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Due Oct. 30, 2017

Top-Down Analysis of Decarbonization

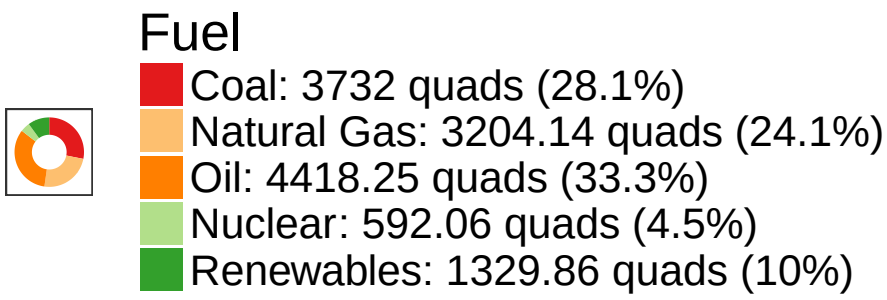
```
target_year = 2050
reference_year = 2005

target_reduction = 0.36

start_year = 2016

world_data = get_kaya_data("World")
world_fuel_mix = get_fuel_mix("World")
world_projection = project_top_down("World", target_year)

target_emissions = filter(world_data, year == reference_year)$F * (1 - target_reduction)
projected_E = world_projection$E
```

The pathway for keeping warming below 2°C implies a target of reducing global CO_2 emissions by 36% below the 2005 level by 2050. Top-down projections predict that global energy demand will be `format_md(projected_E, 0)` in 2050, so what does that imply for the need to install low-carbon energy?

The current energy mix is shown in the Figure below:

“‘r world_fuel_mix = get_fuel_mix(“World”) e_factors = emissions_factors()

plot_fuel_mix(world_fuel_mix) “‘



Let's calculate what the emissions in 2050 would be if the world were still using this fuel mix.

```
r  kable(e_factors)
```

fuel	emission_factor
Coal	94.4
Oil	70.0
Natural Gas	53.1
Nuclear	0.0
Renewable	0.0
irst, let's ca	lculate how many quads of energy of each fuel the world would
e consuming in	2050:

```
world_fuel_mix_2050 = world_fuel_mix %>%
  select(fuel, pct) %>% # We only need to worry about the percentage of each fuel
  mutate(quads = projected_E * pct) # We multiply the total energy demand by
                                    # The percentage from each fuel to figure
                                    # the number of quads of each fuel that
                                    # the world would consume if the fuel
                                    # mix stayed the same.
  kable(world_fuel_mix_2050)
```

fuel	pct	quads
Oil	33.279193	27079.279
Natural Gas	24.134287	19638.070
Coal	28.110216	22873.283
Nuclear	4.459507	3628.701
Renewables	10.016796	8150.667

Now, let's combine the emissions factors and the fuel mix into a single table:

```
world_fuel_mix_2050 = world_fuel_mix_2050 %>%
  mutate(fuel = as.character(fuel)) %>% # This is to avoid a warning from R. You don't need to worry ab
  left_join(e_factors, by = "fuel") # left_join combines two tables, taking all rows from world_fuel, a
                                    # rows of e_factors by matching the column "fuel" for the two table
                                    # Because it's a left join, it ignores any rows of e_factors if the
                                    # have a matching row in world_fuel_mix
  kable(world_fuel_mix)
```

country	year	fuel	quads	pct
World	2016	Oil	4418.2477	33.279193
World	2016	Natural Gas	3204.1420	24.134287
World	2016	Coal	3731.9985	28.110216
World	2016	Nuclear	592.0579	4.459507
World	2016	Renewables	1329.8606	10.016796

Now that we combined the tables, we can multiply the number of quads by the emission factors to get the emissions from each fuel:

```
world_emissions_2050 = world_fuel_mix_2050 %>%
  mutate(emissions = quads * emission_factor)
```

```
kable(world_emissions_2050)
```

fuel	pct	quads	emission_factor	emissions
Oil	33.279193	27079.279	70.0	1895550
Natural Gas	24.134287	19638.070	53.1	1042781
Coal	28.110216	22873.283	94.4	2159238
Nuclear	4.459507	3628.701	0.0	0
Renewables	10.016796	8150.667	NA	NA

Pielke, Jr., Roger. 2010. *The Climate Fix: What Scientists and Politicians Won't Tell You About Global Warming*. New York: Basic Books.

Pielke, Roger A., Jr. 2009a. "Mamizu Climate Policy: An Evaluation of Japanese Carbon Emissions Reduction Targets." *Environmental Research Letters* 4: 044001.

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