An Environmental View of the UNC Co-Gen Facility

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What drives energy policy?

- ***Pollutant releases***
- Price of energy
- Availability of technology
- Security of resources
- Social acceptability/concern

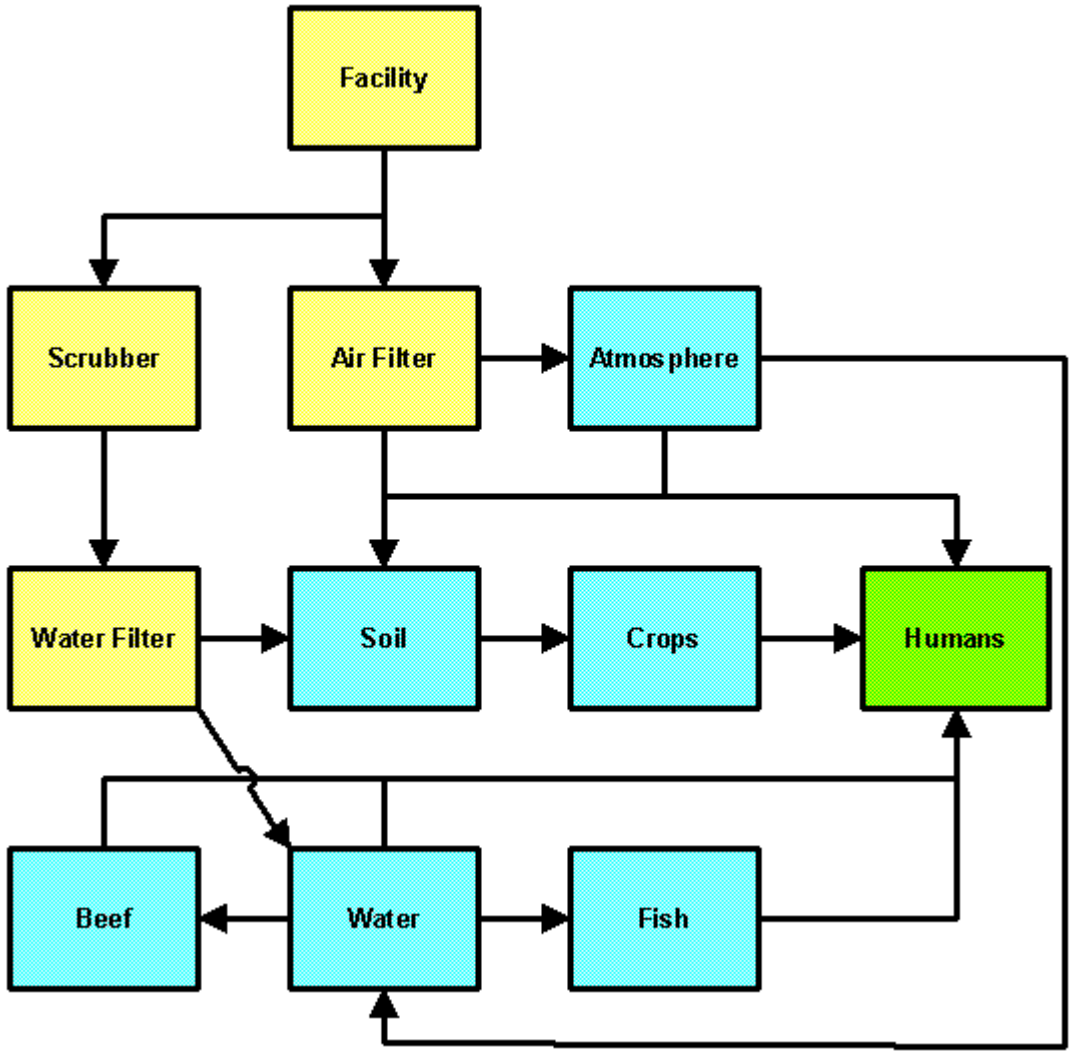
Two Main Issues

- Global issue- Carbon dioxide emissions

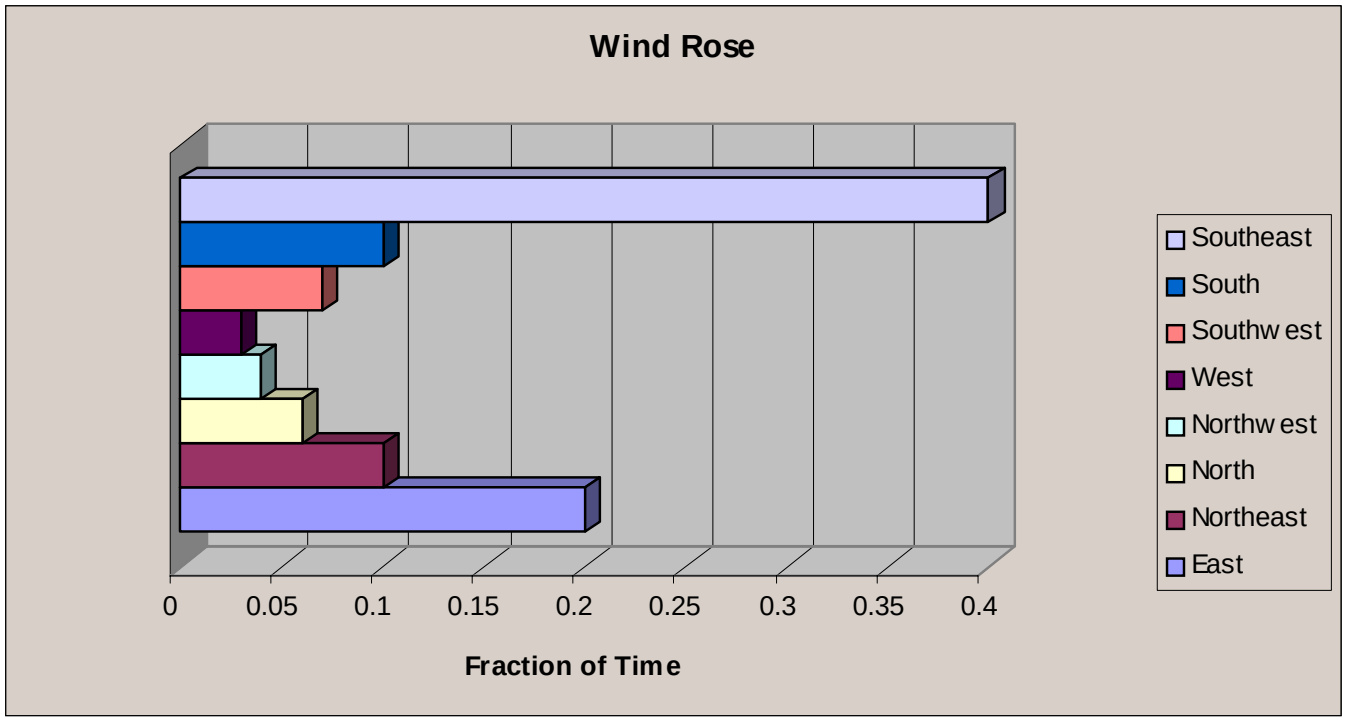
- Local issue- Emissions of toxics, with mercury as the “driver”

