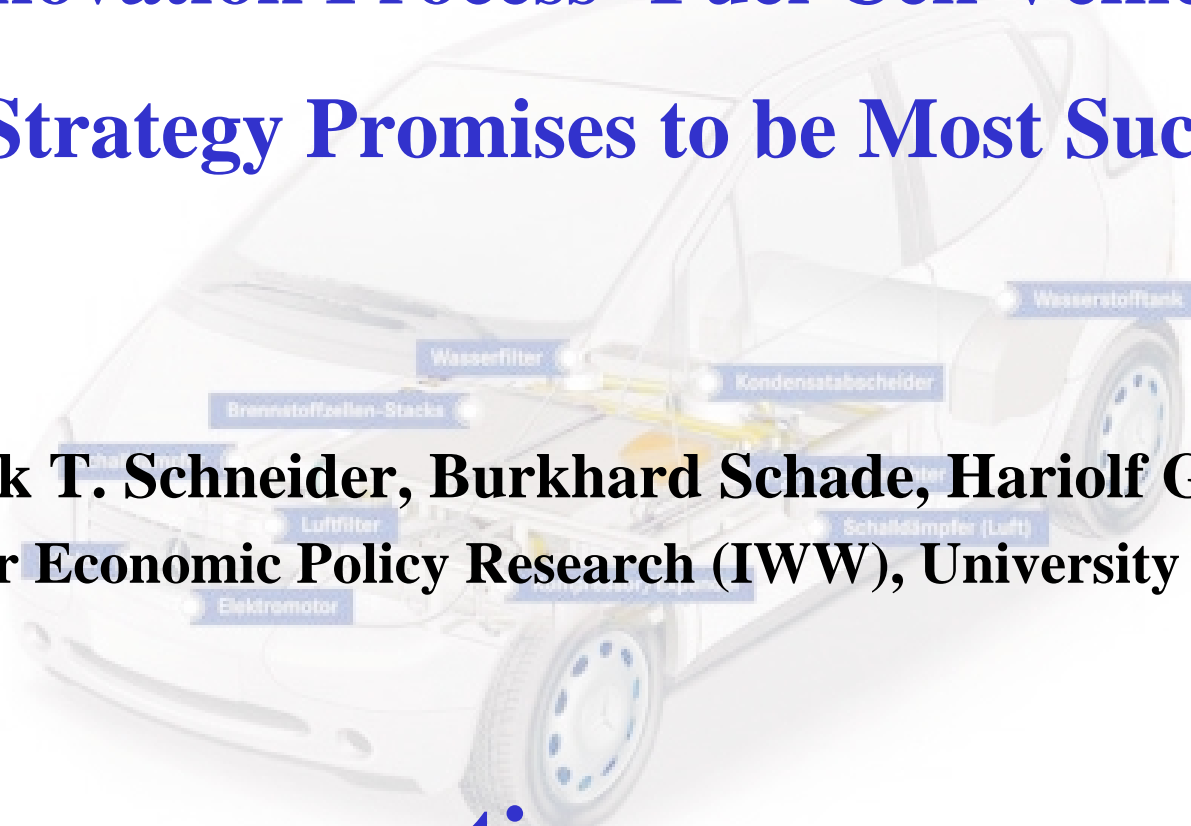


# Innovation Process 'Fuel Cell Vehicle': What Strategy Promises to be Most Successful?



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**tim2003**

Oct. 24<sup>th</sup>, 2003

# Outline of the Presentation

- Strategies for Market Entry
- The Model Structure
- Simulation Results
- Conclusions





