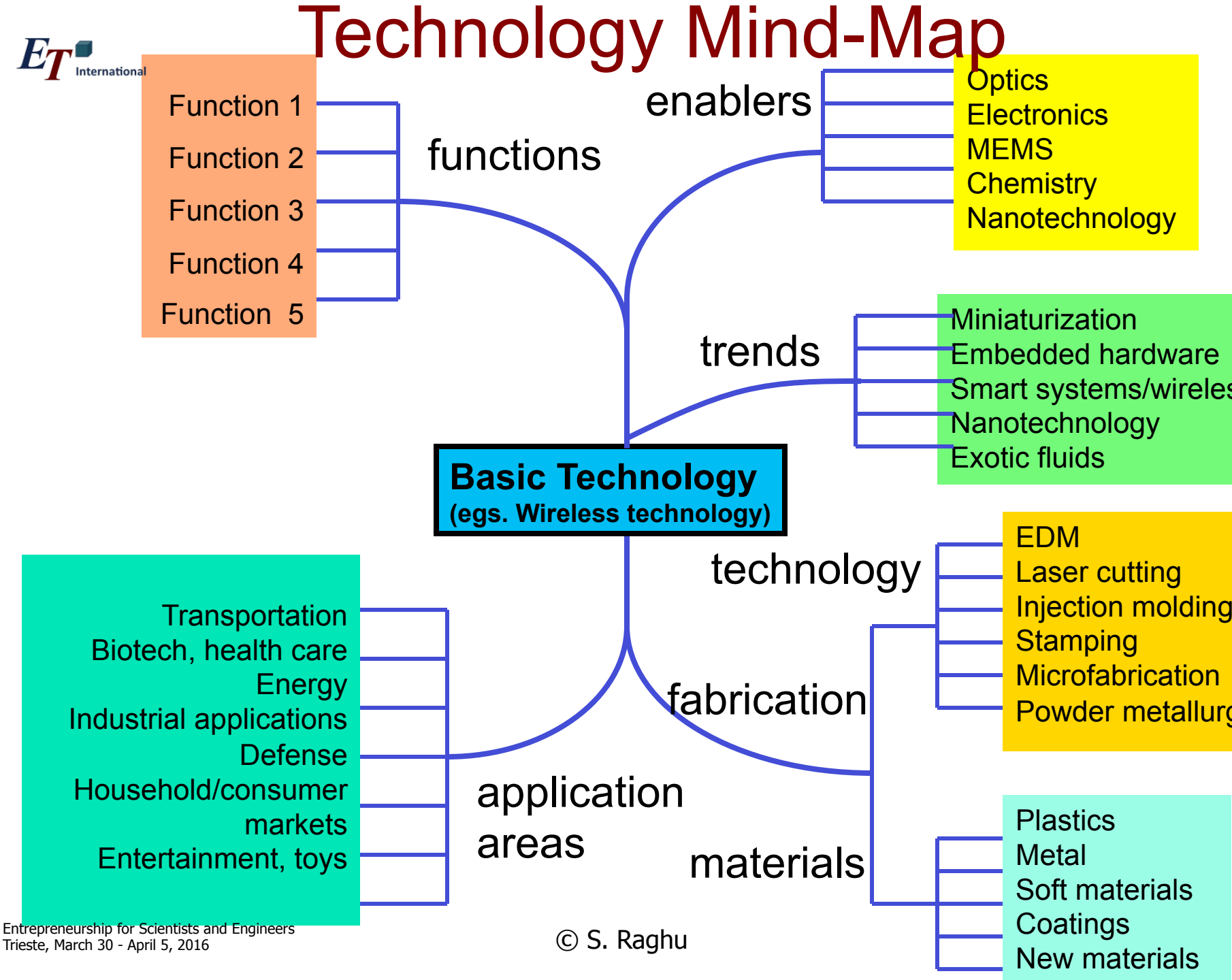
© S. Raghu

Technology Roadmap

Healthcare?
Energy?
Water?
Agriculture?
Food Security?