A local issue: mercury, co-gen and the City of Salzburg

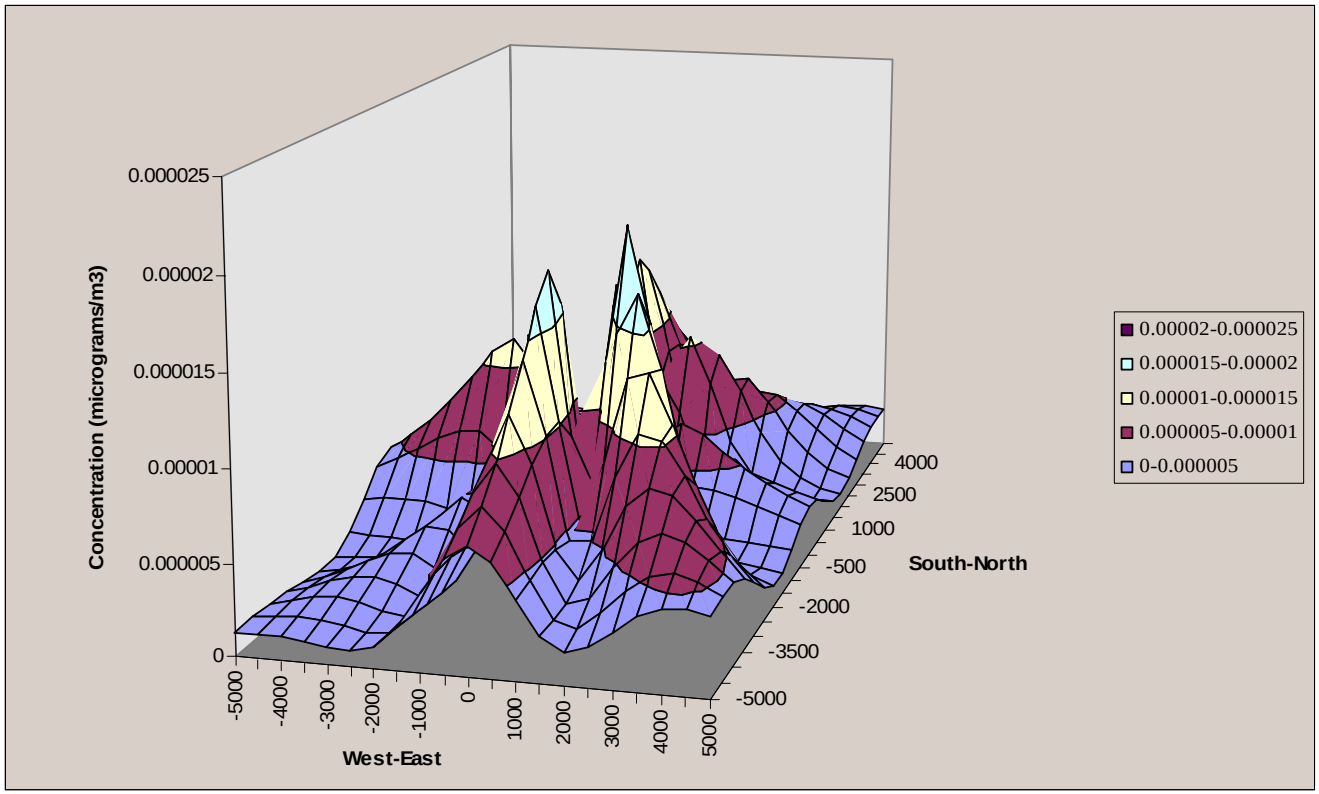
The model


Facility
Scrubber
Air Filter
Atmosphere
Water Filter
Soil
Crops
Humans
Beef
Water
Fish