# Strategies for Market Entry

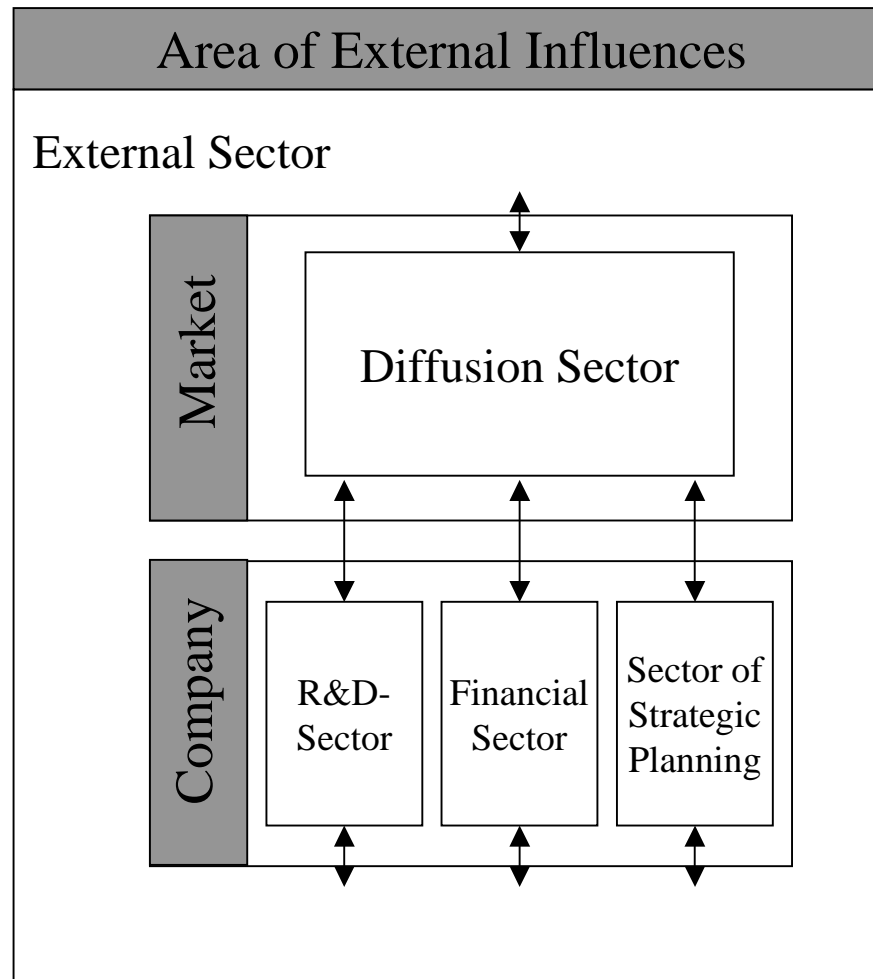
|                     | <b>Pioneer</b>  | <b>Early Follower</b>   | <b>Late Follower</b>   |
|---------------------|---|---|--|
|                     | <ul style="list-style-type: none"> <li>• First to market</li> <li>• High R&amp;D expenses</li> </ul>        | <ul style="list-style-type: none"> <li>• Shortly after pioneer</li> <li>• More advanced products</li> </ul>               | <ul style="list-style-type: none"> <li>• Imitate dominant design</li> <li>• Low price</li> </ul>     |
| <b>Advantage</b>    | <ul style="list-style-type: none"> <li>• Quasi-monopoly</li> <li>• Establish market barriers</li> </ul>     | <ul style="list-style-type: none"> <li>• Learn from pioneer</li> <li>• Better estimation of future development</li> </ul> | <ul style="list-style-type: none"> <li>• High standardization</li> <li>• Less uncertainty</li> </ul> |
| <b>Disadvantage</b> | <ul style="list-style-type: none"> <li>• High uncertainty</li> <li>• High market education costs</li> </ul> | <ul style="list-style-type: none"> <li>• Market barriers</li> <li>• Uncertainty</li> </ul>                                | <ul style="list-style-type: none"> <li>• Market barriers</li> <li>• Negative image</li> </ul>        |



