



Urban Water Challenge

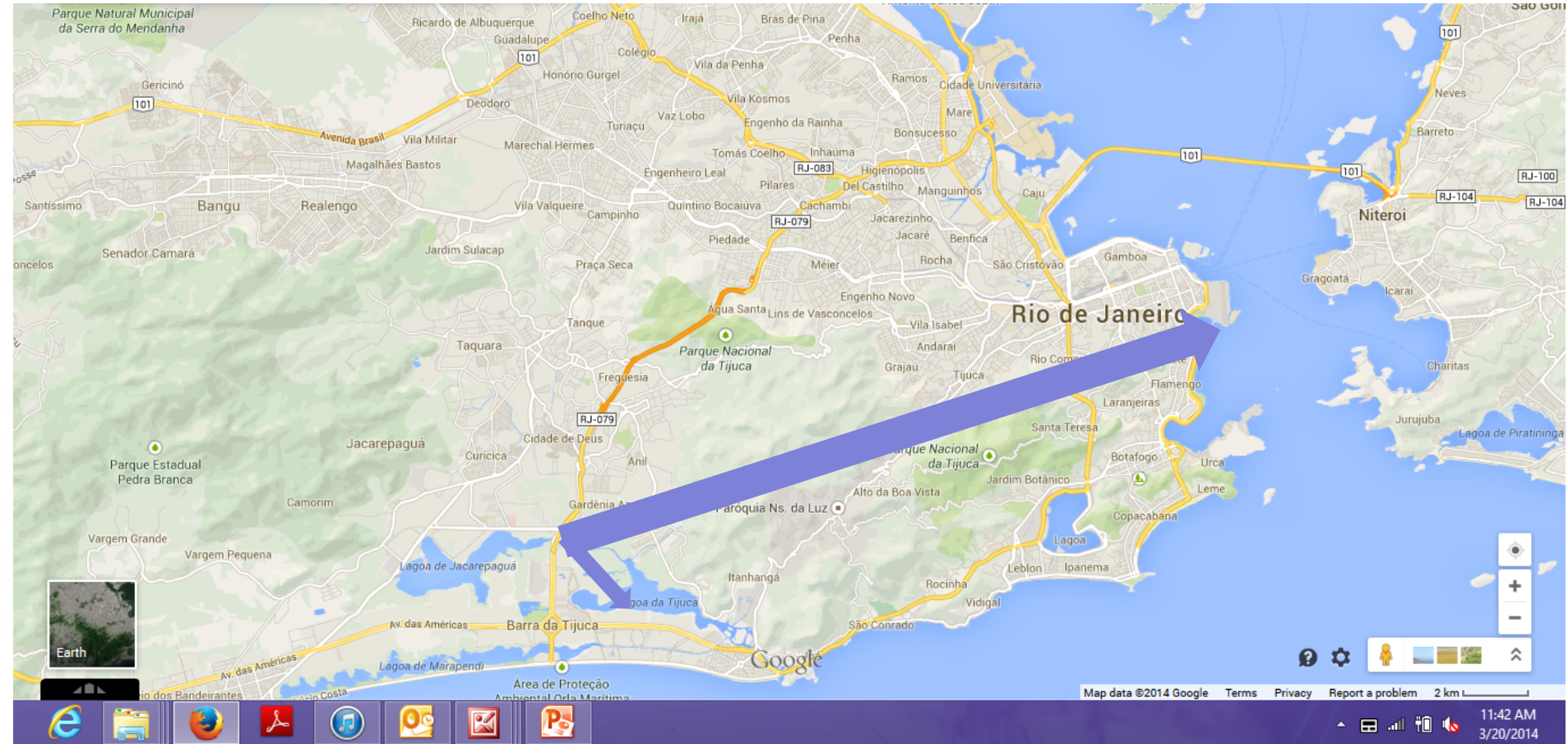
Kartik Chandran

December 7th, 2015









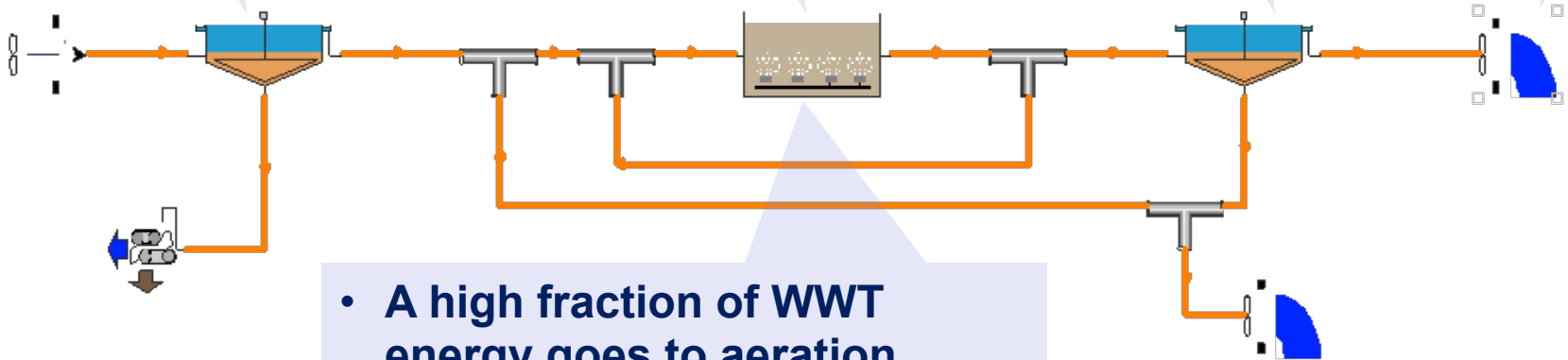
Brief overview of biological sewage treatment