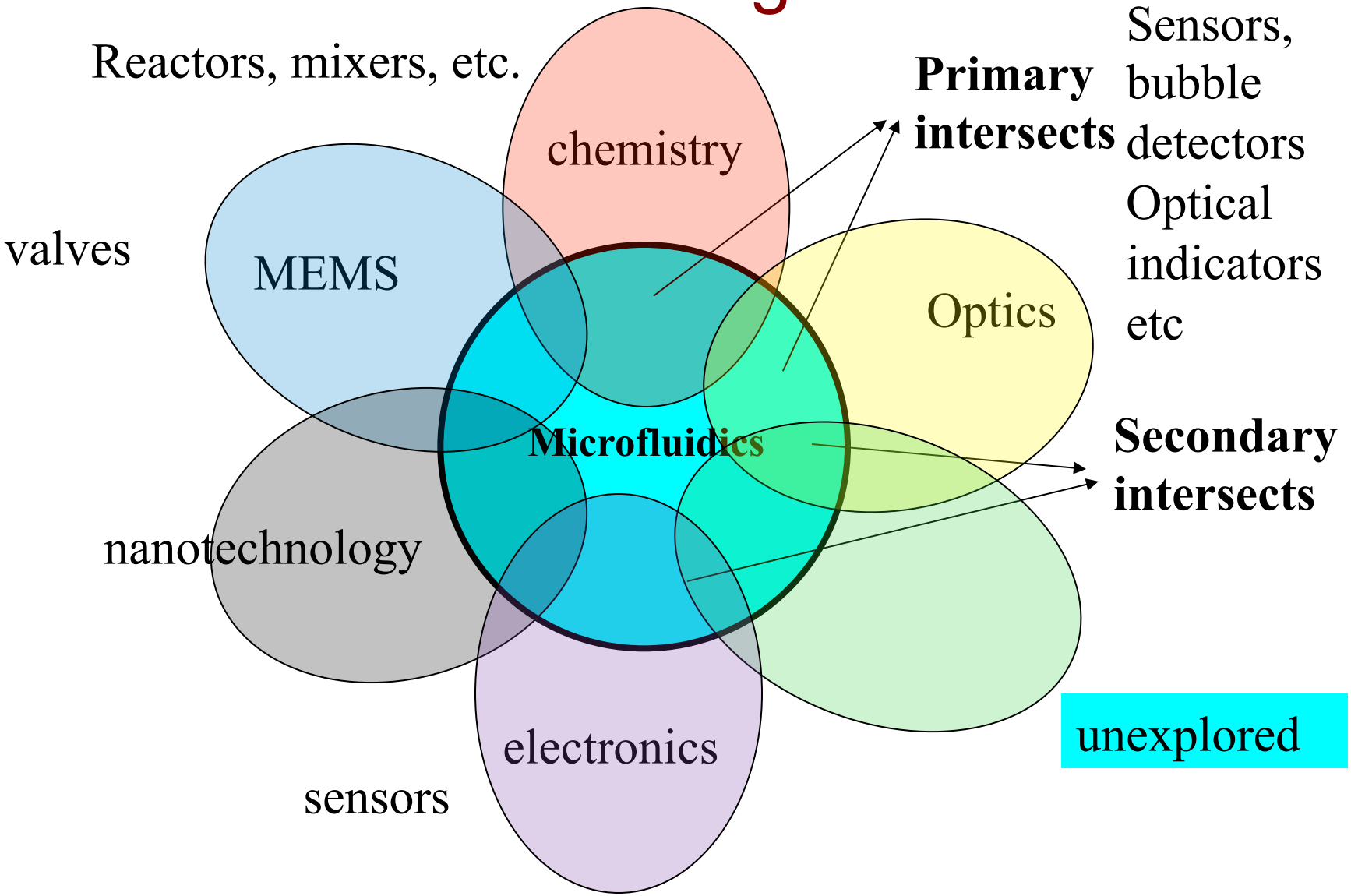
© S. Raghu

Technology Mind-Map



© S. Raghu

Technology Intersects with Emerging Technologies



© S. Raghu

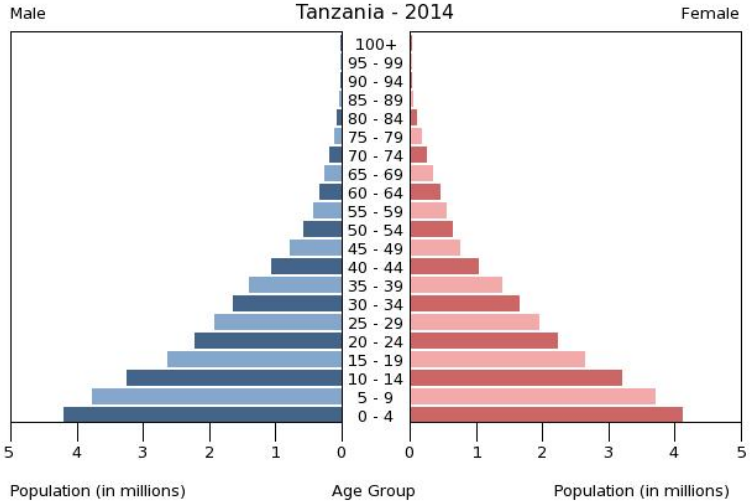
Technology Forecasting

Points to consider for forecasting

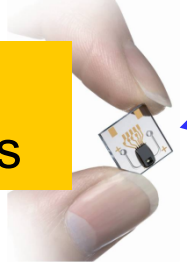
- Observing/Studying Trends (weak signals in high noise)
- Economic factors
- Societal factors
- Technological Advances
- Political Action/Regulatory statutes

© S. Raghu

Technology Forecasting



Micro-sensors



Health Monitoring

Generation-3 Internet

24-hour medical care

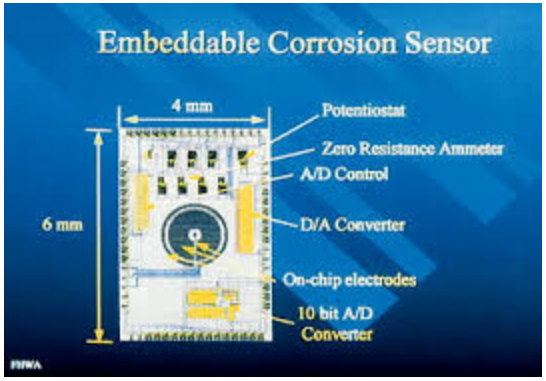
http://www.i-micronews.com/

© S. Raghu

Infrastructure Health Monitoring

Drones

Wireless Sensors



Continuous Monitoring

Generation-3 Internet

© S. Raghu

4 Different Methods of Finding Opportunities/Generating Ideas

Next……

Assessment and Feasibility Analysis

© S. Raghu

Assessing the idea

Technology feasible?

Is there a market?

Is there a business opportunity?

© S. Raghu

Feasibility Analysis

Feasibility Analysis: The process to determine if an idea is viable and worth pursuing for commercialization

Product/service feasibility analysis

Customer interest, desirability and purchase interest

Industry/market feasibility

- Industry attractiveness
- Market timeliness example
- Identification of niche market

© S. Raghu

Feasibility Analysis

Organizational feasibility

Sufficient management expertise, organizational competence & resources to successfully launch a business