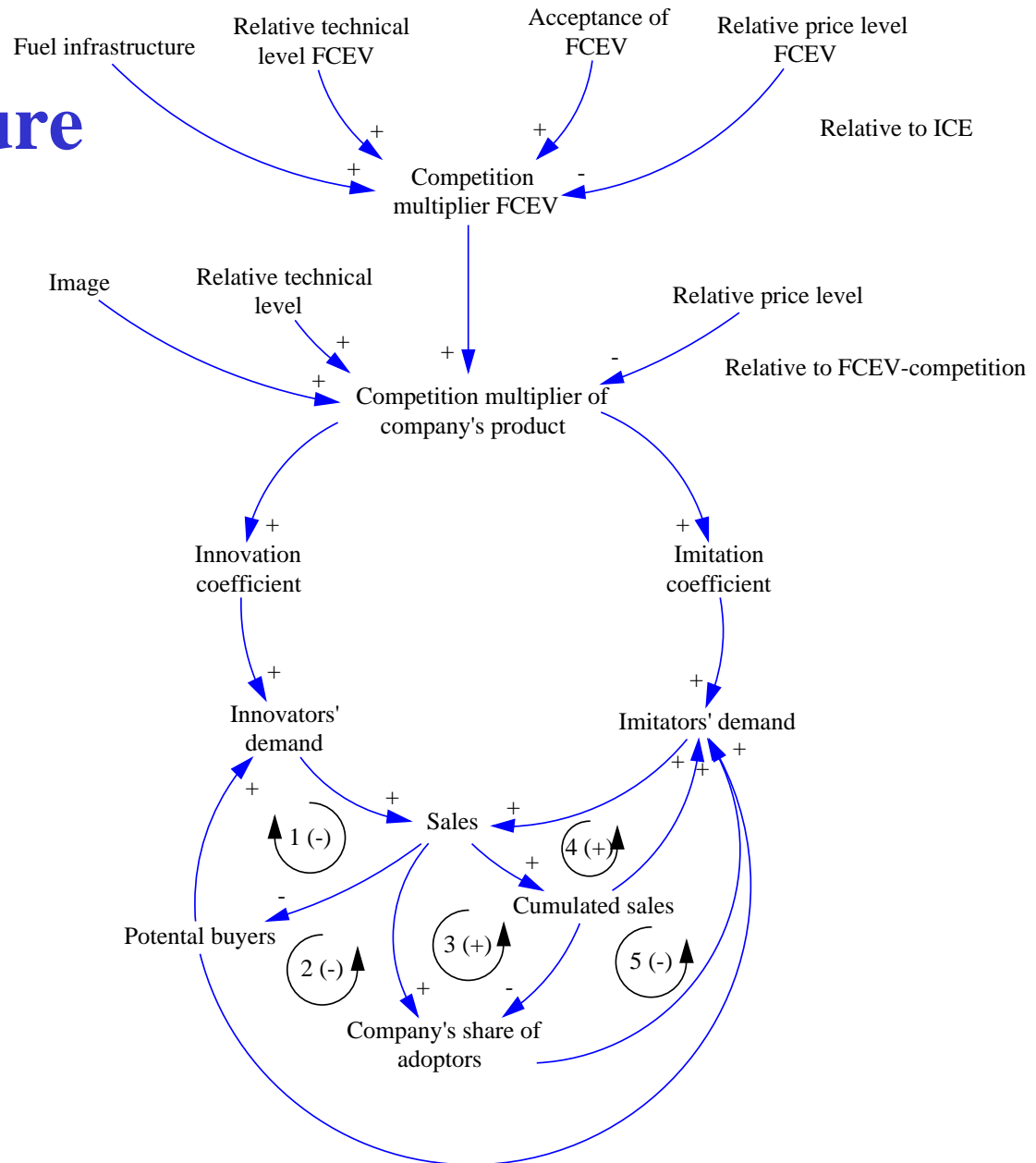
# Strategies of the Automobile Manufacturers

| Strategy       | Company  | Desired Launching Dates |
|----------------|--|-------------------------|
| Pioneer        | DaimlerChrysler & Ford,<br>General Motors &<br>Toyota,<br>(Honda, Mazda) | 2004 - 2008             |
| Early Follower | Volkswagen, Renault,<br>Peugeot-Citroën (PSA)                            | around 2010             |
| Late Follower  | Fiat   | around 2015 or later    |

# The Model Structure



# The Loop-Structure of the Diffusion Sector



## Basic Model Features

- Simulation **Time Interval**: 2000 – 2030
- Each of the companies can launch up to **four product generations**
- **Pioneer** follows **skimming price** strategy, **Early Follower** and **Late Follower** offer first product generation at a **penetration price**, the successive product generations at a **full cost price**
- **Three scenarios** (external influences)
  - Reference Scenario
  - Scenario ‚Politics and Ecology‘
  - Negative Scenario