Solids, inerts separation

Aerobic C & N removal

Recycle of bacteria

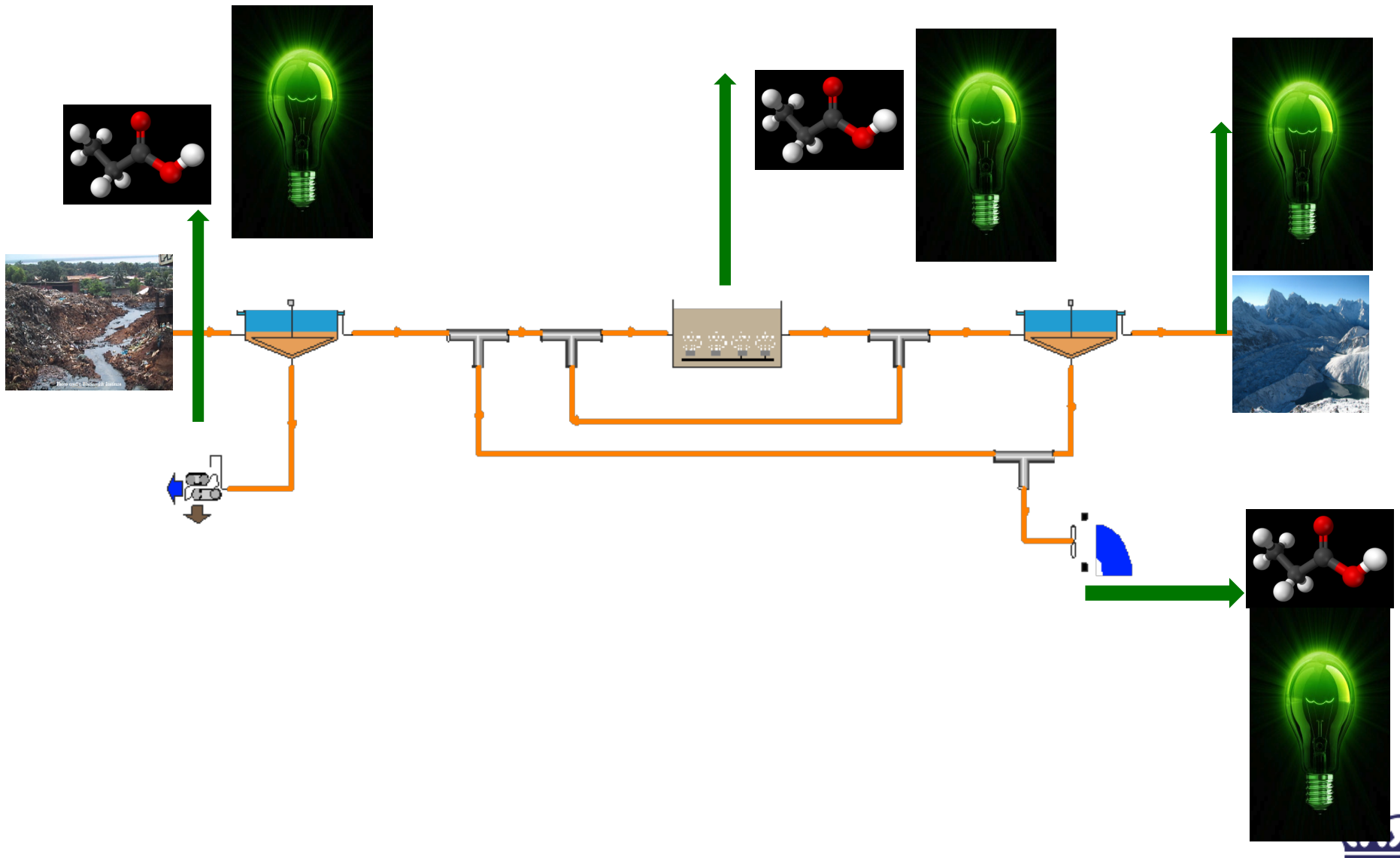
Disinfection and discharge

