Stanford Cleantech Hackathon:

Shell Challenge

Team: 2302 AUTOMATIC

Meet The Team

Jonathan Wang

University: UC Berkeley, Undergraduate

Major: B.S. Economics and B.A. Data Science

Year: Sophomore

Joe Fedota

University: UC Berkeley, Undergraduate

Major: B.S. Computer Science

Year: Sophomore

Noelle Link

University: UC Berkeley, Undergraduate

Major: B.S. Business Administration, Concentration: Global Management

Year: Sophomore

Stefan Schlotter

University: UC Berkeley, Undergraduate

Major: B.A. Data Science, Concentration: Economics

Year: Sophomore

HYDROGEN VERSUS ELECTRIC

Hydrogen	VS	Electric
A 312 mile range allows the driver to travel **as far as** they wish[1]		The most common EVs have a range from 150-285 miles[8]
The Toyota Mirai has a MSRP of $58,500[1]		The median price for electric vehicles in 2019 is around $55,600[9]
A **5 minute** refuel time allows drivers to minimize wasted time spent at the refueling[1]		For a full charge, it takes the Nissan Leaf **6 hours** and the Tesla S **1 hour** on a supercharge[10]

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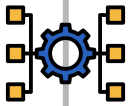
Rideshare versus Trucking

Rideshare	VS	Trucking
US Ride-hailing and taxi segment is sized at **over $67 billion** with CAGR of more than **2%**		The US trucking industry is sized at over **$700 billion** and moves roughly **71% of US freight**
Best suited to **centralized hydrogen infrastructure** in urban centers		Best suited to **distributed hydrogen infrastructure** on major supply chains
Successful implementation of hydrogen fueled cars in German rideshare industry		While not used in a current trucking fleet, **implemented into fork-lifts** along the supply chain

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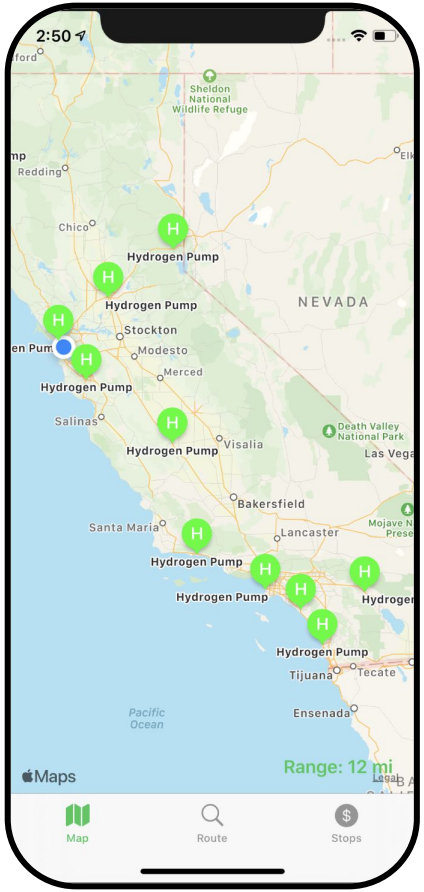
Demo Application



Strategic Advantages

Integration

- **Easy to integrate** into existing rideshare applications
- Generates additional traffic to partner application

Efficiency

- Pays for stops in one tap or ahead of time, reducing time spent refueling
- Reduces cost by **optimizing** a driver's route

Scalability

- Easily implemented across a variety of services **outside of rideshare**
- Is applicable once other states expand their hydrogen infrastructure