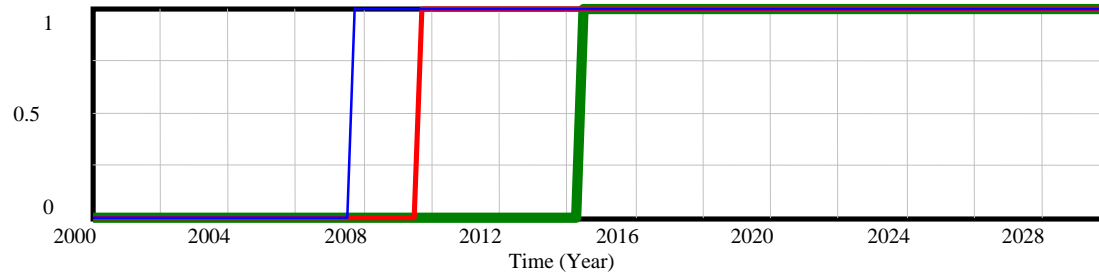




| External influence factor                | Model parameter |          | Scenario  |                      |                           |
|--|-----------------|----------|-----------|----------------------|---------------------------|
|  |                 |          | Reference | Politics and ecology | Negative                  |
| <b>Fuel infrastructure</b>               | incraltFS       |          | 0.45      | 0.55                 | 0.35                      |
| <b>Fuel cost</b>                         | fcost           | petrol   | 1         | 1                    | 1                         |
|  | dev             | MeOH, H2 | 1         | 1                    | +50%                      |
| <b>Tax</b>                               | vehtax          | petrol   | 1         | +20%                 | 1                         |
|  | dev             | MeOH, H2 | 1         | 0                    | no tax exemptions         |
|  | fueltax dev     | petrol   | 1         | +100%                | 1                         |
|  |                 | MeOH     | 1         | 1                    | Same as petrol            |
|  |                 | H2       | 1         | 1                    | Half the amount of petrol |
| <b>Market education</b>                  | initknowpotcust |          | 0.01      | 0.2                  | 0.01                      |
| <b>Consciousness for the environment</b> | initecology     |          | 1         | 1.3                  | 0.5                       |
|  | pollution       |          | 1         | +100%                | -25%                      |