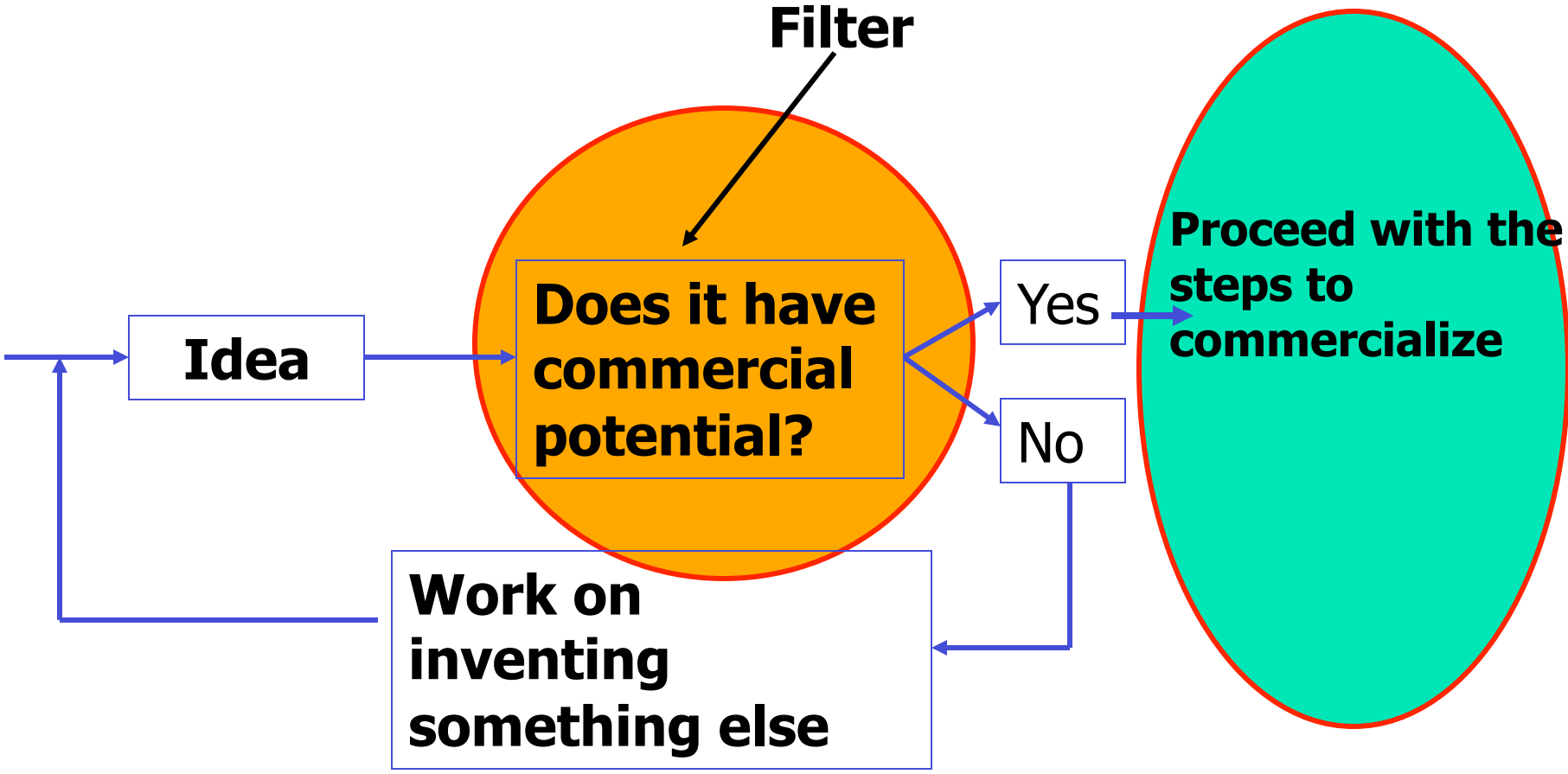
- Management ability
- Resource sufficiency

Financial feasibility

Total start-up cash needed (example)
Financial performance of similar businesses
Overall Financial Attractiveness of the proposed venture