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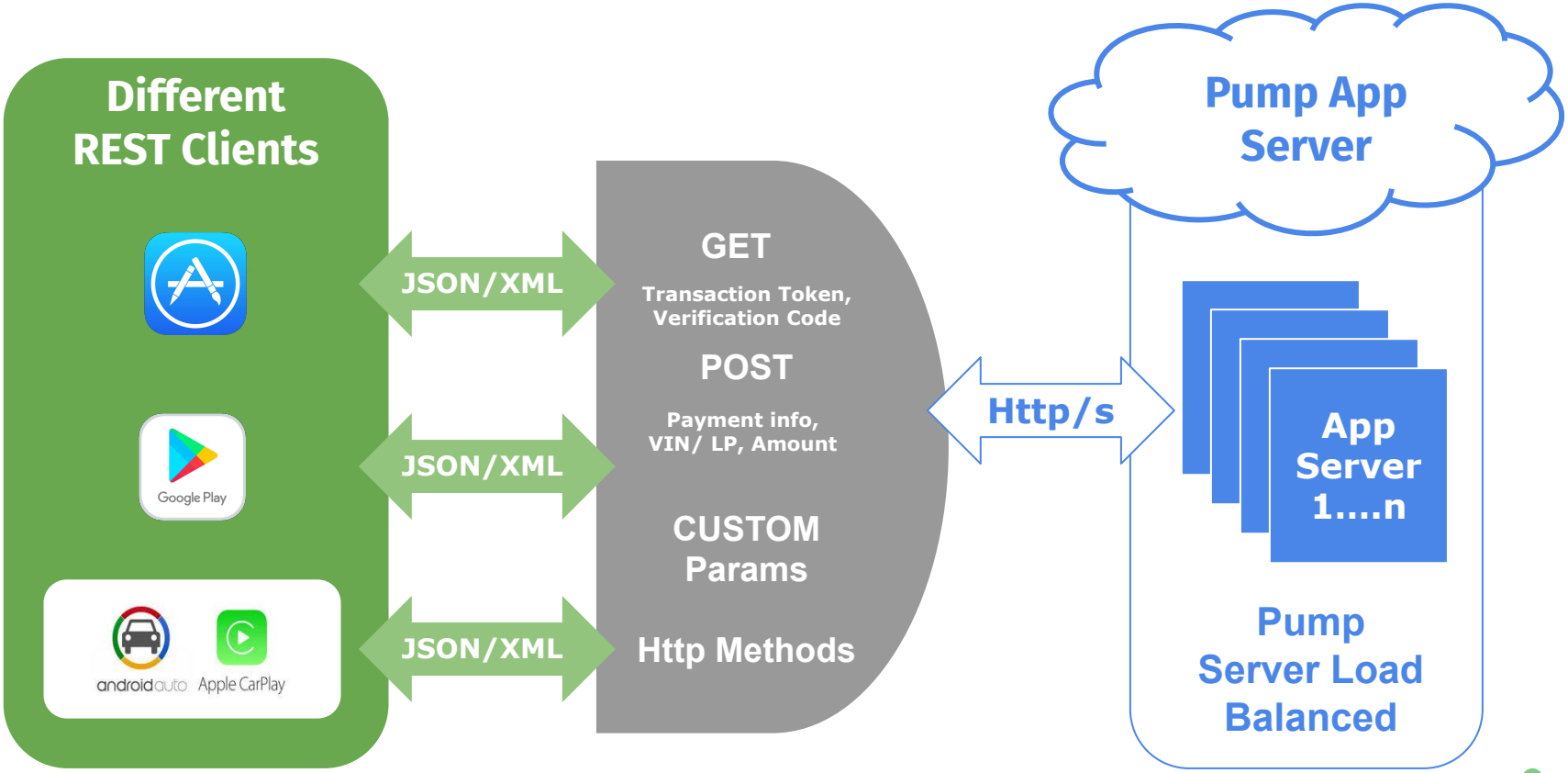
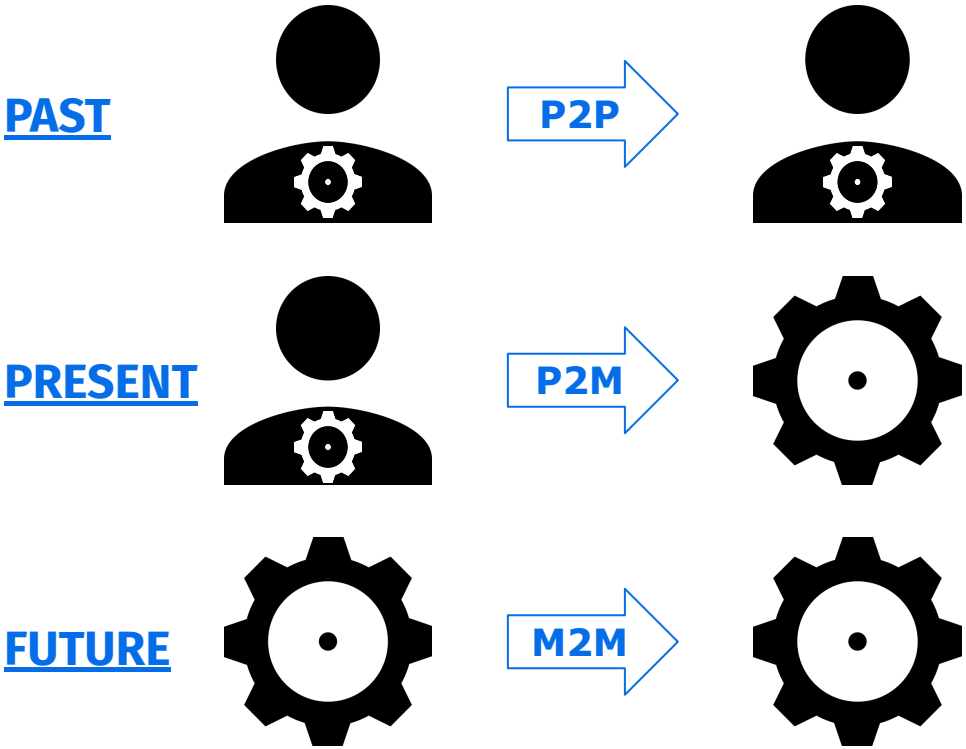
API Architecture