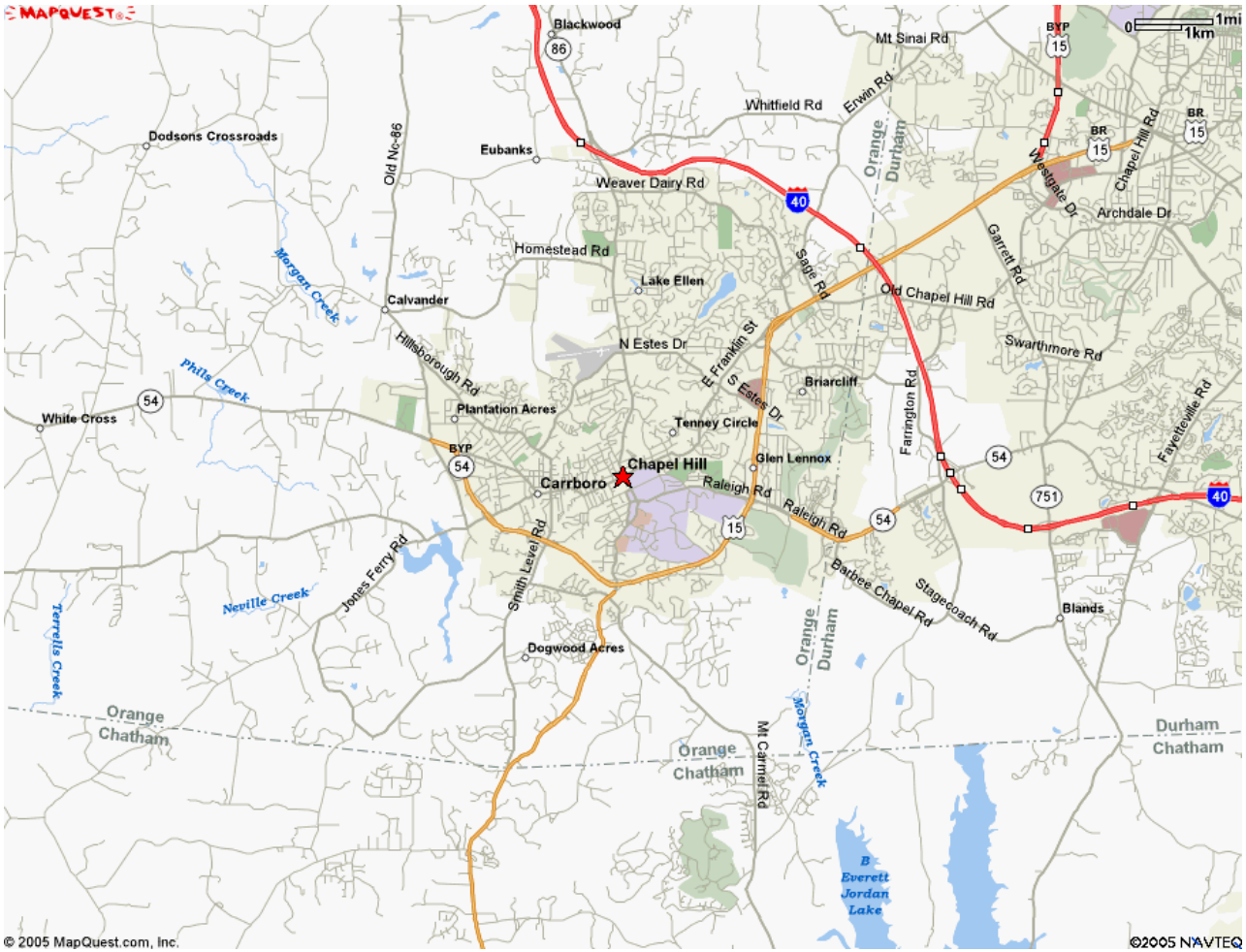
The wind in Chapel Hill



An example air dispersion result



The geographic area



Exposure pathways

- Inhalation of air
- Ingestion of vegetables from a back-yard garden
- Ingestion of soil from vegetables
- Ingestion of fish from University Lake
- Ingestion of water from University Lake

Precautionary assumptions used

- People spend all of their time in Chapel Hill
- People ingest all vegetables from the back-yard garden
- Water is untreated before consumption
- People eat all fish from University Lake
- Highest bioaccumulation factor for fish
- Assumes mercury is a carcinogen

All parameter values taken from:

- EPA’s Mercury Report to Congress
- EPA’s Integrated Risk Information System (IRIS)
- EPA’s Exposure Factors Handbook

So the steps…

- Estimate mercury emission rate
- Calculate concentrations in air, water, soil, vegetables and fish
- Calculate rate at which people inhale or ingest mercury from these
- Add them all up
- Multiply by the cancer slope factor (to get the probability of cancer)
- Divide by the Reference Dose (to get the hazard quotient for non-cancer effects)

What do I compare these against?

- A probability of cancer of 1E-4 (one chance in ten thousand)

- A hazard quotient of 1 (protection against the effect with an “ample margin of safety”)

So, where does the co-gen facility stand (for current daily operations)?