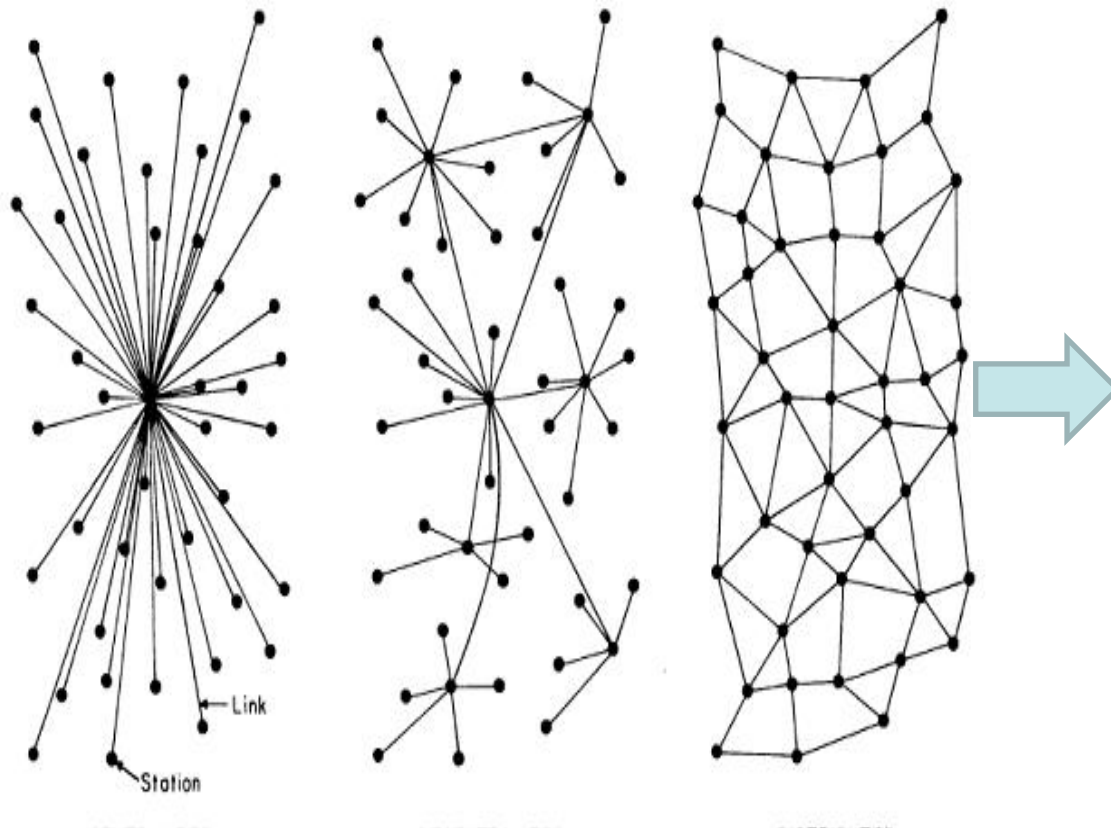


- A high fraction of WWT energy goes to aeration
- \$MM in organic chemical purchase