Frictionless Transition to Automation



- API communication structure allows for **easy portability** from person to machine (P2M) to machine to machine (M2M) connection
  - Car manages GPS data, internal range data more accurately, payment data as entered by car owner/business
- Frameworks like this **need to be** in place in order to adapt to driverless vehicles
  - Algorithm **seamlessly transitions** to the optimization-oriented AV biases
  - M2M **eliminates inefficiencies** or error associated with human users

Rideshare Choices

	lyft	Uber	zipcar
Operation	US platform that connects drivers and passengers	Global platform connecting drivers and passengers	Platform that offers hourly car rentals in urban US centers
Ownership	No company-owned fleet, regular or automated	No current ownership but developing automated fleet	Ownership of fleet in use
Opportunity	Potential incentives for hydrogen fueled cars, difficult to implement	Implementation into automated fleet or partnership	Offer new "green" hydrogen car option

Uber + zipcar Partnership

Current Partnership	Proposed Partnership
Drivers sign up on Uber's platform and select Zipcar as the hourly option on Uber's marketplace	Same
Complete Zipcar application or pair account to reserve a car	Add a new "hydrogen fuel car type"
Accept rides through the Uber app, use pre-loaded card in Zipcar to pay for gas	Take clients through the Uber app, use our API to find convenient hydrogen stations along route