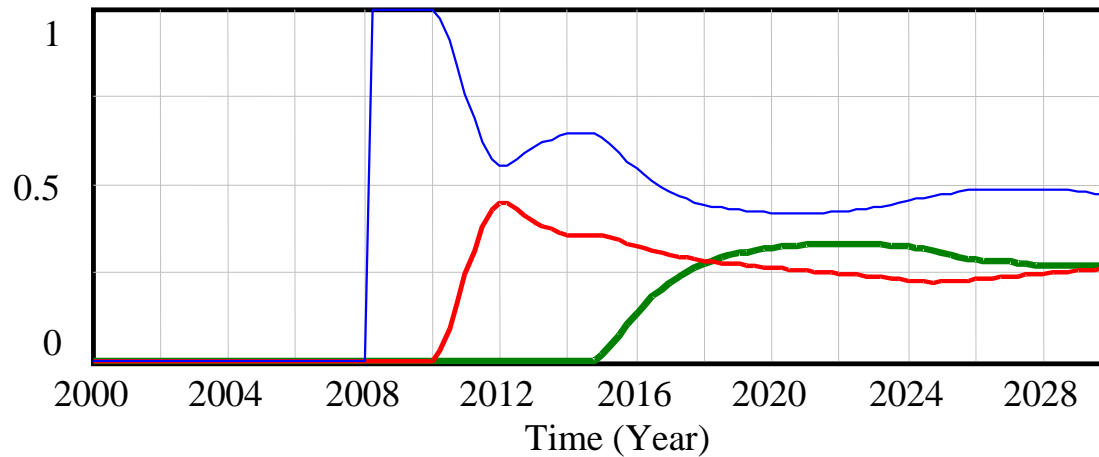
# Simulation Results

## Market Entry



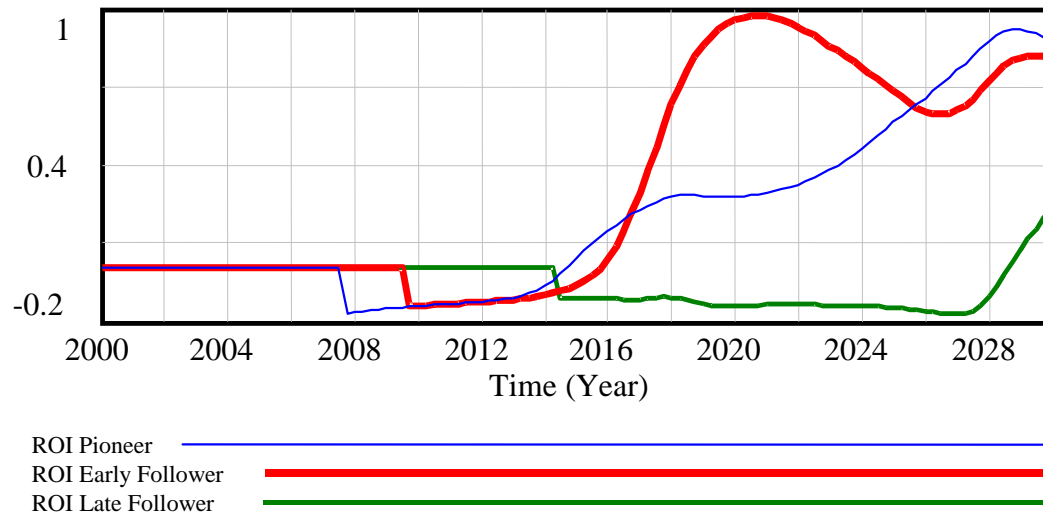
Market Entry Pioneer —————  
Market Entry Early Follower —————  
Market Entry Late Follower —————

## Market Share

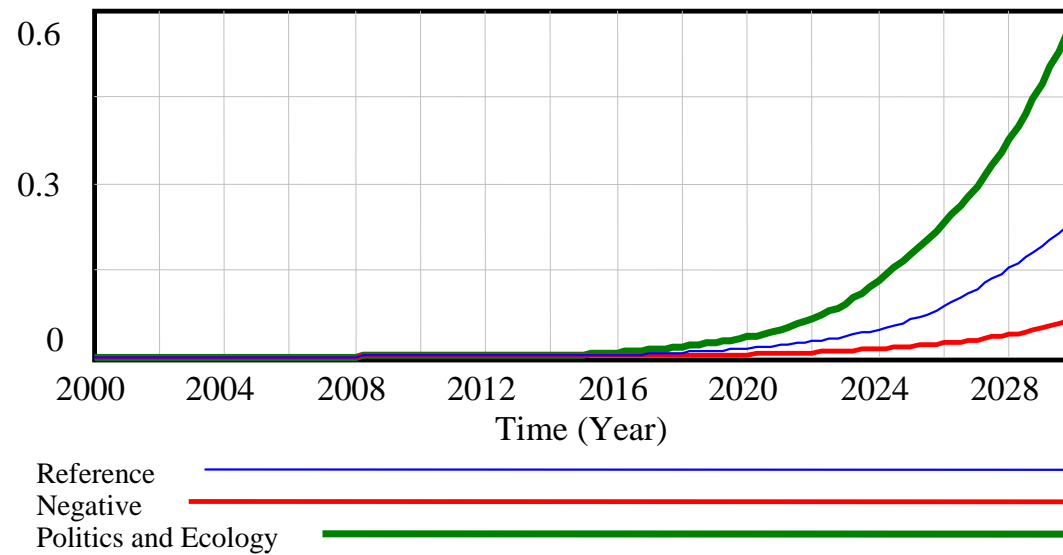


Market Share Pioneer —————  
Market Share Early Follower —————  
Market Share Late Follower —————