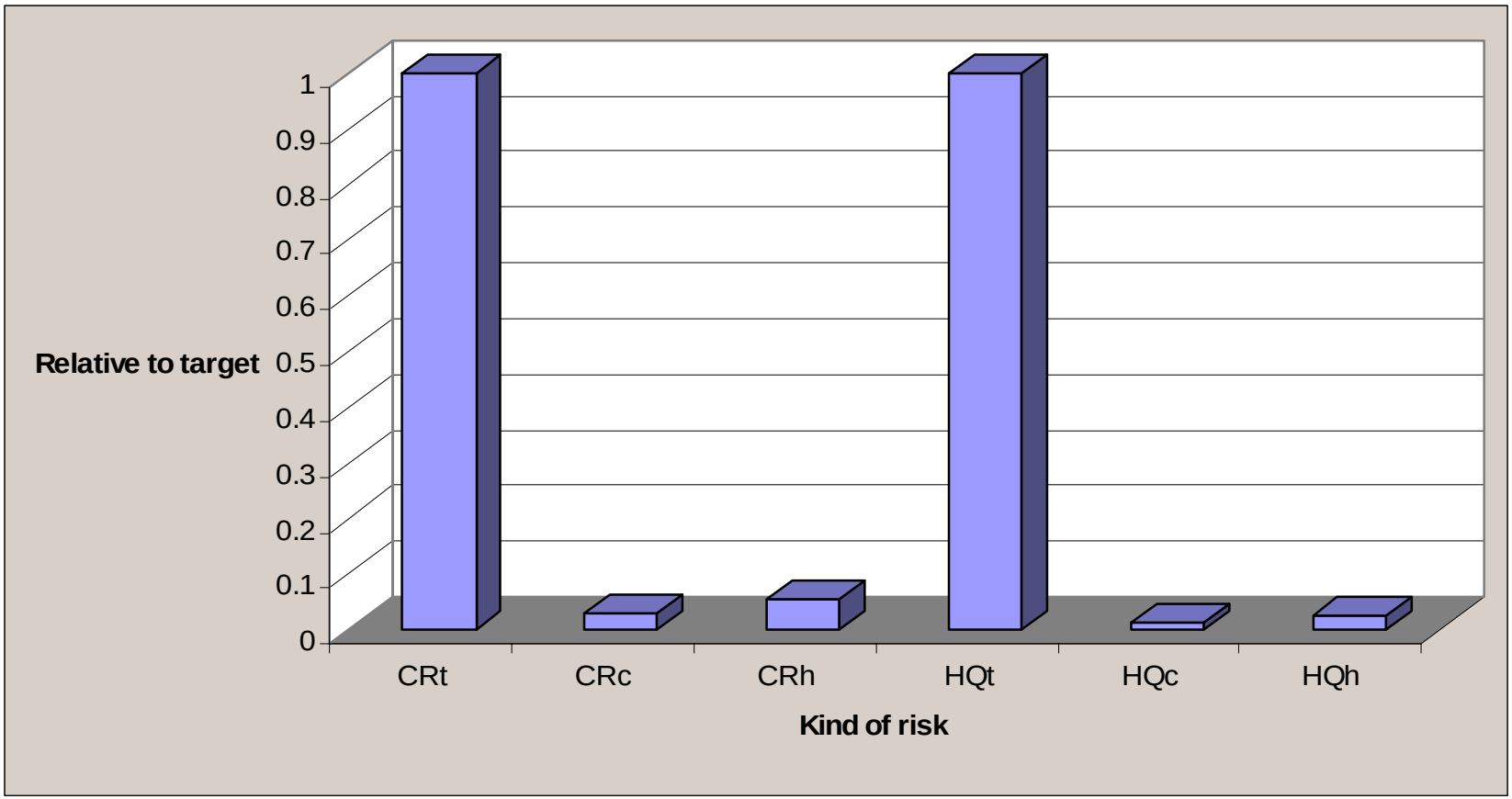
- The maximum lifetime probability of cancer from the mercury is 3E-6 (three chances in a million), or a factor of 33 below 1E-4
- The maximum hazard quotient is 0.015, or a factor of 67 below a value of 1.0

So, where does the co-gen facility stand (for maximum operations)?

- The maximum lifetime probability of cancer from the mercury is 5.6E-6 (5.6 chances in a million), or a factor of 18 below 1E-4