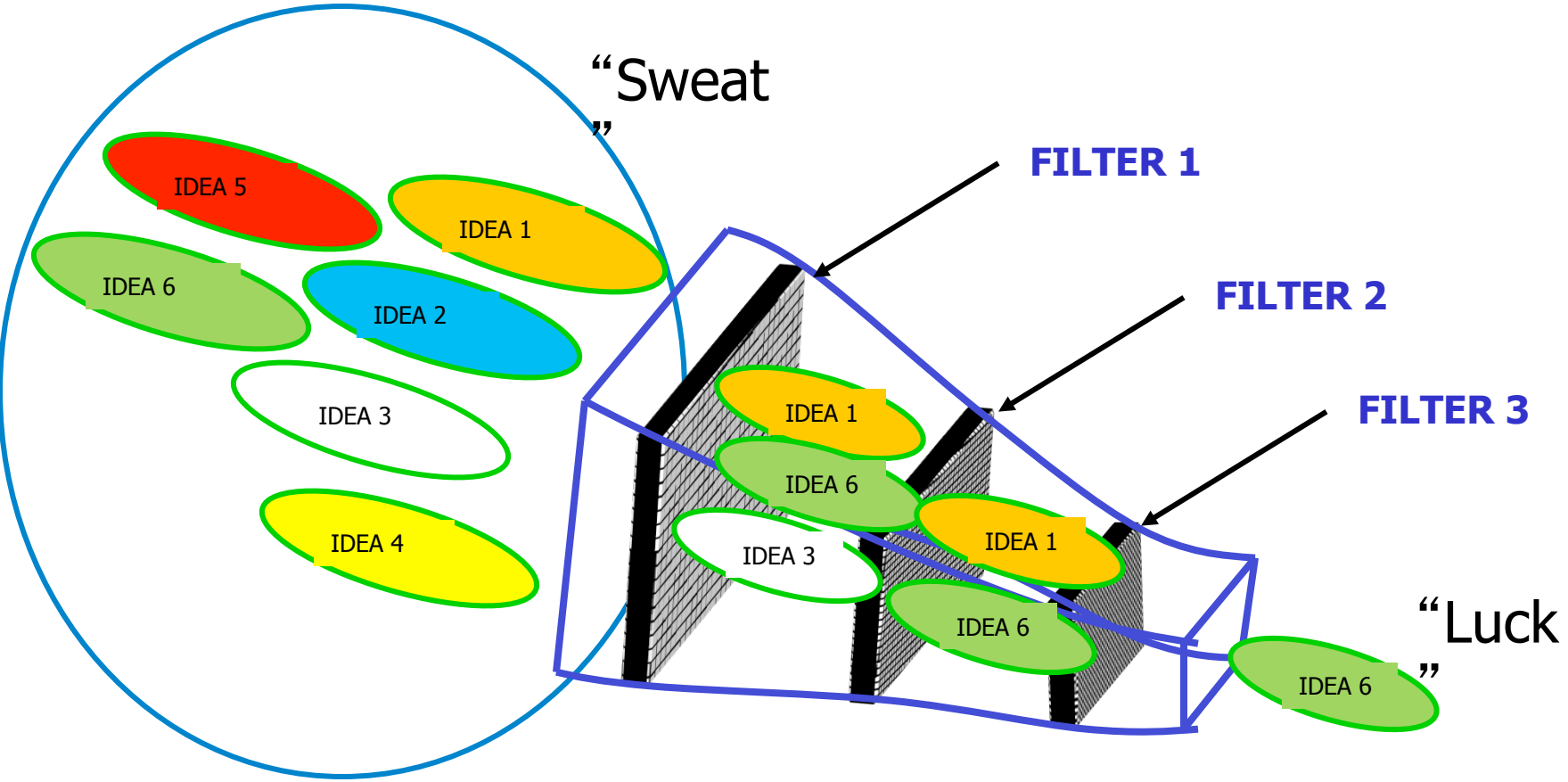
© S. Raghu

Filtering Your Ideas



© S. Raghu

Filtering of Technical Ideas



Just one idea at a time at the end helps focus

© S. Raghu

Filters

Filters: Can be used to sort out feasible ideas right at the very beginning.

Examples of filters:

1. Market Opportunity and Market Attractiveness
2. Do you have the background to proceed with this product
3. Sustainability of market (seasonal or year-round), time scales of sustainability of market interest and technology. Give examples
4. Regional and international competition

What are the other factors that can be used as filters?

© S. Raghu

Possible Filters

Cost
Weight
Size
Safety/Health
Speed
Ease of Use
Ease of Production
Durabililty
Repairability
Novelty
Convenience
Social Benefit
Reliability

Saleability
Appearance
Noise
Odor
Trend of Demand
Seasonal Demand
Market penetration
Market size
Competition
Quality
Life cycle

Legality
Obsolescence
Product Liability
Service requirements
Profitability
Learning & unlearning required

© S. Raghu

Summary

- Finding Opportunities
  - Technology Forecasting
  - Technology mapping (Roadmaps, Mind-map, Intersects)
- Assessment and Feasibility analysis
  - Filtering your ideas

© S. Raghu

Group Work

1. Form groups of 4

2. Sketch a road map for technologies for solving any of the 10 problems/area that you selected in the morning - 5, 10 and 20 years time scale

3. Random/volunteer groups to present it to the class

15 minutes time

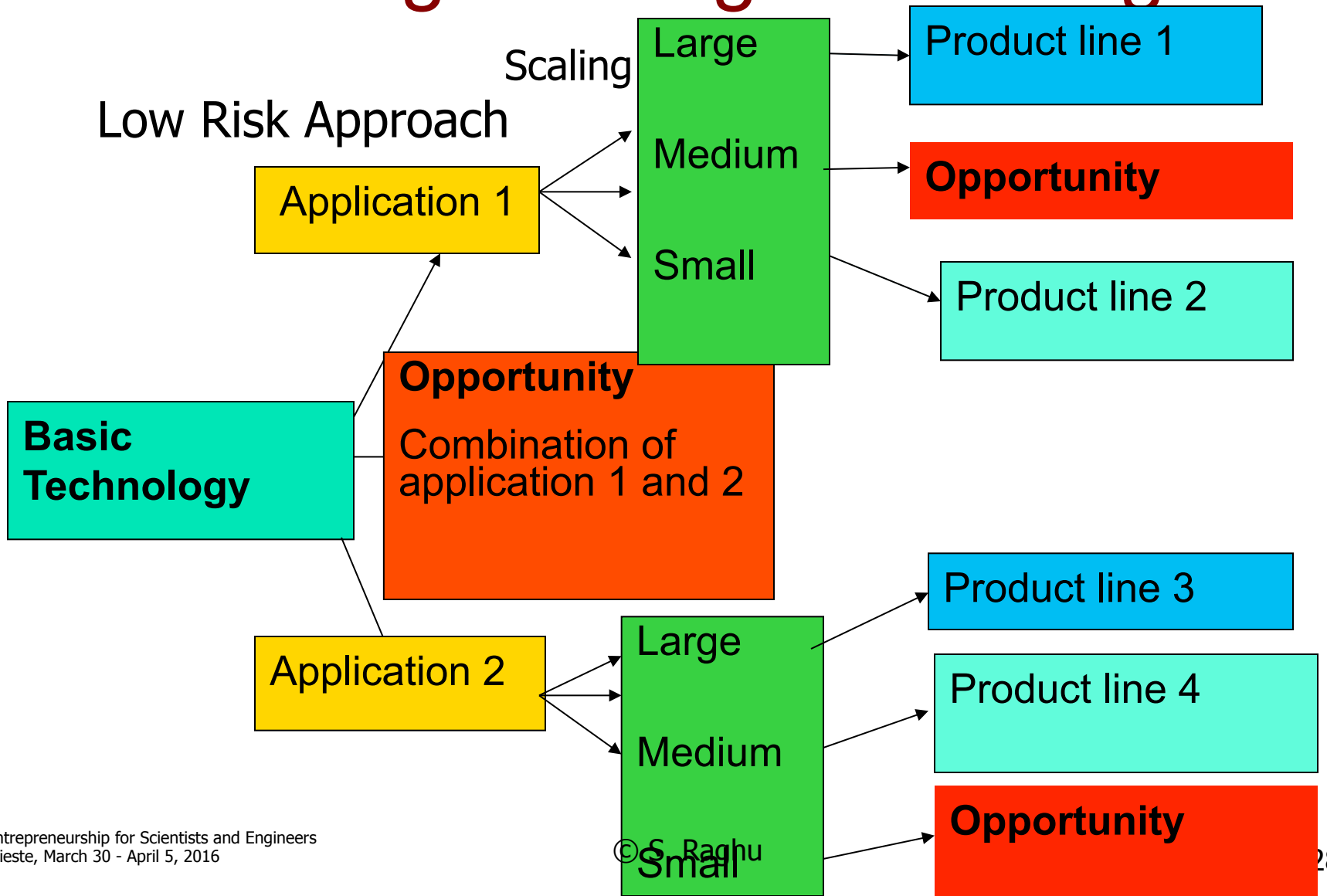
© S. Raghu

THANK YOU

Questions?