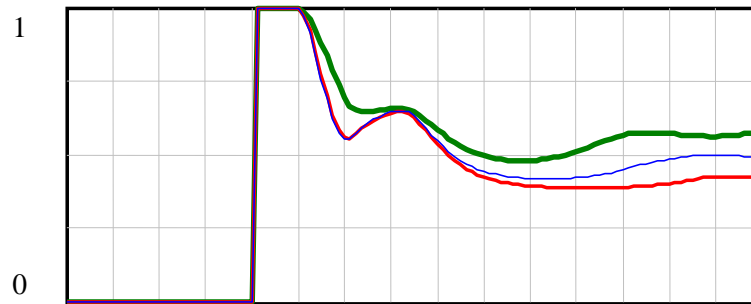
### Return on Investment



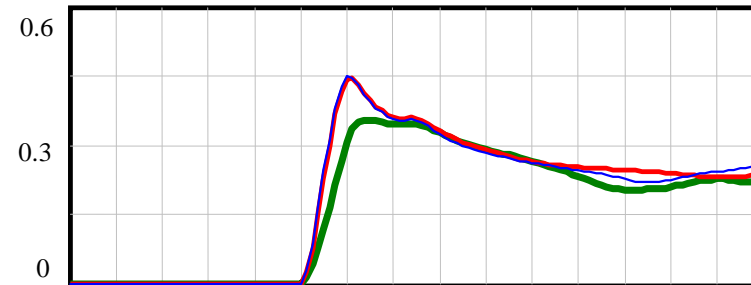
### Market Saturation FCEV



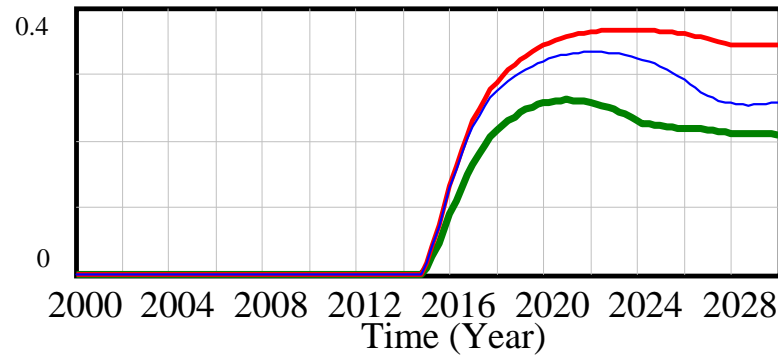
**Market Share Pioneer**



**Market Share Early Follower**



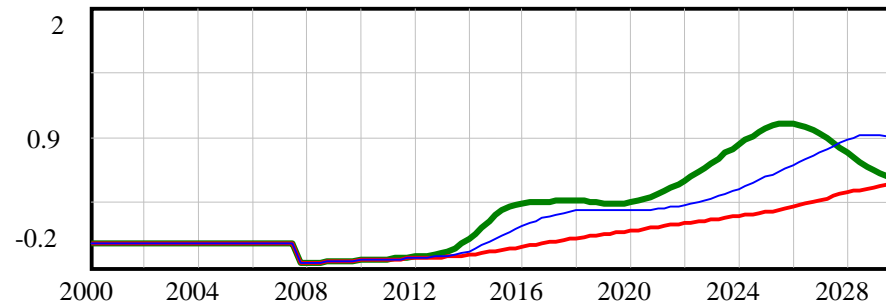
**Market Share Late Follower**



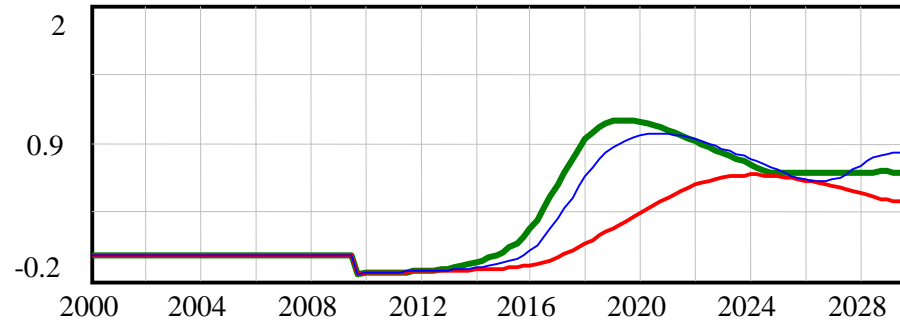
Market Share Reference ————— blue line  
Market Share Negative ————— red line  
Market Share Politics ————— green line