- The maximum hazard quotient is 0.028, or a factor of 36 below a value of 1.0

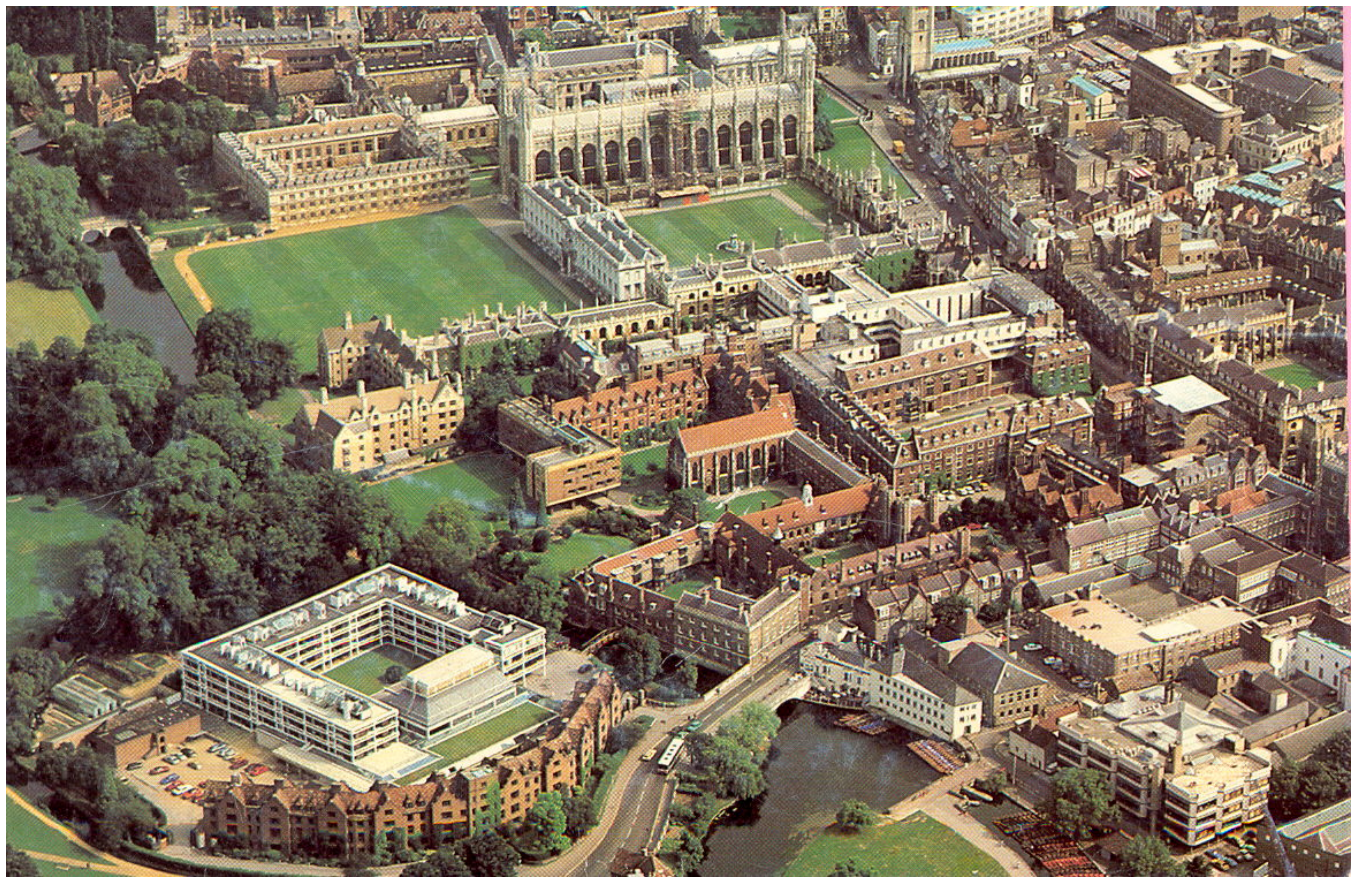
So, where does the co-gen facility stand?



A global issue: carbon dioxide emissions

Or???

Back to Cambridge for the methods



What is compared against what?

- The total carbon dioxide emissions from electricity and steam generation from the co-gen facility

against

- The total carbon dioxide emissions from having Duke Power supply this same energy as electricity, with some converted back to heat for the buildings