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Commercial Business Model

Uber + zipcar Partnership

Drivers

Can accept Uber rides without needing to own a car

Uber/Zipcar

Increased market penetration and a new market segment

Bay Area Launch

The Bay Area will serve as launch point

Zipcar will own 25 Toyota Mirai vehicles

Start with test launch in Bay Area

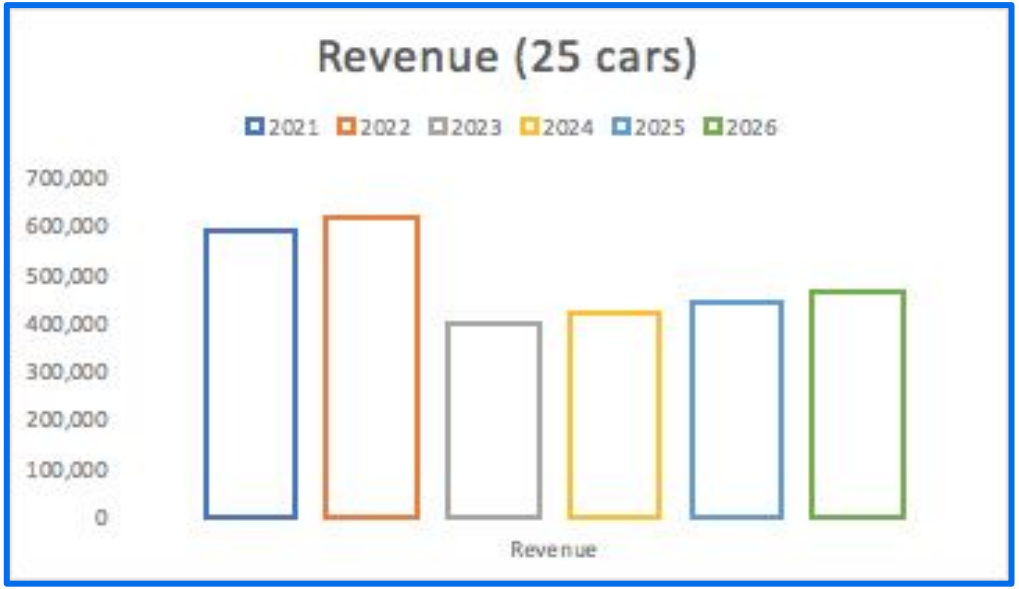
Financials

Initial Investment

$1,525,000

Assumptions

- Toyota Mirai is priced at **$57,000**
- **No new infrastructure** is needed
- Tax Credits **apply**
- **$15,000** gas credit



1st Year Revenue: ~$600,000

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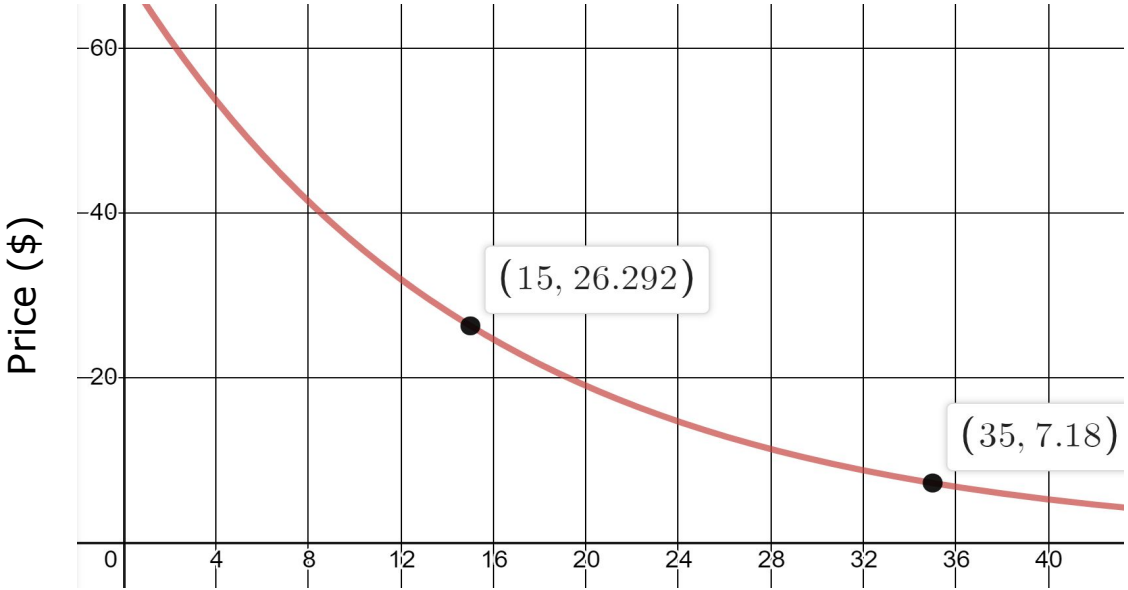
Fuel Cell Cost Reduction