© S. Raghu

Opportunities Based on Extending Existing Technologies



© S. Raghu

Technology Roadmap Example: Climate Change

Your niche?

	Near-Term	Mid-Term	Long-Term
Goal #1 Energy End-Use & Infrastructure	• Hybrid & Plug-In Hybrid Electric Vehicles • Engineered Urban Designs • High-Performance Integrated Homes • High Efficiency Appliances • High Efficiency Boilers & Combustion Systems • High-Temperature Superconductivity Demonstrations	• Fuel Cell Vehicles and H_2 Fuels • Low Emission Aircraft • Solid-State Lighting • Ultra-Efficient HVACR • "Smart" Buildings • Transformational Technologies for Energy-Intensive Industries • Energy Storage for Load Leveling	• Widespread Use of Engineered Urban Designs & Regional Planning • Energy Managed Communities • Integration of Industrial Heat, Power, Process, and Techniques • Superconducting Transmission and Equipment
Goal #2 Energy Supply	• IGCC Commercialization • Stationary H_2 Fuel Cells • Cost-Competitive Solar PV • Demonstrations of Cellulosic Ethanol • Distributed Electric Generation • Advanced Fission Reactor and Fuel Cycle Technology	• FutureGen Scale-Up • H_2 Co-Production from Coal/Biomass • Low Wind Speed Turbines • Advanced Biorefineries • Community-Scale Solar • Gen IV Nuclear Plants • Fusion Pilot Plant Demonstration	• Zero-Emission Fossil Energy • H_2 & Electric Economy • Widespread Renewable Energy • Bio-Inspired Energy & Fuels • Widespread Nuclear Power • Fusion Power Plants
Goal #3 Capture, Storage & Sequestration	• CSLF & CSRP • Post Combustion Capture • Oxy-Fuel Combustion • Enhanced Hydrocarbon Recovery • Geologic Reservoir Characterization • Soils Conservation • Dilution of Direct Injected CO_2	• Geologic Storage Proven Safe • CO_2 Transport Infrastructure • Soils Uptake & Land Use • Ocean CO_2 Biological Impacts Addressed	• Track Record of Successful CO_2 Storage Experience • Large-Scale Sequestration • Carbon & CO_2 Based Products & Materials • Safe Long-Term Ocean Storage
Goal #4 Other Gases	• Methane to Markets • Precision Agriculture • Advanced Refrigeration Technologies • PM Control Technologies for Vehicles	• Advanced Landfill Gas Utilization • Soil Microbial Processes • Substitutes for SF_6 • Catalysts That Reduce N_2O to Elemental Nitrogen in Diesel Engines	• Integrated Waste Management System with Automated Sorting, Processing & Recycle • Zero-Emission Agriculture • Solid-State Refrigeration/AC Systems
Goal #5 Measure & Monitor	• Low-Cost Sensors and Communications	• Large Scale, Secure Data Storage System • Direct Measurement to Replace Proxies and Estimators	• Fully Operational Integrated MM Systems Architecture (Sensors, Indicators, Data Visualization and Storage, Models)

http://www.climatetechnology.gov/library/2006/testimony20sep2006.htm

© S. Raghu

Sustainable Development Goals

Goal 1. End poverty in all its forms everywhere

Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture

Goal 3. Ensure healthy lives and promote well-being for all at all ages

Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Goal 5. Achieve gender equality and empower all women and girls

Goal 6. Ensure availability and sustainable management of water and sanitation for all

https://sustainabledevelopment.un.org/post2015/transformingourworld

© S. Raghu

Sustainable Development Goals

Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all

Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

Goal 10. Reduce inequality within and among countries

Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable

Goal 12. Ensure sustainable consumption and production patterns

https://sustainabledevelopment.un.org/post2015/transformingourworld

© S. Raghu

Sustainable Development Goals

Goal 13. Take urgent action to combat climate change and its impacts

Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development

Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

Goal 17. Strengthen the means of implementation and revitalize the global partnership for sustainable development

https://sustainabledevelopment.un.org/post2015/transformingourworld

© S. Raghu

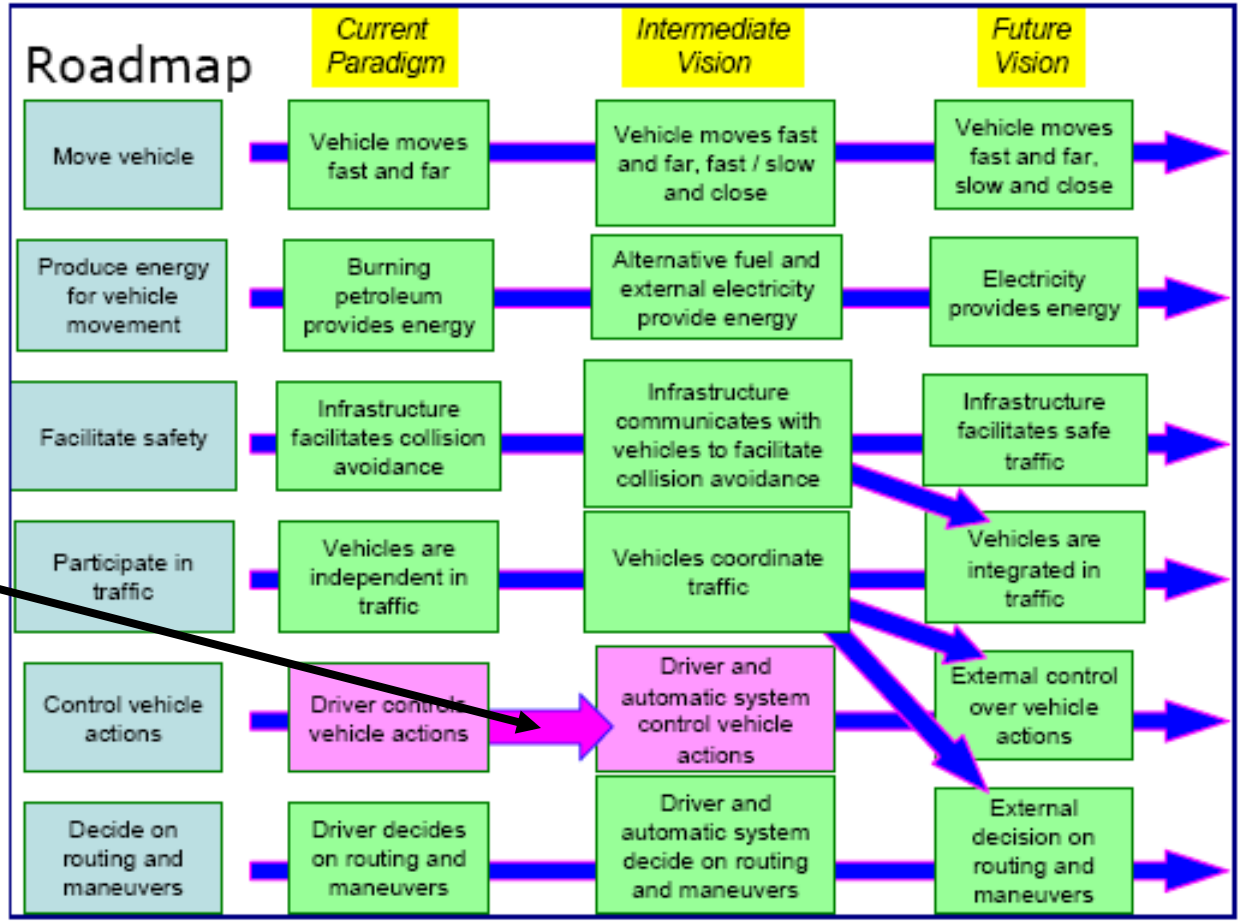
Technology Roadmap Example: Intelligent Vehicles