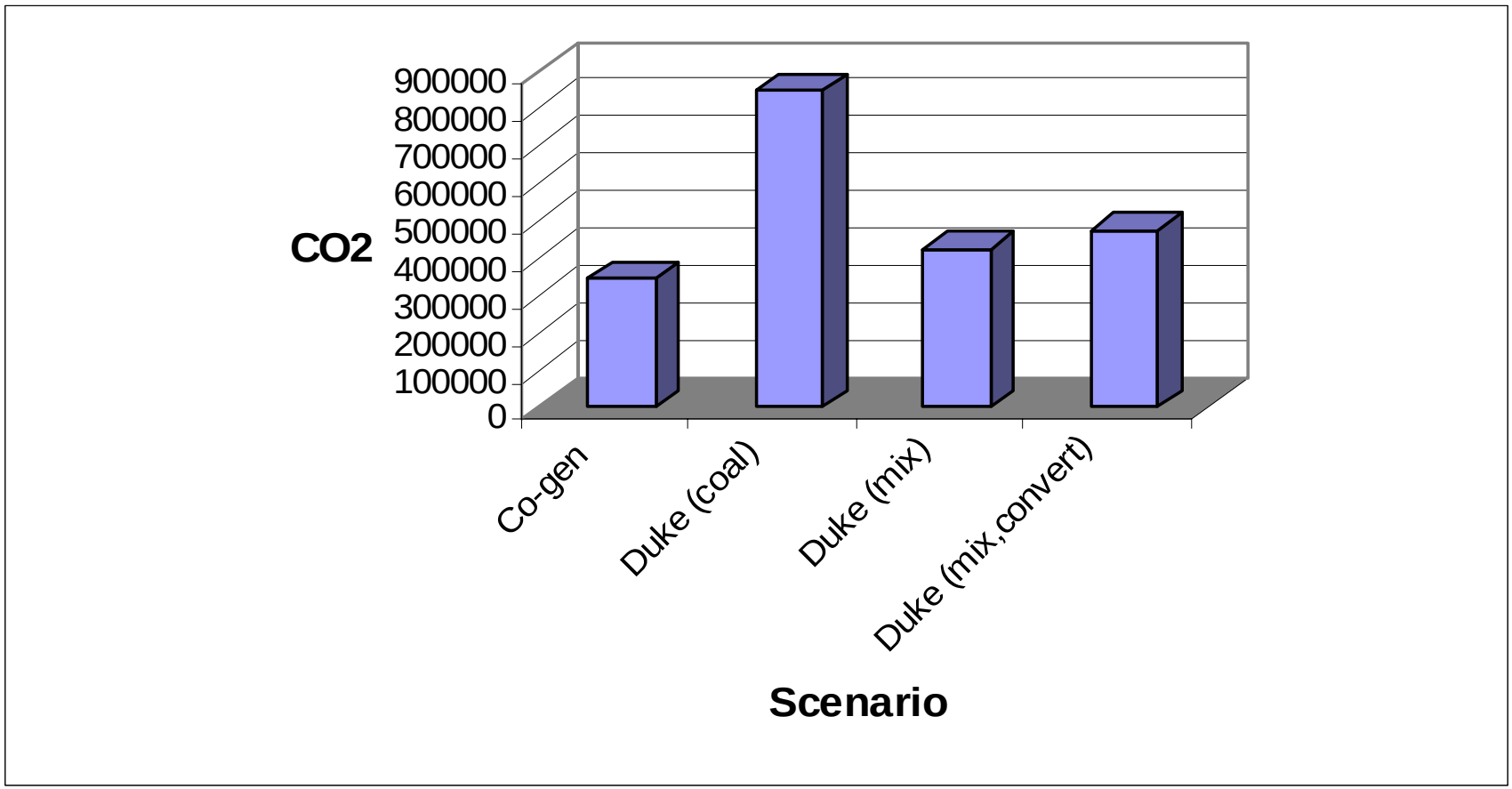
The relevant numbers:

- Co-gen released **345,335** tons of carbon dioxide last year (if we assume ALL carbon is converted).
- Co-gen has 81% efficiency
- Overall Duke Power efficiency is 33%
- So, Duke Power would have produced **847,640** tons of carbon dioxide to provide the same energy if they used coal

The relevant numbers:

- So, Duke Power would have produced **423,820** tons of carbon dioxide to provide the same energy if they used their mix of 50% nuclear
- Or Duke Power would have produced **472,989** tons of carbon dioxide given current efficiencies of converting electricity to heat on campus

Or to make it more visual:



My conclusions from an environmental perspective:

- The co-gen facility does not produce local health risks from mercury that approach regulatory limits.
- Generating energy from the current co-gen facility to supply the campus produces a lower global risk from carbon dioxide emissions than does purchasing the equivalent energy from Duke Power.