Prices for 80 kW Stack PEMFC

Optimal scenario is based on DOE Targets[11]

Assumed for Mass Production (500,000 units)

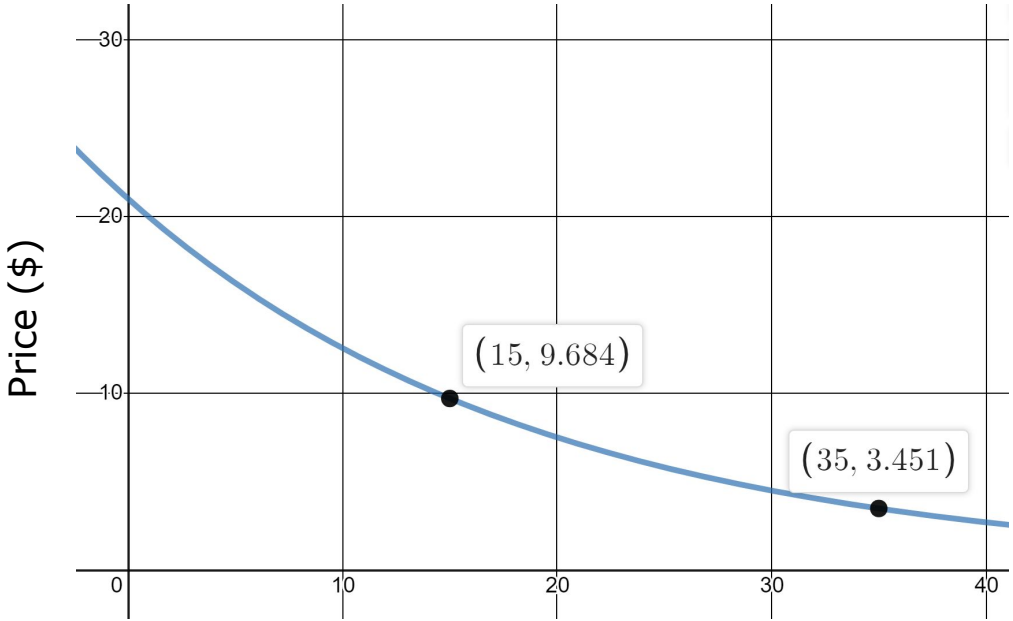
Highlights

Over 40% of costs is attributed to Platinum electrocatalyst material used[11]

As the amount of Pt drops, costs drop too

Around 2045, storage may realistically vary at $12-18/kwH[13]

Fuel Tank Cost Reduction



Prices for Single 5.6 kg Tank Storage

Model based on Carbon Fiber Tank (Optimal Scenario)[13]

Assumed for Mass Production (100,000 units)

Highlights

Over 50% of costs is attributed to Carbon fiber material used[12]

As manufacturing processes become efficient, these costs are dropping

Around 2045, storage may realistically vary at $5/kwH[12]

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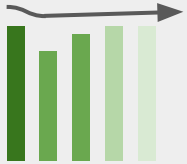
Building up Fueling Stations

Lack of Infrastructure

There are not enough to meet current demand[15]

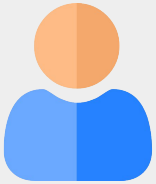
Stagnation

Hydrogen infrastructure has slowed while EVs have risen[16]