© S. Raghu

Technology Roadmaps

Roadmap for automobiles

Paradigm shifts offer opportunities for inventions?

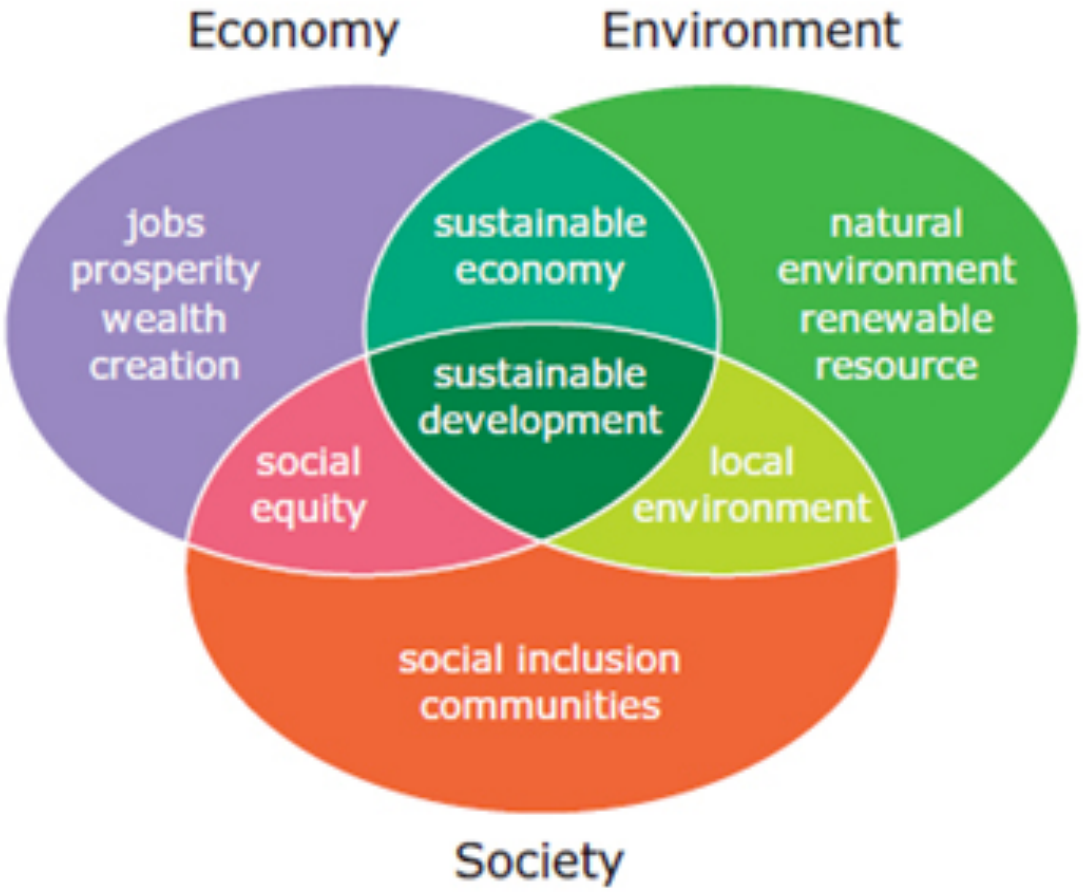


Your niche?

(http://www.ceeti.org/technology_roadmap/pdf/Roadmapping_Final_Report.pdf)