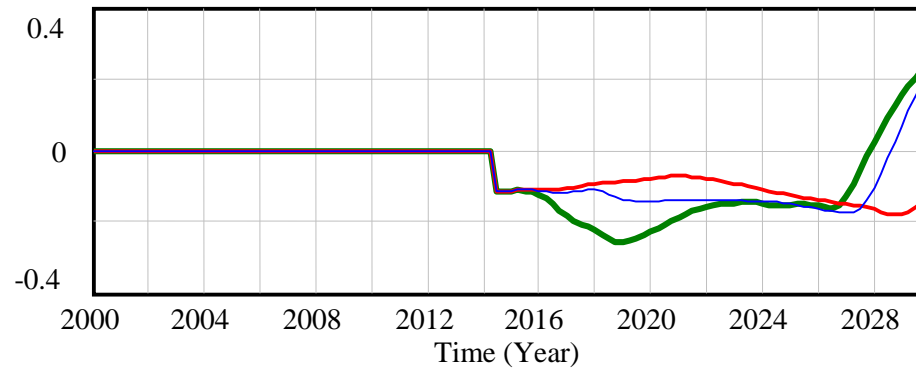
**ROI Pioneer**



**ROI Early Follower**



**ROI Late Follower**



ROI Reference — (blue line)  
 ROI Negative — (red line)  
 ROI Politics — (green line)

## Conclusions

- **Slow diffusion of fuel cell technology** in the automobile market
- **Pioneer** can establish a leading market position and maintain it over the simulation period
- **Early Follower** early follower strategy is least sensitive to the exogenous frame. It shows positive financial figures, but is vulnerable to the late follower in terms of market share
- **Late Follower** has to shoulder considerable losses to gain a foothold in the market, however it will most probably move into profits at the end of the simulation
- The **relative advantage** is shifting towards the pioneer strategy with positive external conditions, whereas it is moving towards a follower strategy with a negative external frame

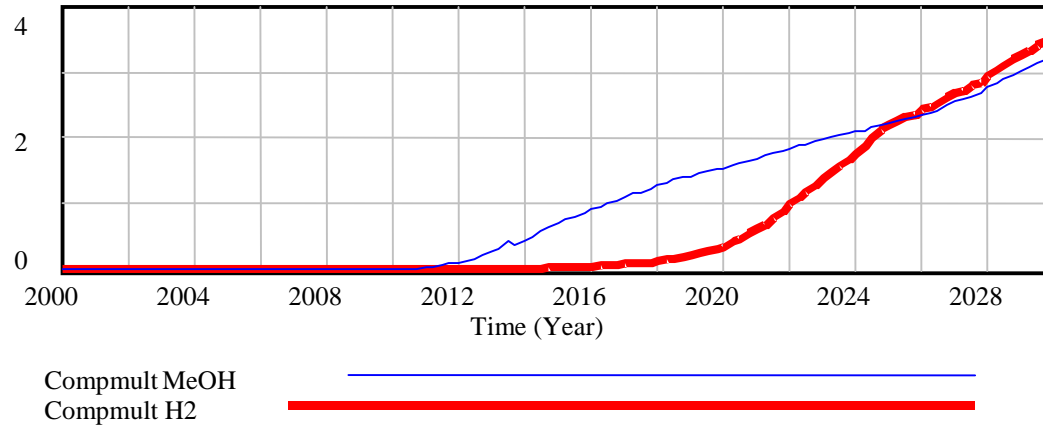


# Technological Considerations

- **Drive System**
  - Combustion Engine
  - Battery Driven Electro Car
  - Hybrid Vehicle
  - Fuel Cell Vehicle
  
- **Fuel Infrastructure**
  - Natural Gas
  - Methanol
  - Hydrogen



### Compmult FCEV



### Profits