- Bacteria could produce unwanted products (N_2O)



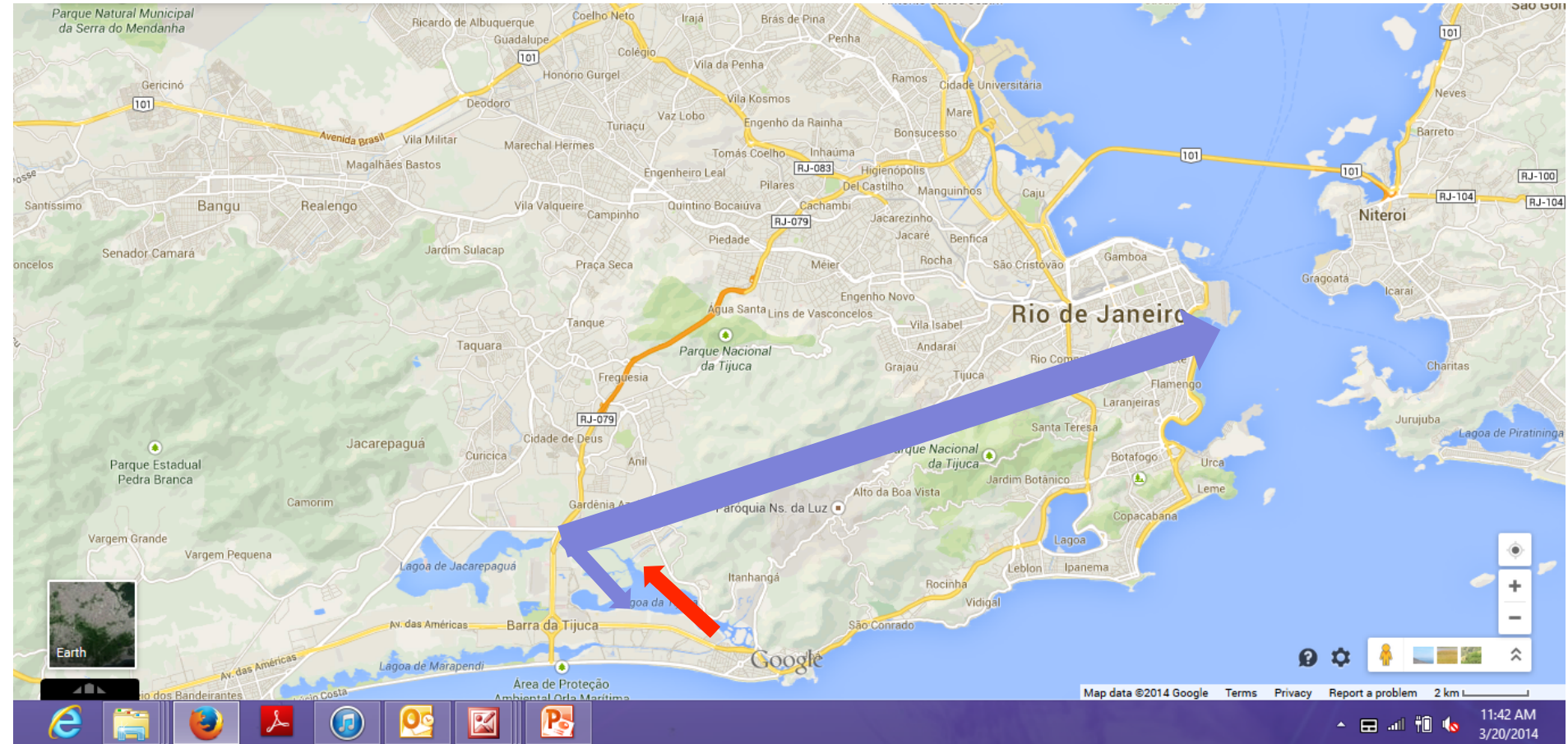
Engineered Resource Recovery from 'Waste' Streams