© S. Raghu

Sustainable Development



© S. Raghu

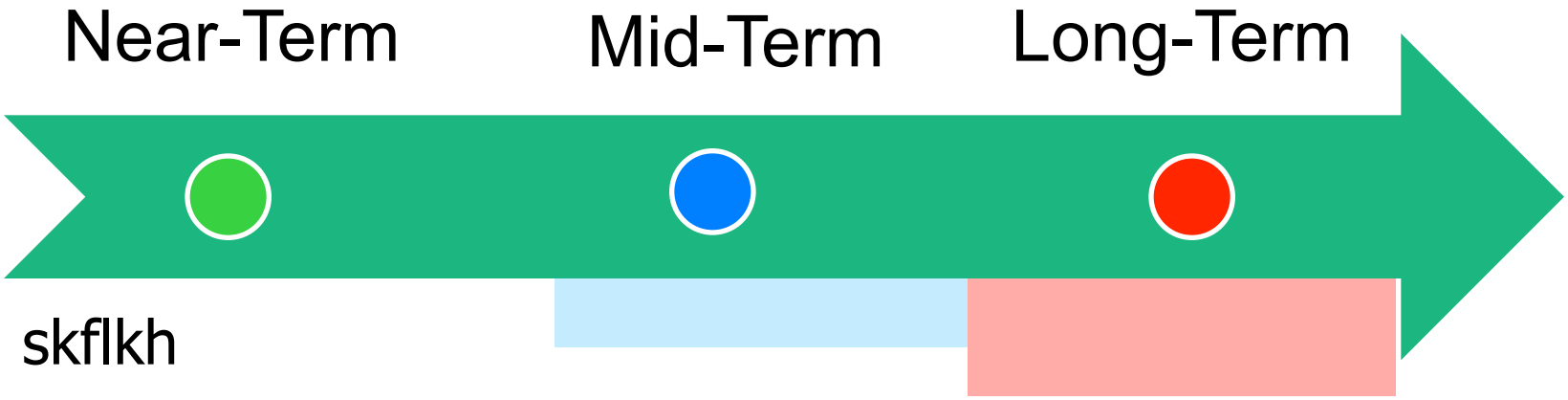
Points to consider

1. Prepare a roadmap for the technology you are developing for your project
2. Prepare a set of filters for evaluating your project idea

© S. Raghu

Technology Road Map Group 1

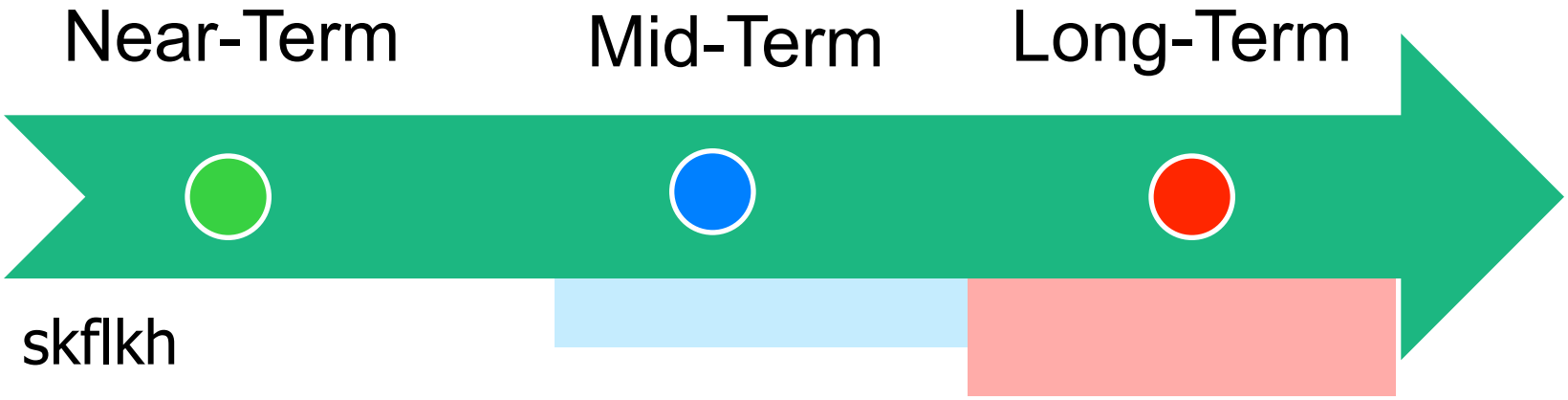
http://www.climatetechnology.gov/library/2006/testimony20sep2006.htm



© S. Raghu

Technology Road Map Group 6

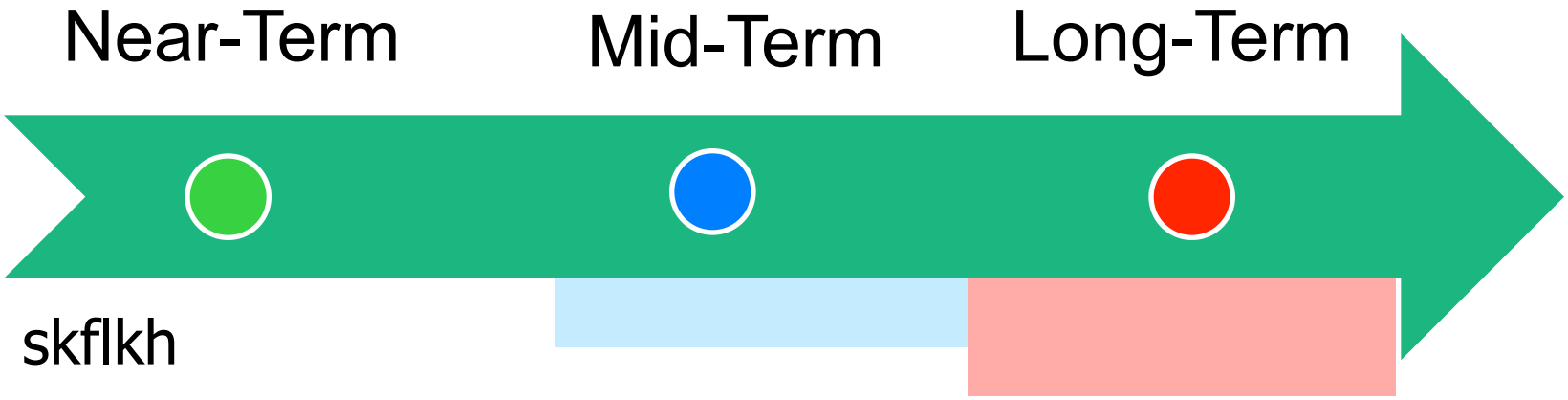
http://www.climatetechnology.gov/library/2006/testimony20sep2006.htm