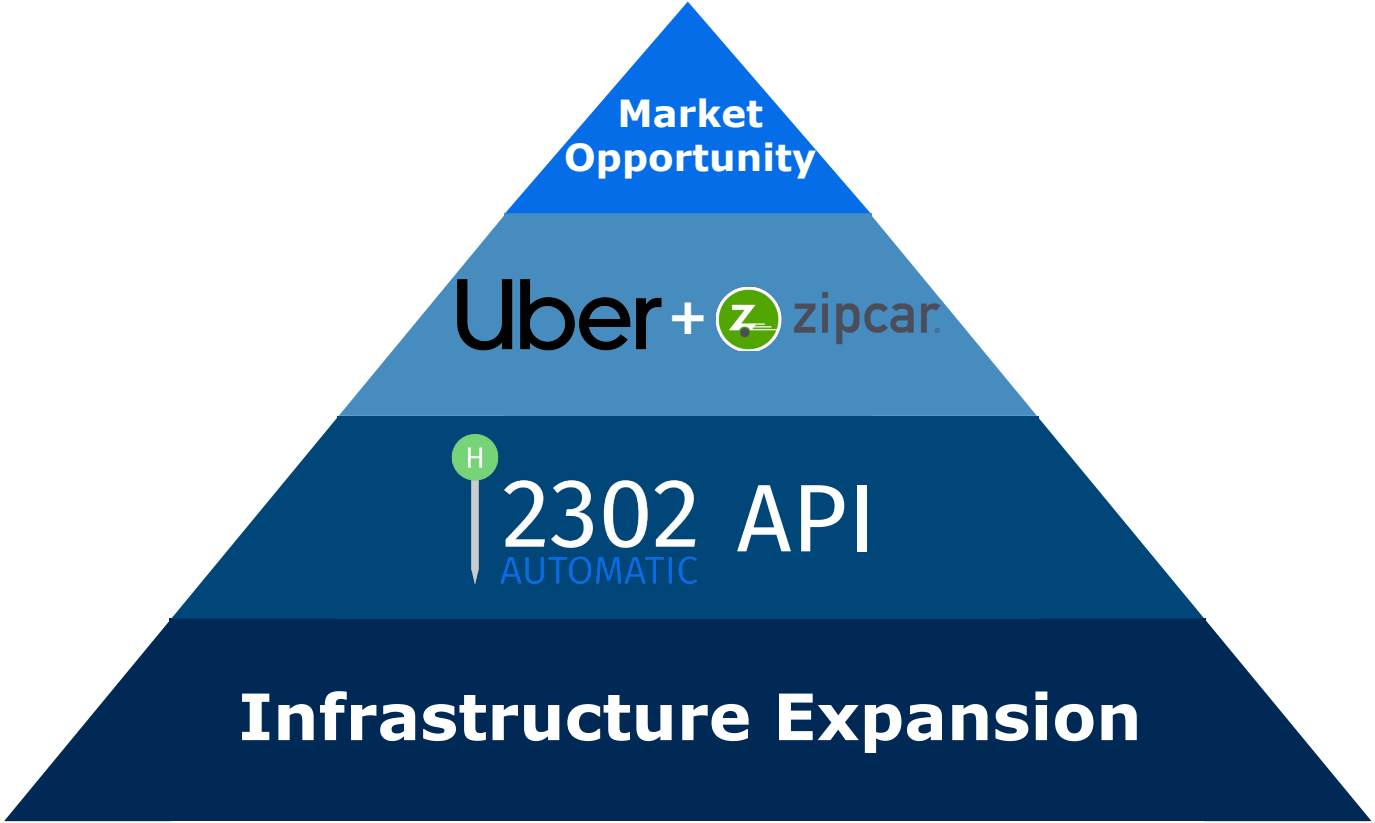
Public Acceptance

Customer confidence is weakened due to lack of accessibility[15]



Key Takeaway: With infrastructure development, consumers and investors will become **more confident** in hydrogen

Summary


Market Opportunity
Uber + zipcar
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Infrastructure Expansion

Thanks for listening!

Appendix

References

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Style Guide

Main Colors

#77d579ff

#056de7ff

#efefefff

Alternative Colors

Experiment with different colors that would go well with this primary **blue color** and record them here:

Other style Elements

Title Font: Fira Sans
Body Font: Verdana

-Normal: for titles
-**Bold**: for emphasis

Use boxes with no borders

Example Boxes

Cool Insight

One cool insight from our Sierra Club ACs is that they will produce **great looking** decksOne cool insight from our Sierra Club ACs is that they will produce **great looking** decks

Cool Insight

One cool insight from our Sierra Club ACs is that they will produce **great looking** decksOne cool insight from our Sierra Club ACs is that they will produce **great looking** decks