- Does decentralization truly enhance resilience?
- Is there an optimum (cost, energy?)





Layout of activities

- **Characterization of flows and C,N,P loads**
 - Including food waste
 - Design of the recovery system
- **Recovery endpoints**
 - **Energy**
 - Impact on current energy provider
 - **Nutrients as fertilisers**
 - Local or regional use?
 - Prospect of importing carbon and nutrients for conversion at RdP? (Similar model to Dharavi, India)
- **Identifying location of recovery system(s)**
- **Sustained operation and monitoring**





Contact information

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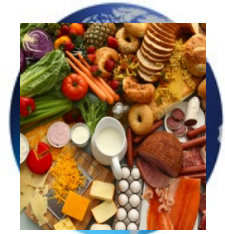
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Energy self-sufficiency for sewage treatment?

Energy present	Energy needed
~ 2500 kWh/MG	~2500 kWh/MG

- Assuming 34% conversion of organic matter to methane and electricity
- Assuming 'conventional' nitrogen removal
- Can 'import' carbon (NYC starting with this)
 - Not at the expense of excessive N discharges





- **Distributed treatment in NYC**
- **Flow: 1.2 billion gallons per day**
 - 1860 tons of organic carbon (ox. state?) per day
 - 280 tons of N(-III) per day
 - 60 tons of P(+V) per day



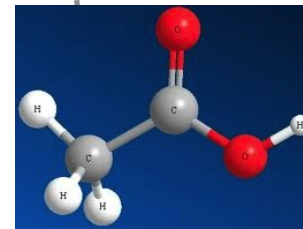
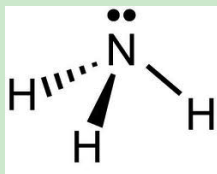
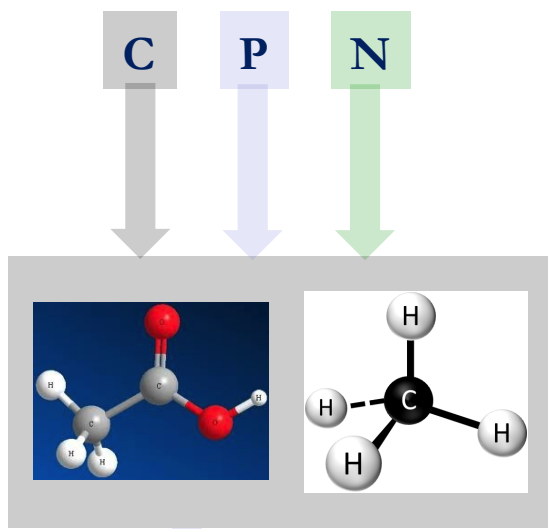
The connection to food

(one example of embedded water-energy-resources)





Possible flowsheet for C, N and P recovery



(Part of new EPA Center)