© S. Raghu

Technology Road Map Group 1

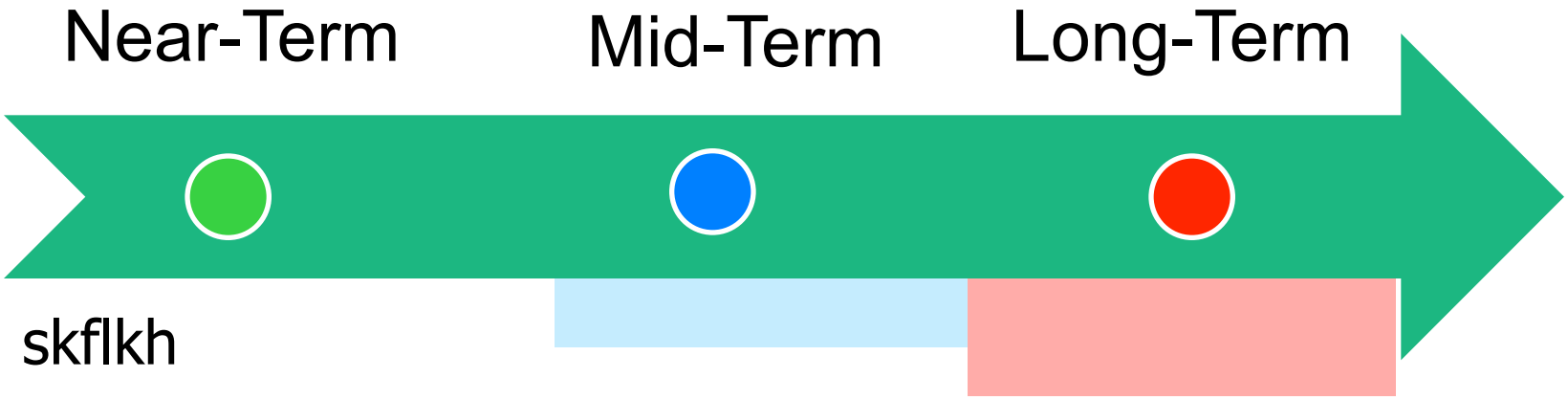
http://www.climatetechnology.gov/library/2006/testimony20sep2006.htm



© S. Raghu

Technology Road Map Group 1

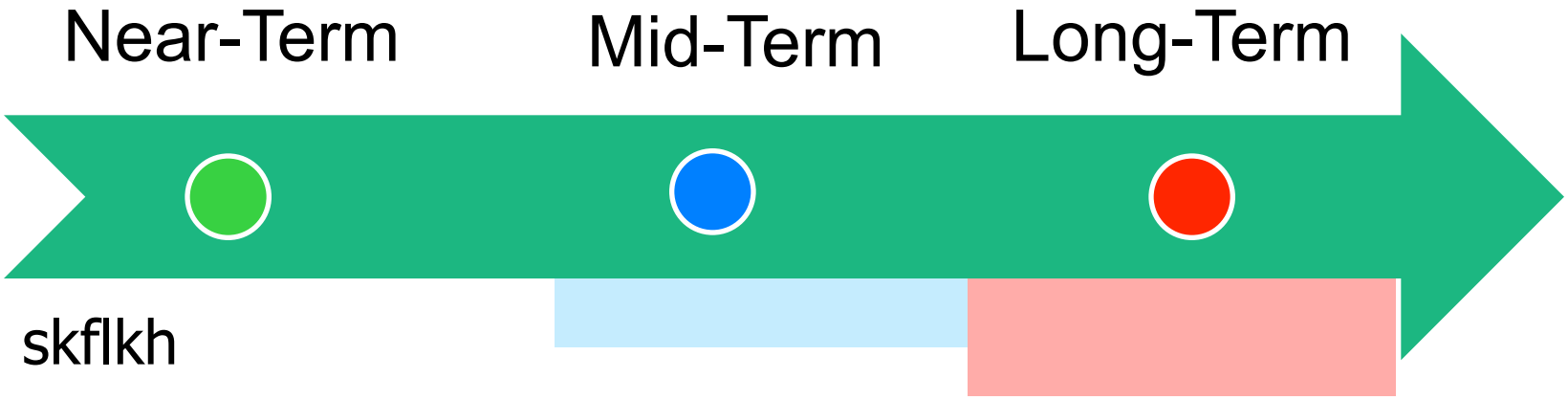
http://www.climatetechnology.gov/library/2006/testimony20sep2006.htm



© S. Raghu

Technology Road Map Group 1

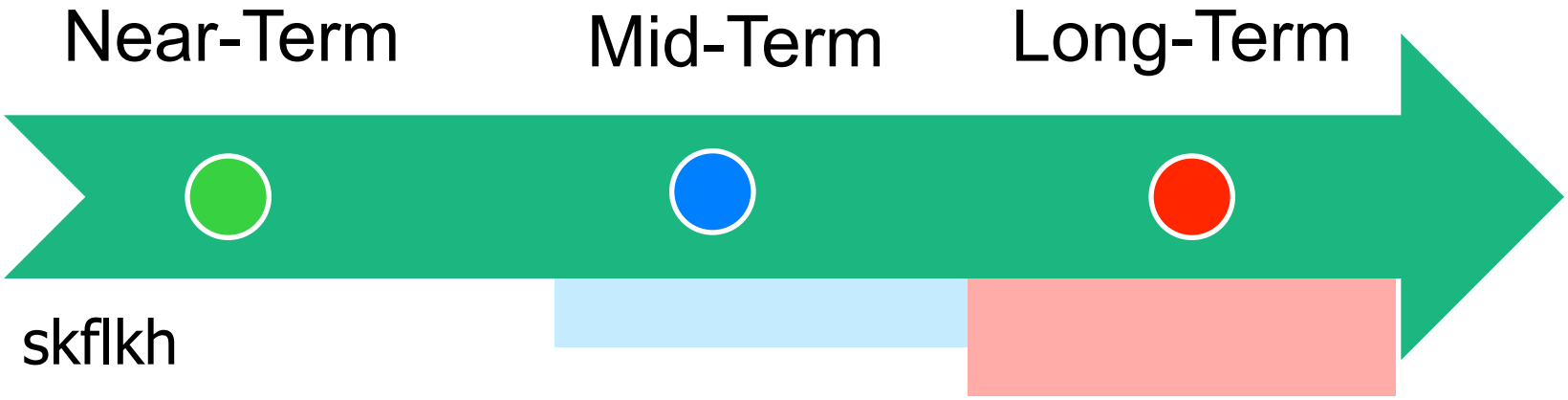
http://www.climatetechnology.gov/library/2006/testimony20sep2006.htm



© S. Raghu

Technology Road Map Group 1

http://www.climatetechnology.gov/library/2006/testimony20sep2006.htm



© S. Raghu